Mekong River Commission
Cambodia • Lao PDR • Thailand • Viet Nam

Office of the Secretariat in Phnom Phenh (OSP)
567 National Road,
#2, Chak Angre Krom,
P.O.Box 623, Phnom Penh, Cambodia
Tel : (855-23) 425 353
Fax : (855-23) 425 363

Office of the Secretariat in Vientiane (OSV)
Office of the Chief Execuive Officer
184 Fa Ngoum Road
P.O. Box 6101, Vientiane, Lao PDR
Tel : (856-21) 263 263
Fax : (856-21) 263 264

ISSN: 1683-1489
MRC Technical Paper No.42
August 2014

SIMVA 2011

Social Impact Monitoring and Vulnerability Assesment 2011

Report on Baseline Survey 2011 of the
Lower Mekong Mainstream and Flood Plain Areas

Report prepared by
Mekong River Commission
Environment Programme

ISSN: 1683-1489
MRC Technical Paper No.42
August 2014

SIMVA 2011

Social Impact Monitoring and Vulnerability Assesment 2011

Report on Baseline Survey 2011 of the
Lower Mekong Mainstream and Flood Plain Areas

Report prepared by
Mekong River Commission
Environment Programme

Published in Vientiane, Lao PDR in August 2014 by the Mekong River Commission

Suggested citation:
Lilao Bouapao, Jens Sjorslev, Penroong Bamrungrach, Lo Thi Duc, James Robert Chamberlain. 2014.
Social Impact Monitoring and Vulnerability Assessment: Report on Baseline Survey 2011 of the Lower Mekong Mainstream and Flood Plain Areas, MRC Technical Paper No.42. Mekong River Commission, Vientiane & Phnom Penh, 119pp.

Editor: Jens Sjorslev (Lead, data analysis, maps, graphs), Robin Taylor, Robert Brown

Photographers: © Mekong River Commission

Office of the Secretariat in Phnom Penh (OSP)
576 National Road, #2, Chak Angre Krom, P.O. Box 623, Phnom Penh, Cambodia
Tel. (855-23) 425 353. Fax (855-23) 425 363

Office of the Secretariat in Vientiane (OSV)
Office of the Chief Executive Officer
184 Fa Ngoum Road,
P.O. Box 6101, Vientiane, Lao PDR
Tel (856-21) 263 263. Fax (856-21) 263 264

Email: mrcs@mrcmekong.org
Website: www.mrcmekong.org

Table Of Contents

Table Of Contents

List of Figures

List of Tables

Acknowledgements

Many people and organisations provided support and input into this baseline survey of Social Impact Monitoring and Vulnerability Assessment (SIMVA). First, the authors would like to thank the 2,720 villagers in Cambodia, Lao PDR, Thailand, and Viet Nam who spent valuable time and effort responding to the lengthy questionnaire and those representing the village and district/provincial authorities who supported the enumeration teams. Without their support the survey would not have been completed and we hope the present report will be distributed and read.

The efforts of the enumeration teams and the valuable inputs of the national experts and members of the regional team at all stages of the project, including training, fieldwork supervision, data entry and writing up the national reports is acknowledged. Particular thanks to the national experts: Em Sorany and Koy Ra (Cambodia), Phetsamone Sone (Lao PDR), Dilok Sarawadi (Thailand), and Pham Trong Thinh (Viet Nam). Many thanks also go to Ho Van Bao, software design specialist, who was very important and helpful in designing software for data entry, carrying out data entry and cleaning up the data.

Special appreciation goes to Environment Programme (EP) team namely Nguyen Van Duyen, EP Coordinator, Men Prachvuthy, Social Science Specialist, Henrik Larsen, International Technical Advisor, and Thim Ly, Socio-Economic Specialist, for their coordination, support and constructive comments.

The final version of this report is by Jens Sjorslev, International Consultant, who edited and wrote text, analysed and checked the data and made graphs and maps.

Acronyms

BDP	Basin Development Plan
CCAI	Climate Change and Adaptation Initiative
GIS	Geographic Information System
IBFM	Integrated Basin Flow Management
Lao PDR	Lao People's Democratic Republic
LMB	Lower Mekong Basin
MRC	Mekong River Commission
MRCS	Mekong River Commission Secretariat
OAAs	Other Aquatic Animals
OAPs	Other Aquatic Plants
ORNL	Oak Ridge National Lab
PPS	Probability Proportionate to Size
SEA	Strategic Environmental Assessment
SIMVA	Social Impact Monitoring and Vulnerability Assessment

Glossary

Aquaculture	Raising of fish, shrimp and any other aquatic species.
Climate change	A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use (Verbruggen, Moomaw, & Nyboer, 2011)
Climate change related livelihood activities	Variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forces (external variability) (IPCC 2001).
Climate variability	Variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forces (external variability) (IPCC, 2001).
The survey area	Many rural households in the LMB are increasingly dependent on a combination of activities. Some or all members of some farming households in rural areas work part- or full-time in non-agricultural activities. The SIMVA questionnaire was designed to identify the first and second most important occupations.
Fishing effort	Computed based on the average catch divided by average hours fishing per day in the year.
Income from non-aquatic sources	Can destroy assets directly in the case of floods, storms, etc. and can also force people to abandon their homes and dispose of assets such as lands. Shocks that devastate the livelihoods of the poor are natural processes that destroy natural capital, e.g. floods that destroy agricultural lands (DFID 1999).
Main occupation of individuals	What people spend most of their time doing.
Most important occupation of households	Many rural households in the LMB are increasingly dependent on a combination of activities. Some or all members of some farming households in rural areas work part- or full-time in non-agricultural activities. The SIMVA questionnaire was designed to identify the first and second most important occupations in terms of sustaining the livelihood of a household.
Other Aquatic Animals	Include frogs, tadpoles, crabs, snails, clams/shells, shrimps, eels, turtles, and other (unspecified).
Resilience	Livelihood resilience allows a household or a social system to absorb and utilize (or even benefit from) change. In SIMVA, resilience is measured by the level of consumption, expenditure, and ownership or access to livelihood assets, based on the assumption that households with (i) more consumption and spending, (ii) more food stored, (iii) more diverse livelihood assets and sources of income and (iv) better health and more social capital, will be more resilient to change.

Sensitivity	The extent to which people who depend on water resources for their livelihood might be affected by man-made or natural changes in resources in the LMB.
Shock	Can destroy assets directly in the case of floods, storms, etc. and can also force people to abandon their homes and dispose of assets such as lands. Shocks that devastate the livelihoods of the poor are natural processes that destroy natural capital, e.g. floods that destroy agricultural lands (DFID 1999).
Social groups	Include religious groups, Women's Union (in Viet Nam and Lao PDR), youth union, elderly, saving/credit groups, farmers' groups, fishers' groups, share labour group, and veterans.
Trends	A key element in the vulnerability context, which can have a positive or negative effect on livelihoods. Trends involve changes that take place over a longer period of time than is the case with changes brought about by shocks or seasonality, e.g. population trends (increasing population pressure), resource trends, economic trends (DFID, 1999).
Vulnerability	Vulnerability can be defined as the diminished capacity of an individual or group to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard or major change, which can be social, economic and environmental. The concept is relative and dynamic. Vulnerability is most often associated with poverty, but it can also arise when people are isolated, insecure and defenceless in the face of social, economic or environmental major change, risk, shock or stress (amended from IFRC). Livelihoods vulnerability has been seen as a balance between sensitivity and resilience of livelihood systems (Alwang, Paul, & Steen, 2001). Highly vulnerable systems are characterized as low resilience and high sensitivity, while less vulnerable systems have low sensitivity with high resilience. In the context of climate change, vulnerability has been defined as "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity" (IPCCWG2, 2007, p. 883).
Water related occupations	Include fishing, collection of OAAs, aquaculture, navigation and farming. Note that data collection related to navigation was not included in the present SIMVA survey.
Water related resources	Include fish, OAAs, irrigated and riverbank crops. Rain fed crops is not included in this category in SIMVA.

Executive Summary

Background and objectives

The Mekong River Commission (MRC) carries out a Social Impact Assessment and Vulnerability Assessment (SIMVA) programme to survey and monitor social conditions and vulnerability related to changes in the natural and social environment and the availability of aquatic resources in the Lower Mekong Basin. The present report is based on a SIMVA study undertaken in March-May 2011 in the Lower Mekong Basin in Cambodia, Lao PDR, Thailand and Viet Nam. The survey provides a baseline that is large and comprehensive enough to be a foundation from which indicators can be monitored on a periodic basis with a view to determine the social and socio-economic effects and changes in water related livelihoods and food resources. The objective of the present SIMVA survey was to obtain baseline data and information on 1) The vulnerability context, comprising eight socio-economic variables; 2) The level of people's dependence on water resources for their livelihoods; 3) People's resilience, i.e., their capacity to cope or recover from stresses; 4) Shocks, and trends over the longer term; and 5) Climate change associated vulnerability. The SIMVA programme has been ongoing since 2006 with pilot studies. It is planned to carry out both broad and more focused versions of SIMVA periodically, providing data to facilitate timely response to potential negative impacts from water resources development.

Methodology

The primary data collection for the study was a household questionnaire based survey covering 2720 households in 133 villages. The questionnaire included 275 questions relating to 62 indicators on dependence of water resources, resilience and climate change associated social vulnerability. The sampling frame was all rural villages, in Viet Nam communes, within a corridor of 15 km on both sides of the mainstream Mekong and extending in a 40 km buffer zone around the maximum extent of flooded areas as recorded by satellite in year 2002. Further, a 15 km corridor was made on main tributaries 40 km upstream from Mekong, Bassac and Tonle Sap. These corridors to a large degree overlapped with the flooded areas. The sample size of 2720 households was determined to represent the whole survey area within the available resources. For reasons of comparability and equity the sample size was set at 680 households in each of the four countries. Each country has two socio-ecological sub-zones, with 340 households allocated to each zone. The sampling of villages was done using Probability Proportionate to Size (PPS), which should ensure inclusion of villages with larger populations. Twenty households were sampled in each village. Households were selected by systematic sampling, and household heads were interviewed using the questionnaire. Interviews took on average 1.5 hours, but longer in ethnic villages. Data entry was done at the national level while data checking and analysis was done at MRC. Analysis was done in SPSS and SAS JMP.

Scope, limitations and challanges

The study is not intended to cover the-whole LMB. Still, the large survey area combined with the limited sample size resulted in inclusion of villages that were very far from the Mekong mainstream or the Tonle Sap proper. Some geographical areas within the zones were not represented. The sampling strategy limited the possibility of statistically robust comparisons between sub-zones. Confidence intervals were not computed for the different variables, as this exceeded the resources available. Thus results are reported without confidence intervals. Application of weights could not be done. The village/community level was not included in the data collection. Only few indicators can be disaggregated by gender and age. Some questions were not detailed enough to elicit the information needed for precise and accurate calculation. Instances of interview fatigue and translation problems were reported from the fieldwork, resulting in a reduced precision in responses. Conversion rates to US$ from national currencies were based on MRC exchange rate, rather than local market exchange rate. Updated official statistics on vulnerability indicators were difficult obtain and were not complete.

Findings and results

Baseline vulnerability

Secondary data on eight general vulnerability indicators are presented in thematic maps that show: dependency ratio, fertility rates, household size, poverty rate, child malnutrition, and infant mortality. Overall, the values of these indicators are lowest, i.e., indicating low vulnerability, for Thailand and highest for Cambodia and Lao PDR, with Viet Nam in between.

Demography

In 2010, an estimated 62.7 million people lived in the LMB[1], with more than half, almost 33.8 million, living within the survey area. Cambodia and Viet Nam had by far the largest rural populations in the survey area with 9.6 and 14.7 million people, while Lao PDR and Thailand accounted for 2.3 and 2.1 million people respectively. The average household size in the survey area was 4.7 persons. Lao PDR had the highest household size of 5.7, followed by Cambodia with 5.0, Viet Nam with 4.3 and Thailand at 4.0. In general, a high proportion of larger households in a society indicate presence of traditional family structures. The four large groups of Khmer in Cambodia, Kinh in Viet Nam, Lao Isan in Thailand and Lao in Lao PDR made up 82.5% of the surveyed population.

[1] LandScan Global Population data - as grid - created by Oak Ridge National Lab (ORNL) and distributed by East View Companies (USA).

The size and locality of ethnic groups is a proxy indicator for their access and vulnerability to changes in the aquatic resources. There were 18 other smaller ethnic groups, mostly in Lao PDR and Thailand, with each group accounting for between less than 0.1% to 6.9% of the total sample.

In the survey area 82 % of the households are headed by men and 18% by females. Zone 2 in the Lao PDR has the lowest rate of female household heads with only 3.2%, while zone 3 in Thailand has the highest rate of 28.5%. Overall the population pyramid of the LMB indicates a stage in a transformation from an agricultural, rural economy to an industrialized, urban society.

Livelihood dependence on water resources

The assessment of livelihood dependence on water resources is based on the following: the distribution of primary and secondary occupations and their importance for household livelihoods; analysis of water resource dependent income; dependence on fish and fishing and collection of OAAs and aquaculture; and dependence on irrigation and riverbank cultivation.

Farming is by far the most common primary occupation, accounting for 90% of households in Lao PDR, 69% in Thailand, 61% in Cambodia and 56% in Viet Nam.

Fishing and collecting of OAAs are of course directly dependent on water resources.

Fishing was only considered as the most important source of income for a small percentage of households: 3.1% in Cambodia , 1.6% in Thailand, 0.3% in Viet Nam and 0.1% in Lao PDR. However, slightly more households considered fishing the second-most important occupation: about 10% in Cambodia, 9% in Thailand, 2% in Lao PDR, and no respondents in Viet Nam.

Collecting OAAs was the most important occupation for only 0.1% of the surveyed households in Cambodia and Viet Nam. A marginally higher proportion of households considered it the second most important occupation: 1.2% in Viet Nam, 0.4% in Cambodia, 0.3% in Lao PDR and no respondents in Thailand.

Aquaculture is only considered a primary occupation in Viet Nam for 7% of the surveyed households and as secondary occupation for 3% of the households. Fish trading and fish processing was not significantly represented as an occupation in any of the survey areas.

The survey showed that there was significant difference in average household incomes between countries. The average annual income per capita was US$1,487 in Thailand, followed by Viet Nam at US $1,204, Cambodia at US$344 and Lao PDR at US$265.

The study categorized the following four main sources of income: 1) Water resource dependent income, which includes sale of fish (own catch and from others), sale of

fish from aquaculture, and sale of crops from riverbank gardens. 2) Income from agriculture and livestock. 3) Income from business and employment. 4) Income from pensions, loans, remittances, interest earned & savings.

Overall, for the whole sample, water resource dependent income accounted for a mean of 23.9% of household income, with a median of 11.6%. Viet Nam had a mean of 32.1% while Cambodia had the lowest mean of 20% of household income from this category. In terms of the percentage of households that had water resources dependent income, it was between 10% and 12% in all four countries. Income from business and employment was the largest source of household income overall, with a mean of 42.4% for the whole sample.

Income from agriculture and livestock was the second largest source of income with a mean of 33.7% of household income. Fishing was a part-time activity for most households and not considered an occupation. Part-time, occasional fishing was very common, with 44% of the surveyed households having a member who had fished in the past 12 months. This percentage was highest in Lao PDR at 61% of households, second in Cambodia (56%), third in Thailand (50%) and lowest in Viet Nam (11% of households).

Fifteen percent of the surveyed households had income from fishing: the highest percentage of households was in Thailand at 20%, second Cambodia at 19%, third Lao PDR at 16%, and lowest in Viet Nam at 5%.

For all households having income from fish sales (excluding aquaculture) this contributed 23.5% of total per capita household income. This implies that fishing households living just above US $1.25 per day could easily fall below the conventional poverty line if income from fish declines.

Twelve per cent of households used the Mekong mainstream for fishing during the previous 12 months, with the highest proportion in Thailand (28% of households in April-May). In Cambodia, fishing in rice paddies was very common from July to October, with a similar pattern in the Mekong Delta. In Lao PDR, other rivers and streams were the most fished habitats in March-April.

The average catch per unit of effort (CPUE) across countries and zones was remarkably even, ranging from 0.7kg/hour to 1 kg/hour at the country level. However there was large variation over the year. On average, 67% of the fish catch was consumed, 23% sold and 10% preserved.

Rice was the most important source of calories, ranging from 75% of calorific intake in Thailand to 89% in Cambodia, with Lao PDR and Viet Nam in the same range. For calories from non-rice food sources fish accounted for between 11% in Zone 2 in Lao PDR, to 17-18% in Cambodia and Viet Nam, and 12% for Thailand.

In Lao PDR, calories from OAA comprise on average 10.5% of non-rice food, which is almost the same proportion as calories from fish.

Sixty-three per cent of the surveyed households depended on farming. Overall, only 18% of households used water from the Mekong for irrigation, but in Viet Nam the proportion was 66%. The average percentage of household income from irrigated crops, including rice was 18%, while in Viet Nam irrigated crops accounted for 49% of household income, but in Lao PDR only 11%. Fourteen per cent of households were involved in riverbank cultivation, with the highest proportion in Thailand (29%).

In conclusion, the proportion of households that depended on water resources as their main occupation was relatively small. yet, water resources are widely used as a source of additional income and food. Fishing and collection of OAAs as well as riverbank cultivation provides a buffer to many people's livelihoods.

Resilience

Households' resilience to changes in river water resources was assessed mainly by ownership to diverse livelihood assets, diversity and sources of income, consumption and spending. The vast majority of households (97.4%) reported earning income from non-aquatic sources, ranging from 81.7% of respondents in the Mekong Delta to 45% in zone 3, Thailand. Overall, more than 80% of households worked in their village area, making it likely that they mostly rely on local resources. However, almost 30% of adult household members in Cambodia worked outside their village. About 66% of the average total household expenditure was on non-food items with a lower percentage in Lao PDR and higher in Viet Nam. A low percentage of expenditure on non-food items suggests high expenditure on food.

Thirty-three percent of the households in Viet Nam were engaged in aquaculture, while in Cambodia only 1.4% and in Lao PDR 7.5% of households. In the saline zone of the Mekong Delta, 40% of households were engaged in aquaculture. Aquaculture as a livelihood activity is an indicator of resilience to changes in natural river water resources (though some forms of aquaculture could be affected).

Only 2% of households had members who in the last five years had changed occupation or livelihood activity because of declining productivity of natural resources. About half of respondents had at least one livelihood alternative in their village: 18% would seek employment locally, 13% would shift to livestock, 12% would start a business, and 11% would shift to farming.

Thirty percent of respondents were not sure what they would do if they could not sustain their present livelihood.

On average, 13% of the surveyed households had members in one or more social groups or associations. Membership of a group is often used as a proxy indicator for the level of social capital, which is an important element of resilience.

Overall, more than half of the surveyed households produced food at home. This

food could cover more than half of their total calorific value intake. In Lao PDR, about 92% of households were able to produce more than half their own food. Raising livestock was most common in Lao PDR, where households in zones 2 and 3 had more than one animal per capita. The other countries have a very low number of livestock per capita.

Finally, on average, households in all study areas possess slightly more productive assets than non-productive assets. It is assumed that households with more productive assets are more resilient.

Shocks and trends

Sixty-six percent of the fishing households reported a decline in catch over the past 5 years. More than half of the fishers at most of the study sites reported reduced availability of food due to declining fish catch. Sixteen percent of fishing households reported less income due to declining fish catch, but as much as 32% of the fishing households in Cambodia.

In all four countries many households experienced domestic water sources running dry in the dry season. They also experienced water shortages that resulted in crop damages in both dry and wet seasons. The severity was similar in both seasons in Cambodia and Lao PDR. In Thailand, a high proportion of households reported excess water resulting in crop damage in the last wet season.

Overall, water shortages resulted in crop damages in the last wet season for 35% of households, and for 43% in the last dry season. Excess water caused crop damages to 14% of households in the last wet season.

Forty per cent of households reported lower food security than 5 years ago. The proportion was highest in Cambodia at 55% of households. Thirty-seven per cent reported less income than five years ago (52% of households in Cambodia).

Climate change related social vulnerabilities

A very high proportion of the population depends on farming, fishing, collection of OAAs, and aquaculture, which are livelihood activities that are relatively sensitive to climate change. Almost half of the surveyed households reported losses in rice production due to floods in the last 12 months, with the highest proportion in Cambodia. About two-thirds of households lost assets due to drought in the last 12 months. The largest proportion was in Cambodia at 95%, followed by Thailand and Viet Nam both at 68%. About 67% of households experienced losses in assets due to other climate change events. In Lao PDR, the percentage was highest at 95.5%. However, flood, drought and other climate change events affected only a very small proportion
of livestock production. About 87% of households recovered from floods in less than 6 months. Changing crop varieties and growing time were the common coping strategies that people practised.

Conclusions

A significant proportion of the sample population in the survey area were vulnerable to declining availability of water resources, due to their dependence on these resources for food and income. Only limited livelihood alternatives were available that could compensate for loss of resources. More than half of the rural adults in the survey area were engaged in water resource related occupations, mainly farming, and a much smaller proportion of households engaged in fishing, collection of OAAs, aquaculture, and fish processing/ marketing. Water related resources (irrigated crops, fish, OAAs, and riverbank crops) contributed on average almost a quarter of total household income per year. Fish and OAAs contributed overall more than 20% of the total calorie intake of non-rice food per capita per day.

This would imply that a quarter of rural households in the survey area could be affected by changes in the related water resources, although the severity of these impacts would vary a great deal from zone to zone and country to country. The contribution of cash income from fish and OAAs to household income was very small in some zones, but it should be noted that these resources are the most readily available and easiest to sell, helping households to get by in times of hardship.

Households in the survey area were quite resilient measured by some of the indicators for resilience: the majority were able to recover from flood in less than 6 months and almost all had cash income from non-aquatic sources. However, other indicators suggested low resilience: only slightly more than half the sample households had alternative livelihood options, and a relatively high proportion of household income was spent on food, leaving less for investment in education, medical care or savings.

Resilience appeared to be threatened by decreasing livelihood assets, particularly decline in fish catch and crop damage. The baseline data confirmed that both man-made and climatic factors played a role in the damage to livelihood assets.

Data on baseline vulnerability indicators: dependency ratio, fertility rates, household size, poverty rate, child malnutrition, infant mortality, education and employment opportunities showed a low level in some countries and a high level in others. Although these data are presented at the provincial level for the LMB, these differences apply to the SIMVA zones. In other words, vulnerability to adverse changes in water resources will vary from zone to zone and country to country although the extent of dependence on the resources might be at similar levels.

Recommendations for future SIMVA

With the present survey a SIMVA baseline has been established. The next steps will be to regularly monitor changes in the water related livelihoods and vulnerability status

of people in the survey area. This will assist the countries and MRC to put into place precautionary measures if and when such would be needed.

Based on the experiences from the survey a number of recommendations for future SIMVA have emerged. The key recommendations are summarised as follows.

To allow for a complete assessment and monitoring it is recommended that future monitoring takes into account seasonal variability to reflect the seasonal dimension of vulnerability, e.g. dependence on fish will be different in the wet and dry seasons.

The survey area, while remaining overall as it was for the present survey, should be adjusted to accommodate differences in terrain and access as well as representativeness of smaller socio-ecological sub-zones, while taking into account the size of the sample frame in view of resources available. The study would benefit from a narrower geographical focus so the survey area could be reduced to a 15 km buffer zone around maximum extent of flooded areas.

The eight sub-zones should remain unchanged in order to maintain a solid link between the social and biophysical dimensions. The SIMVA zones have been built on biophysical characteristics defined by the inter-basin flow management (IBFM), which also respects the administrative boundaries used by BDP.

This baseline survey has focused on the mainstream Mekong but expansion of SIMVA to tributaries would be useful for a more complete understanding of river dependencies.

With a limited sampling size of 340 households per zone, the present survey could not make very statistically robust comparisons between the zones, and further could not disaggregate data by ethnicity, which might be relevant for some indicators. Thus it is recommended to increase sampling size to be sufficient for analysis of the number of strata of interest. This will increase the level of reliability and representation.

The data obtained by the SIMVA survey do not distinguish between various types of food. For example, no detailed data are included about the types of fish consumed such as fresh, smoked and/or dried fish. This makes it difficult to calculate calorie intake so an average has been used, which may not be sufficiently accurate. Future monitoring could increase the level of accuracy by increasing the breakdown of species and types. In addition the protein intake from the different food types should be calculated.

The baseline survey did not distinguish between rain fed and irrigated rice. So for future monitoring the questionnaire should be redesigned to distinguish between different growing methods.

Most of the indicators analysed throughout this report remain useful and relevant. Because of the complexity and low level of frequency of some indicators, future

monitoring should focus on a smaller number of indicators that are easy to monitor and have a certain level of frequency (also as a sign of the indicator's importance). For example, very few households reported losses of livestock due to flood, drought or climate variability. It is therefore recommended that these indicators be dropped from long term monitoring. Future surveys should use shorter, focused questionnaires combined with community level data collection.

While most of the indicators were useful and sufficiently detailed, there is a need for more indicators that reflect dependence on water resources as a whole. This is mainly done in the process of analysis, which could be expanded to construct indices comprising a number of variables in a single value.

It is recommended that data on the indicators above be collected and analysed every 3 years. Increased use of updated official statistics, such as Agricultural, Forestry and Fisheries Census data, is recommended.

1. Secondary data for baseline vulnerability data should also be updated at the same time as the primary data collection because the two types of data complement each other. LandScan Global Population data has proved to be quite useful for social analysis at the regional scale, but they are synthetic and have a number of limitations in their applicability. When high resolution data, i.e., commune and village updated population figures, become available from the member countries statistical offices these should used instead..

1. Introduction

This report presents the findings of a baseline survey of the Social Impact Monitoring and Vulnerability Assessment (SIMVA) undertaken in 2011 by the Environment Programme of the Mekong River Commission (MRC). The objective of the survey was to generate baseline data on the socio-economic conditions of people in the LMB, the extent of their dependence on water resources, and their resilience to changes in these resources, both short-term shocks and long-term trends, and further, their climate change associated vulnerability.

The need for economic growth and poverty reduction to meet the Millennium Development Goals means that development activities, including water and related resources have been and will continue to be important in the Lower Mekong Basin (LMB). Development activities include irrigation, hydropower, and flood protection and water diversion. As a result of these activities, the patterns of the hydrological cycle will change. Combined with the predicted impacts of climate change, this may increase, or reduce the occurrence of events such as floods and droughts and cause changes in the productivity and services of aquatic ecosystems. This could potentially affect the wellbeing of millions of people in the LMB. SIMVA aims to monitor social conditions and provide broad data that can be used to assess the extent to which water resources development projects sustain local livelihoods. The survey does not cover the social impact assessment of specific development projects.

1.1. Background

Information on the social conditions in the LMB in the long-term is important for basin planning and identification of opportunities and risks for different development scenarios. MRC has therefore undertaken a programme of recurrent surveys to study the social conditions and the vulnerability of households related to changes in the environment and the availability of aquatic resources.

The focus of the present SIMVA 2011 was on the areas where use of and dependence on river water resources is most direct, namely along the Mekong mainstream and the vast flooded areas in Cambodia and Viet Nam's Mekong Delta. The study of social conditions has the objective of describing how changes in the availability of aquatic resources affect livelihoods over time. The study of vulnerability describes how sensitive people are to negative impacts from changes in access to these resources.

While originally conceptualized as two separate research strands in 2009 it was decided to combine them into a single data collection and analytical process. Phase 1 (SIM+VA) and Phase 2 (SIMVA) are considered pre-baseline phases.

Phase 1 comprised extensive literature review and Phase 2 a pilot survey with a view to determine the validity of indicators and research tools. Although the pilot study sample size was limited it provided

comprehensive data about the social situation at the specific study sites.

Compared to Phase 1 and 2, the present study, SIMVA Phase 3, involved a larger sample of villages/communes and households within the mainstream corridor, and in and around major flooded areas. Further, indicators relating to climate change were added. SIMVA 2011 was designed to provide a foundation from which indicators can be monitored on a regular periodic basis to determine changes in social conditions, livelihood sustaining resources and in food supply. SIMVA's large coverage monitoring data can be used to trigger site-specific studies that could increase chances for timely response to negative impacts from water resources development, while also providing data for broad monitoring of positive impacts.

1.2. Population and livelihood dependence on water resources in the Lower Mekong Basin

• 1.2.1. Population

It was estimated that in 2010 about 62.7 million people, or 35% of the population of Cambodia, Lao PDR, Thailand and Viet Nam lived within the LMB (LandScan Data, 2010; see table 1).

Table 1: Population in the Lower Mekong Basin and countries

Country	Total population	Population in LMB	Percentage of population in LMB
Cambodia	14,453,680	12,467,619	86%
Lao PDR	6,368,162	5,961,502	94%
Thailand	67,089,500	25,088,564	37%
Viet Nam	89,571,127	19,181,816	21%
Total	177,482,469	62,699,501	35%

Source: LandScan Data, 2010
Note: LandScan Global Population data - as grid - created by Oak Ridge National Lab (ORNL) and distributed by East View Companies (USA)

Due to the large size of the LMB, impacts of changes in the river connected water resources will be concentrated in some areas, while other areas will be largely unaffected. Thus, social impacts will also be localized in some areas. It is often stated in the media that all 62 million people in LMB could, or would be affected by for example hydropower construction on the mainstream, but this is not the case. Only some people in the LMB will be positively or negatively affected by changes in water resources, such as fish and OAAs, even if changes occur evenly throughout the LMB such as from climate change. It is therefore of interest to identify which areas are most exposed to potential impacts.

The SIMVA pilot study of 2009 found that the distance, and travel time, from households to rivers and water bodies was an important factor influencing the extent to which households use aquatic resources, especially fish and Other Aquatic Animals and Plants (OAAs/Ps). Not surprisingly, households closer to the river tend to make more use of its resources than those further away. Results of the SIMVA pilot study showed that, on average, local people made use of rivers

and water bodies within 15 minutes distance in the dry season and 20 minutes in the wet season. About 10% of the sample population travelled more than 30 minutes to fishing areas, while only 2% travelled more than one hour to go fishing. However, exceptions occur, such as long distance travel for seasonal fishing in Cambodia's Tonle Sap Lake (Hall & Bouapao, 2010).

In 2003, the rural population accounted for more than 80% of the total LMB population (MRC 2003). Most of the rural population engages in agricultural activities and depends heavily on natural resources for their livelihoods (Hook et al. 2003). However, the population growth rate in urban areas is about twice the national average due to migration toward cities and, if this trend continues, the rural population is projected to decrease to 75-70% of the population by 2025 (BDP, 2006).

• 1.2.2. Livelihoods dependent on water resources

Before year 2003 it was estimated that two-thirds of the LMB households were engaged in fishing mostly on a part time basis, and sixty-five to eighty-five percent of the total labour force in Cambodia, Lao PDR and Viet Nam were engaged in agricultural activities (MRC, 2003).

In Thailand, where agriculture accounts for less than 10% of gross domestic product, 70% of the workforce in the Northeast region worked in the agricultural sector (MRC, 2003). A study of 776 villages in the Lower Songkram River Basin in Northeast Thailand found that the most important activities for subsistence were rice farming and fishing for 92% of households, while livestock farming ranked third with 82% of households engaged in this activity (MRC 2008). In Cambodia, rice cultivation and fishing have long been recognized as the most important sources of livelihood for people living in the Tonle Sap areas (Ahmed, Navy, Vuthy, & Tiongco, 1998).

Fish from inland capture fisheries and aquaculture is still an important source of animal protein for rural households in the LMB (MRC 2010). A meta-study of various studies done in the decade 1996 - 2006 estimated that inland fish and other aquatic animals contribute 47–80% of dietary animal protein, with an average daily intake of 18.3 g/person of a total daily intake of animal protein of 32.5 g/person, which is high compared to the rec-ommended daily amount (Hortle, 2007). Another study in Cambodia found that fish supplied more than 80% of the total protein consumed (BDP, 2006).

In rural Lao PDR, a food security study found that wild meat and aquatic resources, especially wild fish were the biggest source of animal protein (WFP, 2007). In short, rice and fish have been the basis of subsistence livelihoods for millions of people in the LMB, and will remain important in the years to come.

Many factors influence the livelihoods of people in the LMB, including population growth, flooding, drought, and changes in natural resources, including water resources, caused by both human activities and climate change.

Given its mountainous topography, the potential of the Mekong for hydroelectric development of the mainstream has long been considered. The

first serious proposal was the Nam Phong, which was to have been located upstream from Vientiane and for which considerable planning and analysis was carried out in the late 1960s and early 1970s. But China was the first country to put words into action and has moved forward with its plans since 1984. The Manwan Dam in Western Yunnan, completed in 1993, now provides 1,500 MW of electricity for Kunming and surrounding areas. It was followed by the 1,350 MW Dashaoshan completed in 2003 and the 1,750 MW Jinghong in 2008, both downstream from Manwan. Upstream, the world's highest dam, the 292 m high Xiaowan, opened in 2010 and will generate 4,200 MW. The 900 MW Gongguoqiao dam, the furthest upstream, is under construction and is expected to come online in 2012. Nuozhadu, another high dam of 262 m, also under construction, is expected to generate 5,850 MW. The smallest of the dams, the 150 MW Ganlanba, is still in the planning stages, while one of the remaining planned dams, the Mangsong, has been postponed.

Inspired by China, investors are now interested in harnessing the 30,000 MW potential of the Lower Mekong Basin. Eleven mainstream dams have been proposed for the Mekong between Pak Beng in Oudomxay Province and Kratie in Cambodia. Of these, at least four represent investments by Chinese state enterprises (Hirsh, 2011).

Hydropower development is projected to bring millions of dollars, which can be used for economic development. The economic benefits will be accompanied by environmental and social concerns, including trans-boundary issues. Environmental changes are already being felt, for example the Chinese dams have had impacts on the upper Mekong in Yunnan where the Manwan has displaced some 25,000 people in 96 villages (Osborne, 2000).

Regarding climate change, the Inter- governmental Panel on Climate Change (IPCC) has warned that as a result of projected global warming, a higher frequency of intense extreme events all across Asia, including the Mekong region, is possible (Cruze et al., 2007). The projected impacts of climate change on water resources and related livelihoods include: 1) increasing water stress because of the decline in fresh water availability, 2) decrease in river flows as glaciers disappear, 3) decreases in crop yield, putting many millions of people at risk from hunger, and 4) increased land degradation and desertification due to reduced soil moisture and evapotranspiration(UNFCCC., 2007).

1.3. Structure of the report

Following this introductory chapter, Chapter II provides information on the methodology for the baseline survey, including preparation, fieldwork, data entry, data cleaning, and analysis. Chapter III presents the update of secondary data for the baseline vulnerability, using eight indicators. The discussion is based on a series of

maps, combining and comparing two or more indicators on the same map. Chapter IV contains demographic information about the study sites; including household size, ethnicity, gender, population pyramids, and population by zones. Analysis of dependence of people in the LMB on water resources, particularly fish, other aquatic animals (OAAs), irrigation and river-bank cultivation is provided in Chapter V. The analysis shows differences in the indicators between countries and zones.

Chapter VI focuses on resilience, based on 12 indicators. Shocks and trends as factors that potentially threaten people's resilience are presented in Chapter VII. Nine indicators are used for the baseline. Chapter VIII covers climate change related vulnerability, focusing on social rather than biophysical related vulnerability. Chapter IX contains overall conclusions and recommendations.

2. Methodology

2.1. Secondary data collection

The survey included compilation of secondary data on eight baseline vulnerability indicators: (1) Fertility rate; (2) Household size; (3) Dependency ratio; (4) Child malnutrition; (5) Infant mortality rate; (6) Poverty rate; (7) Employment in agriculture; and (8) Education. The secondary data was obtained from the MRC Social Atlas database and relevant line agencies in Cambodia, Lao PDR, Thailand, and Viet Nam. The MRC Social Atlas database contains socio-economic data on the riparian countries by province within the LMB and covers the period 1998–2000. The data were updated from different sources provided by national survey super- visors in the four countries. Population data in GIS format were also purchased from the LandScan Global Population Data 2010 to estimate the number of people living in the 15 km Mekong corridor.

• 2.1.1. The LandScan Global Population Data

Data used in several parts of this report, such as maps, defining corridors, zones and population, were derived from the LandScan Global Population Data developed by the US Department of Energy's Oak Ridge National Laboratory (ORNL). The dataset represents the total population distribution. It may not provide exactly the same population numbers as the national statistics. However for the regional scale analysis and for estimating population within the 15 km corridor, which does not fit administrative boundaries exactly, the LandScan data was found to be useful. The dataset comprises a worldwide population database compiled on a 30" x 30" latitude/longitude grid. Census counts at sub-national level are apportioned to each grid cell based on likelihood coefficients, which are based on proximity to road, slope, land cover, night time lights, and other information. The resulting grid has a population count assigned to each cell of about 1 sq.km. Figure 1 shows the general application of LandScan for the analysis.

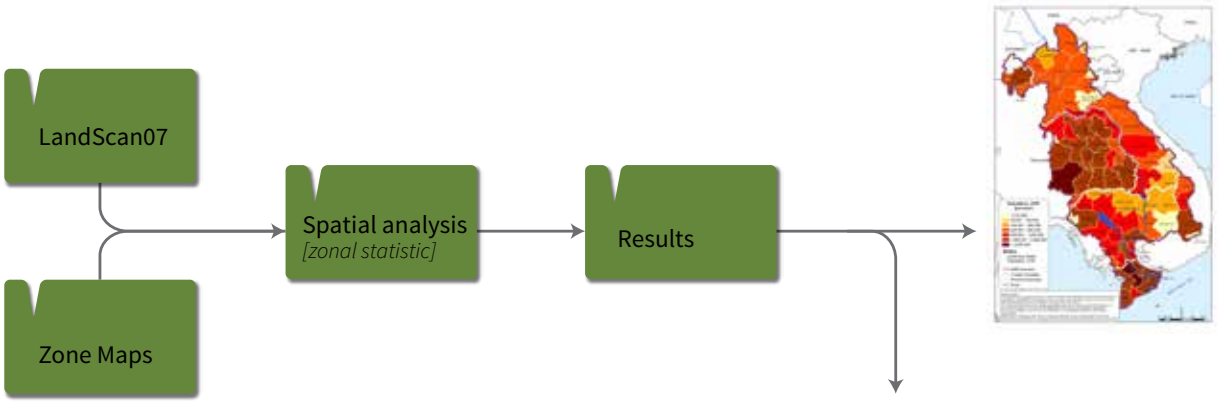
• 2.1.2. GIS analysis and mapping

GIS analysis and mapping were done using ESRI ArcGIS software. Both spatial and tabular data were organised and reformatted to suit the analysis. GIS analysis was mainly used to identify and calculate the population in the area of interest, i.e. the Mekong corridor. Since the population dataset was in the raster form, the "Spatial Analysis" module was used for analysis.

The datasets used in GIS analysis include:

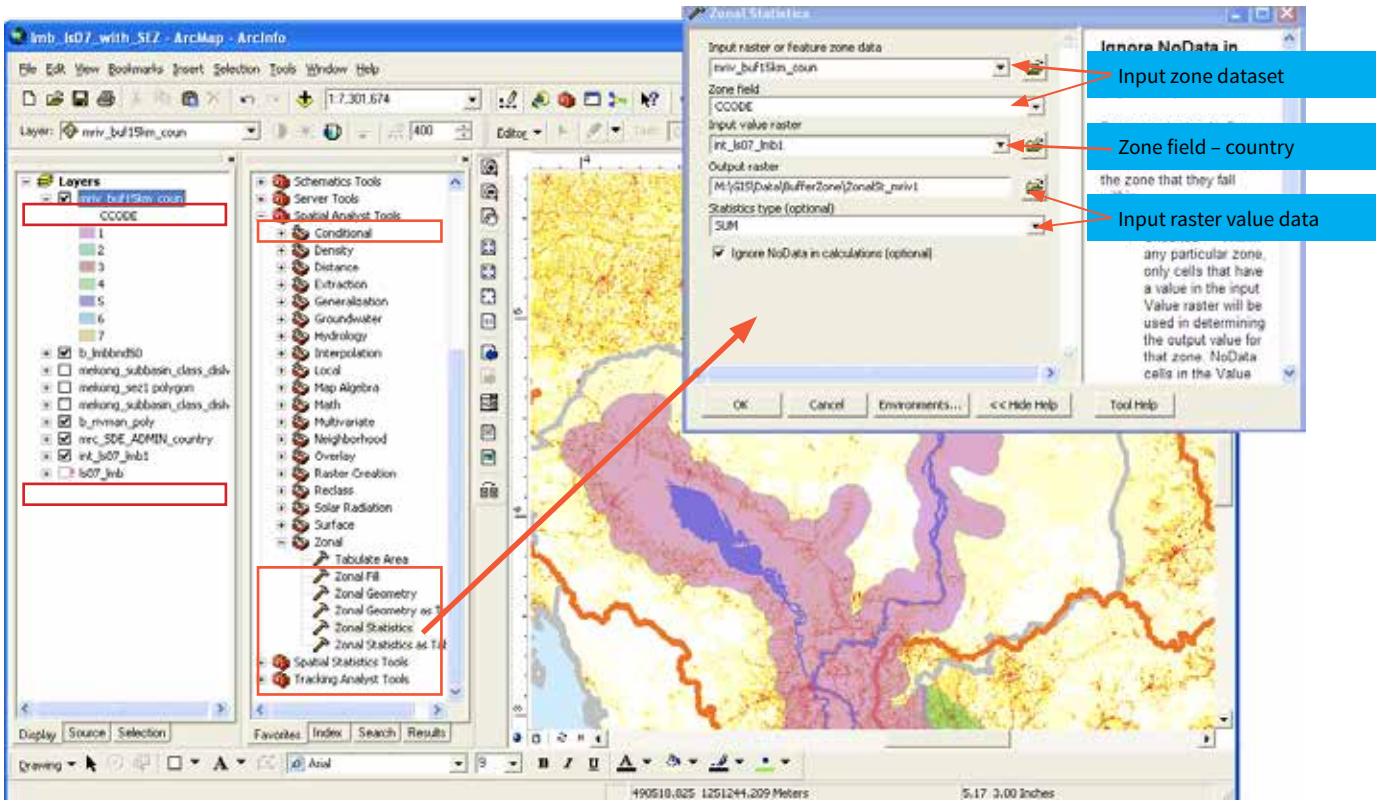
- Population dataset – LandScan 2010 Global Population Dataset
  - > Administrative maps – country and province boundaries
  - > LMB boundary
  - > SIMVA corridor zone boundaries

Figure 1: GIS spatial analysis model



CCODE CNAME	Pop_5km	Pop_10km	Pop_15km
1. Cambodia	8092245	9112887	9895523
2. Lao PDR	2135497	2848364	3430038
3. Thailand	1192212	1868844	2499396
4. Viet Nam	12079681	13008935	13851598
Total	**23499636**	**26839030**	**29676555**

Figure 2: Demonstration of using the spatial analysis tool – "Zonal Statistic" to calculate population (raster value) in buffer zone by country



2.2. Primary data collection

Primary data on water resources dependence, resilience and climate change associated social vulnerability were obtained by a household survey within a corridor of 15 km on both sides of the mainstream Mekong and extending in a 40 km buffer zone around the maximum extent of flooded areas as recorded by satellite in year 2002. This area was split into eight socio-ecological sub-zones, with two sub-zones in each of the four member countries. The baseline survey used a highly structured questionnaire designed to obtain data for 62 indicators. The process of primary data collection included indicator and questionnaire improvement, sampling, training enumerators, data entry, quality control and data analysis. The survey was carried out in March–May 2011.

• 2.2.1. The survey area

The pilot study suggested that the baseline survey focus on a 15 km corridor on each side of the Mekong mainstream. The reasoning being that the further people live from the mainstream, the less they depend on the river resources for their livelihoods.

In addition to the 15 km corridor a buffer zone of 40 km around maximum extent of flooded areas in 2002 were drawn on GIS to provide the sampling frame. The 40 km buffer zone was added because of the vast extension of water around some parts of the mainstream, mainly in Cambodia including Tonle Sap and in the Mekong Delta during the wet season. Further, the 15 km corridor also extended onto main tributaries 40 km upstream from Mekong, Tonle Sap and Bassac. However, in reality only 2

Table 2: IBFM and SIMVA zones in the LMB

Hydro-ecological zone	Description: IBFM	Description: SIMVA	Social survey sub-zones	Description
Zone 1	Lancang, China	Lancang, China (not covered by this study)	n.a.	n.a.
Zone 2	From Chinese border to Vientiane (upstream)	From Chinese border to Vientiane (upstream)	Zone 2 – Lao	Lao side of zone 2
			Zone 2 – Thai	Thai side of zone 2
Zone 3	From Vientiane (upstream) to Pakse	From Vientiane (upstream) to Lao-Cambodian border	Zone 3 – Lao	Lao side of zone 3 (incl. Vientiane)
			Zone 3 – Thai	Thai side of zone 3
Zone 4	From Pakse to Kratie	From Lao-Cambodian border to Cambodian-Vietnamese border	Zone 4 – Cambodia	Cambodia's zone 4: mainstream
Zone 5	From Kratie to Phnom Penh (upstream), incl.Tonle Sap	15 km from the mainstream Mekong in Phnom Penh to Tonle Sap Lake	Zone 5 – Tonle Sap Lake and River	Cambodia's zone 5 Tonle Sap Lake and River
Zone 6	From Phnom Penh to South China Sea (the Delta)	From Cambodian-Vietnamese border to Eastern Sea (the Delta)	Zone 6 – Viet Nam Mekong Delta	Viet Nam's zone 6: freshwater and salinity zones

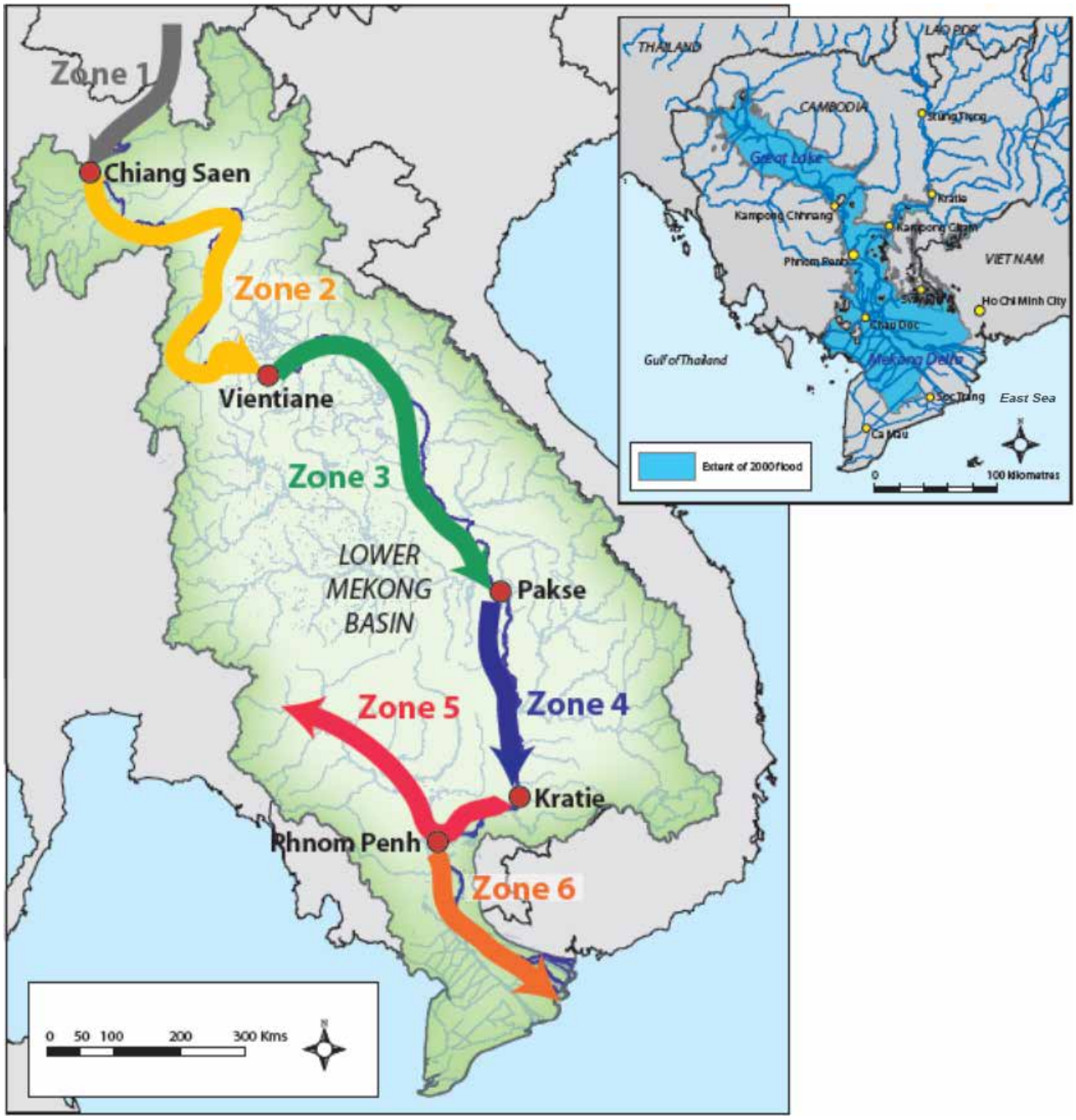


Figure 3: Integrated Basin Flow Management (IBFM) zones

Source: MRC 2009

Table 3: Zones and sub-zones

IBFM zone	Zone 2		Zone 3		Zone 4	Zone 5	Zone 6	
SIMVA sub-zone	Zone 2 Lao	Zone 2 Thai	Zone 3 Thai	Zone 3 Lao	Zone 4 Cambodia Main	Zone 5 Cambodia Tonle Sap	Viet Nam Fresh	Zone 6 Viet Nam Saline
No. sample households	340	340	340	340	340	340	340	340

Sampling was carried out separately for each sub-zone (zone in Cambodia).
Rural villages within the each zone of the survey area were then sorted by north–south and east–west of the river before the selection process began.
For Viet Nam the most detailed dataset available for Viet Nam was at the commune level.

or 3 villages in the tributary corridors in Lao PDR and Cambodia were actually included in the sample. The 40 km buffer zone covers a stretch of some tributaries as seen on map in Figure 4.

Buffer/corridor zones were generated from the following databases:

- Main river within 40 km of the Mekong, Tonle Sap, and Basac mainstreams
- Wetland areas of Songkram, Thailand and Tonle Sap, Cambodia
- Flooded areas (based on maximum flood extent of 2002) but are limited to 40 km.

The survey teams in each country provided lists of the settlements (towns/villages/ hamlets) within these boundaries and their total population (households were not listed). A regional work-shop in August 2008 recommended that the SIMVA should focus on rural areas rather than towns so the urban habitations were excluded from the list. Figures 5 and 6 show the distribution of villages and communes within the sample area.

These datasets used for delineation of the 15 km corridor and the 40 km buffer zone were MRCs:

- Main rivers in the LMB
- Maximum inundation extent in the LMB reached in 2002
- Boundaries of the LMB
- LMB country boundaries
- Boundaries of the freshwater zone in the Mekong Delta

The survey area was divided into five major zones: 2, 3, 4, 5, and 6 (Figure 4). These were further divided into sub-zones as shown in Table 3.

• 2.2.2. Sampling procedure

Drawing the sampling frame

The SIMVA zones are based on hydro-ecological zones defined by the Integrated Basin Flow Management (IBFM) (Figure 3). These zones were used by a number of MRC programmes such as the Basin Development Plan (BDP) and Strategic Environmental Assessment (SEA) of the Sustainable Hydropower Initiative. Since SIMVA is based on social characteristics the zones were adjusted and further split into sub-zones. Table 2 and Figure 4 provide the details and show the SIMVA sub-zones. It was a

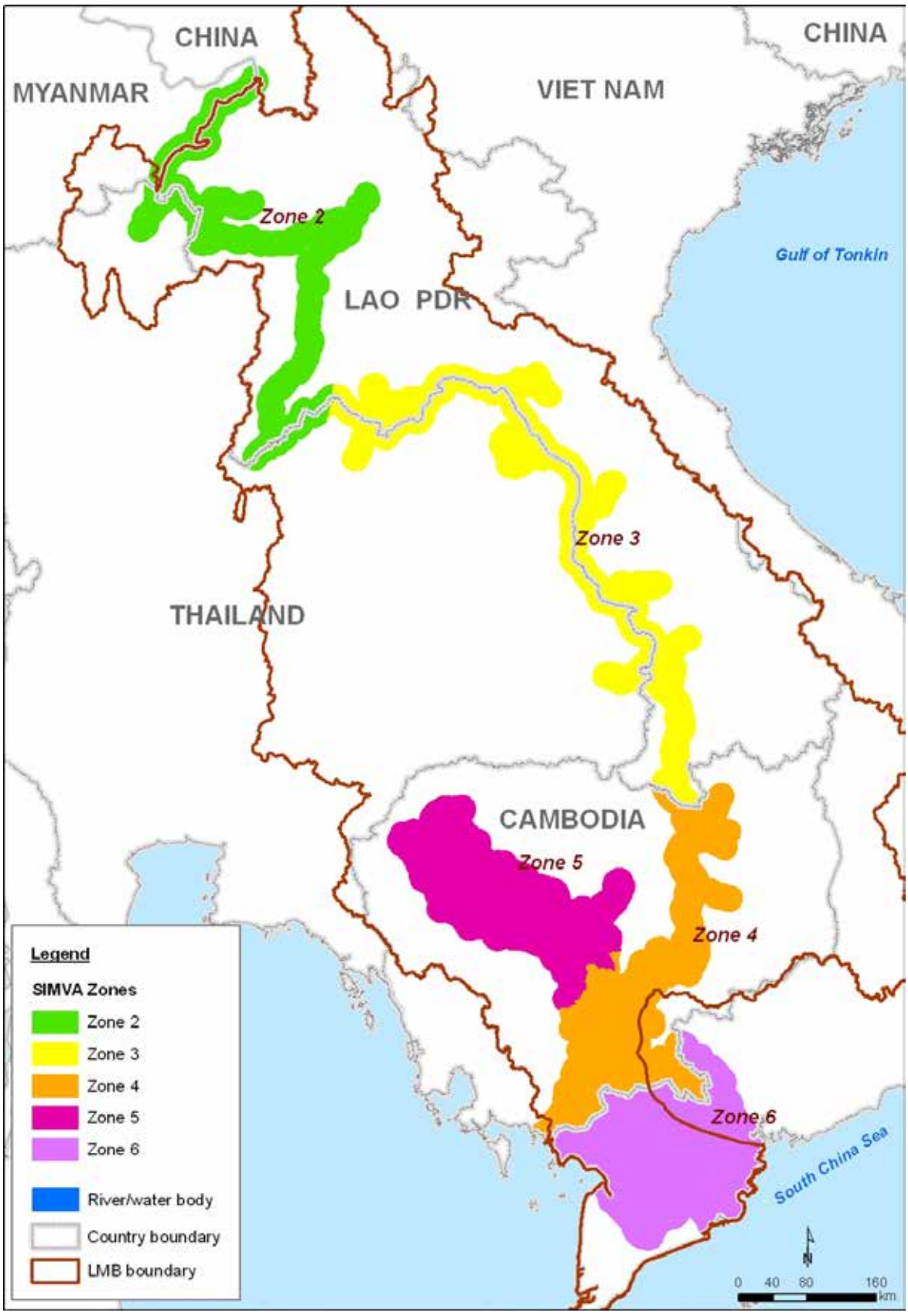


Figure 4: SIMVA zones in the LMB

recommendation from the pilot study that the delta should be divided into a fresh-water and a saline water zone. This gave a total of eight sub-zones (Table 2). Sampling was carried out as follows:

- 8 sub-zones
- 2,720 households overall
- 340 households in each sub-zone
- 20 households in each village (clusters)
- Villages (clusters) randomly selected with probability proportionate to size (PPS).
- In selected areas random selection of enumeration areas drew from a list of all enumeration areas falling in the 15 km corridor in the zone with PPS.
- 20 households in each sample village selected by systematic sampling based on household lists.

Sampling process

A two-step sampling process was applied. Lists of villages were available at the national level, while household data were, and in general are, most up to date at the village level (household data might be available at the central level through censuses, which are usually taken at 10-yearly intervals). The sample villages were selected in advance of the fieldwork by statisticians in the countries applying the PPS method. Households were selected when the enumeration team arrived in the villages.

Village selection

Because of the equal sample size in each sub-zone and country, the Probability Proportionate to Size (PPS) method was applied. In cases such as for SIMVA, where the sample size is set at a fixed number, the PPS method concentrate the sample on larger elements that have greatest impact on population estimates. Using PPS ensured that villages with larger populations were included in the sample.

A list of the sample villages is provided in the Annex 2. Figure 5 and 6 shows the distribution of the sample villages across the four countries. Figure 7-10 presents a higher resolution view of the distribution of the sample villages in Cambodia, the Lao PDR, Thailand, and Viet Nam, respectively.

Household selection

Twenty households per village were sampled using systematic sampling. In the sample village the enumeration team obtained the list of households from the village authorities. Households that had been in the village for less than six months were excluded. The total number of households was divided by 20 to get the interval and, starting from a random number on the list, the sample households were selected.

• 2.2.3. The household questionnaire

The household questionnaire was designed based on experiences drawn from the pilot study in 2009–2010, with additional climate change related questions. It contains 275 questions in18 sections (Annex 1). The questions are mainly about the household

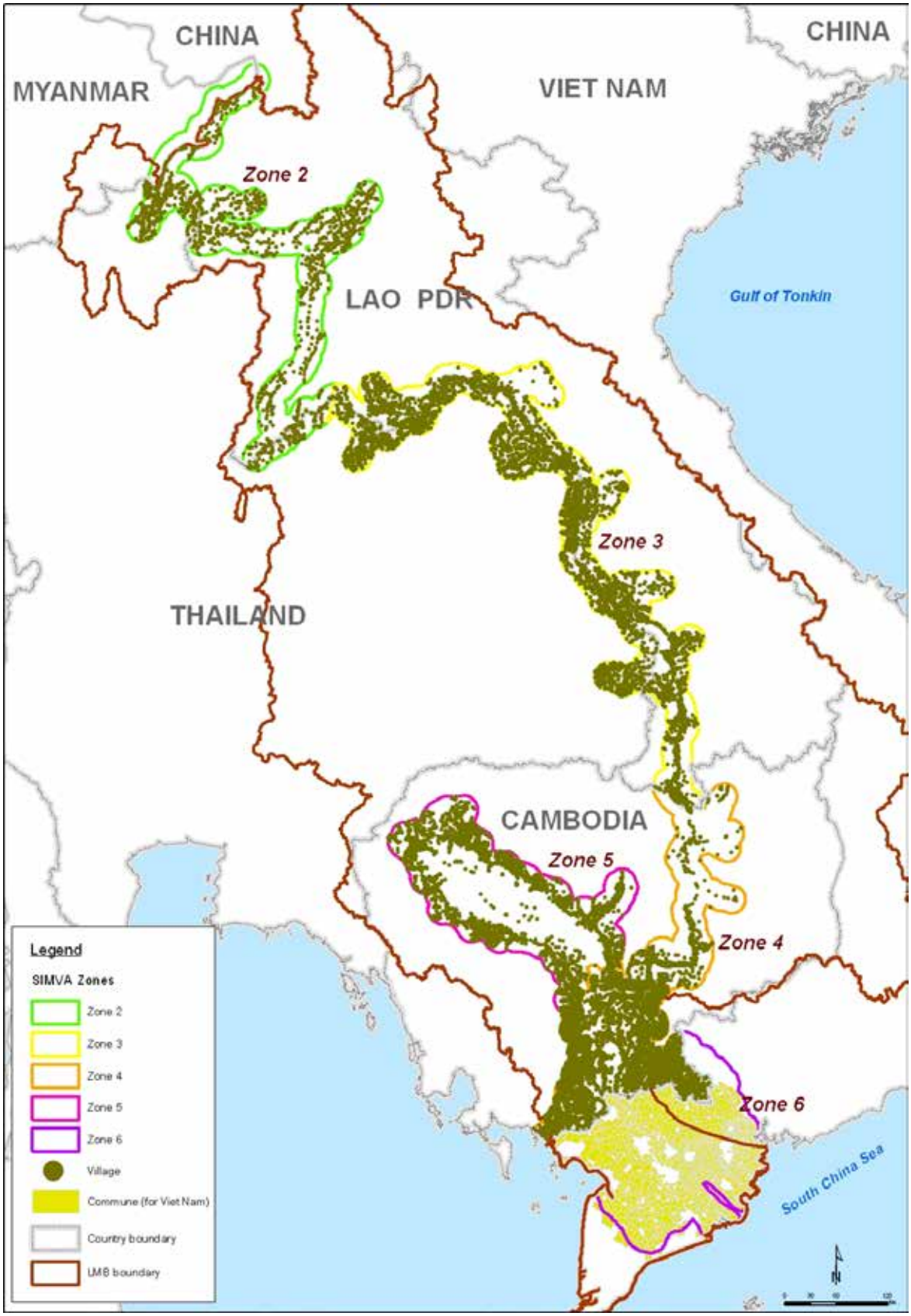


Figure 5: Location and distribution of villages in the survey area

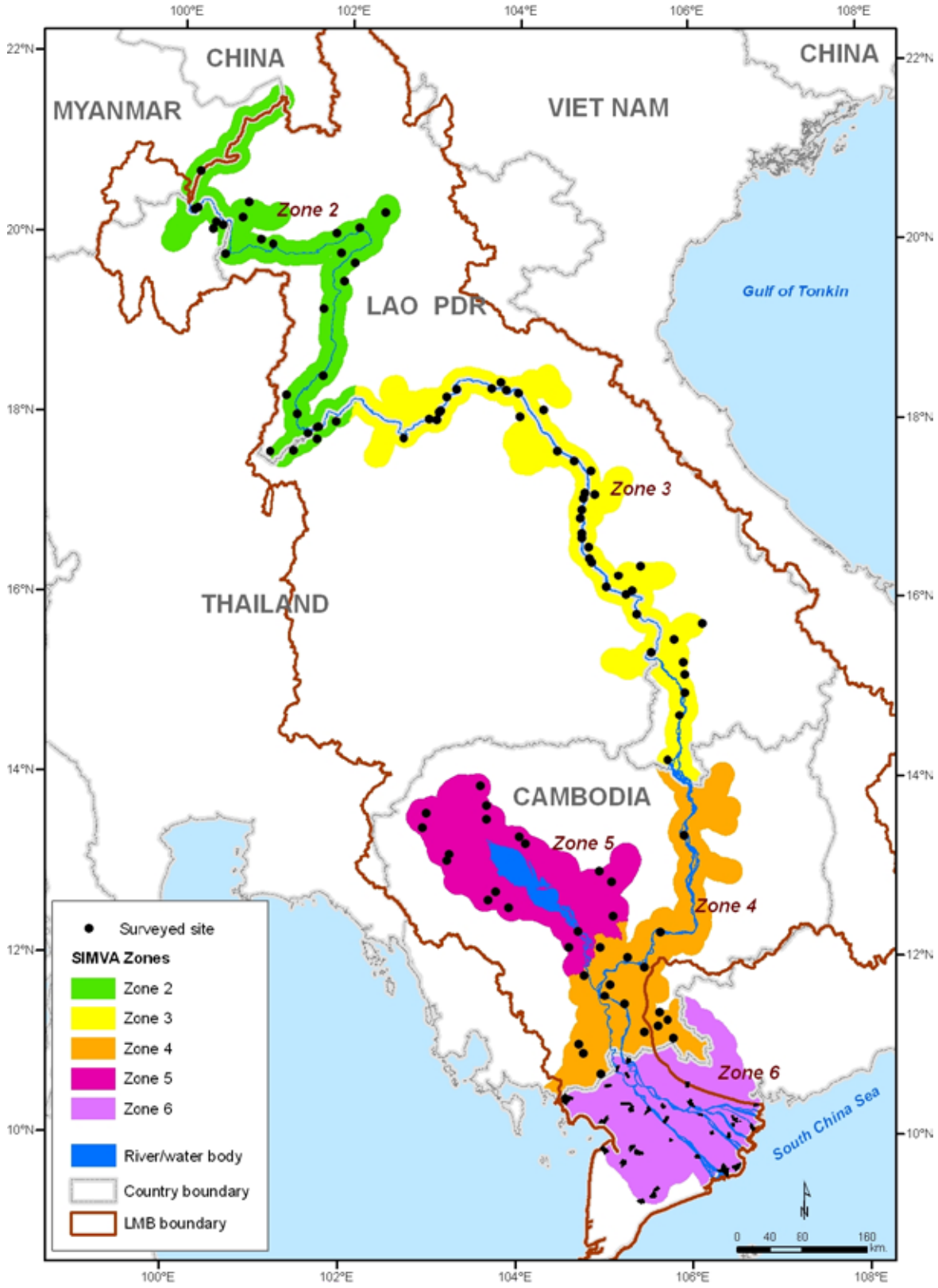


Figure 6: Location and distribution of sample villages in the five zones

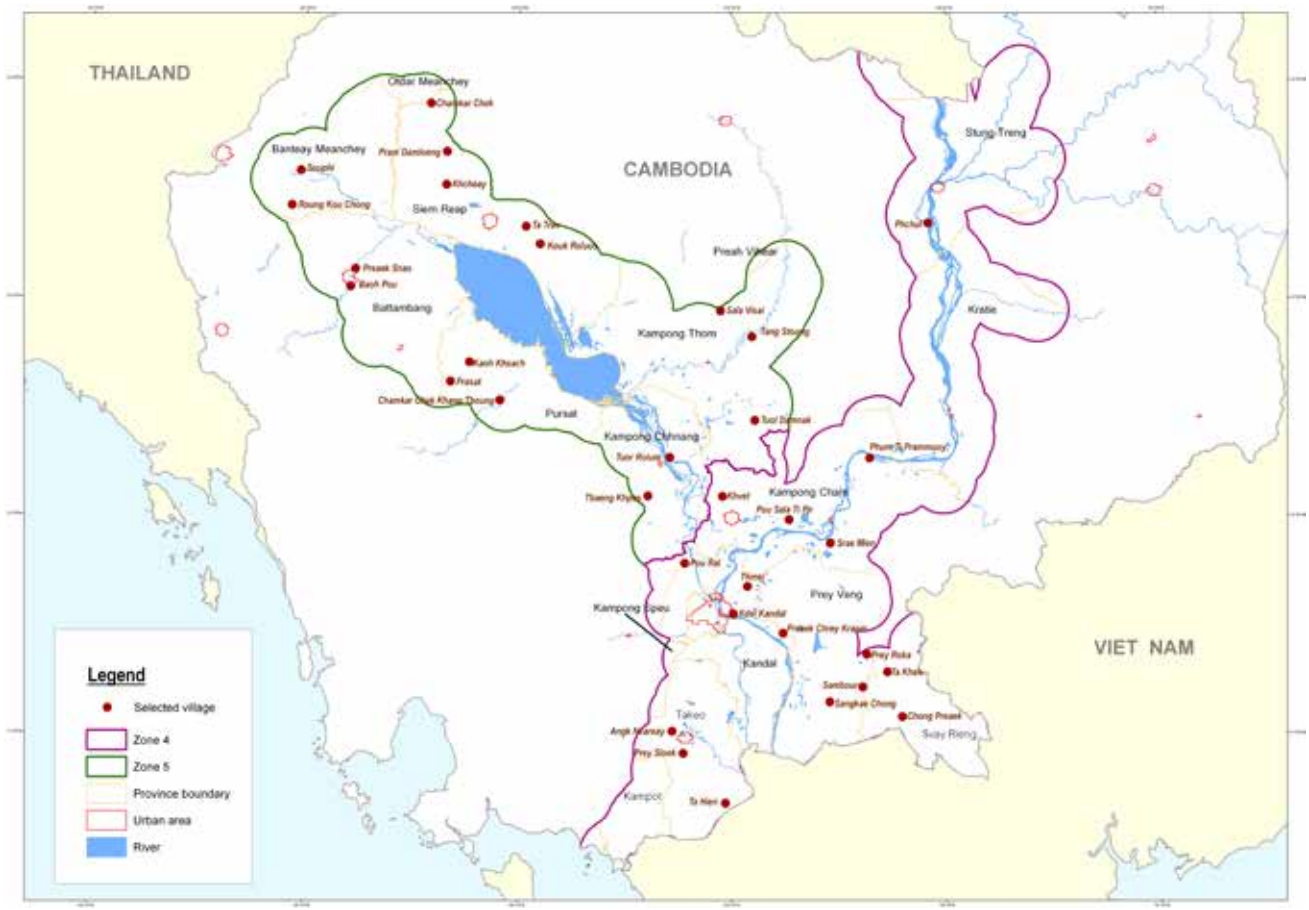


Figure 7: Distribution of sample villages by zone in Cambodian corridor

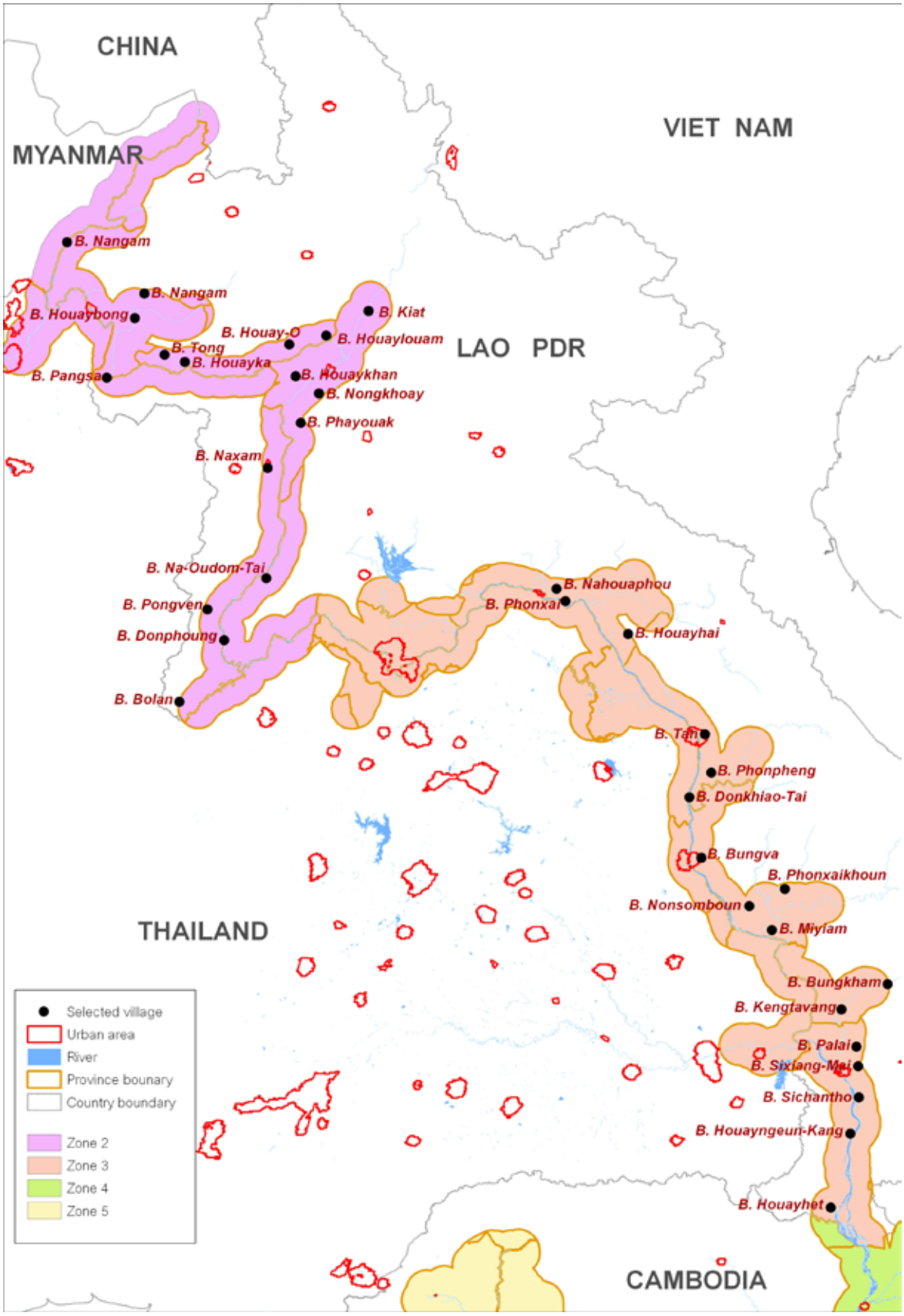


Figure 8: Distribution of sample villages in the Lao PDR corridor

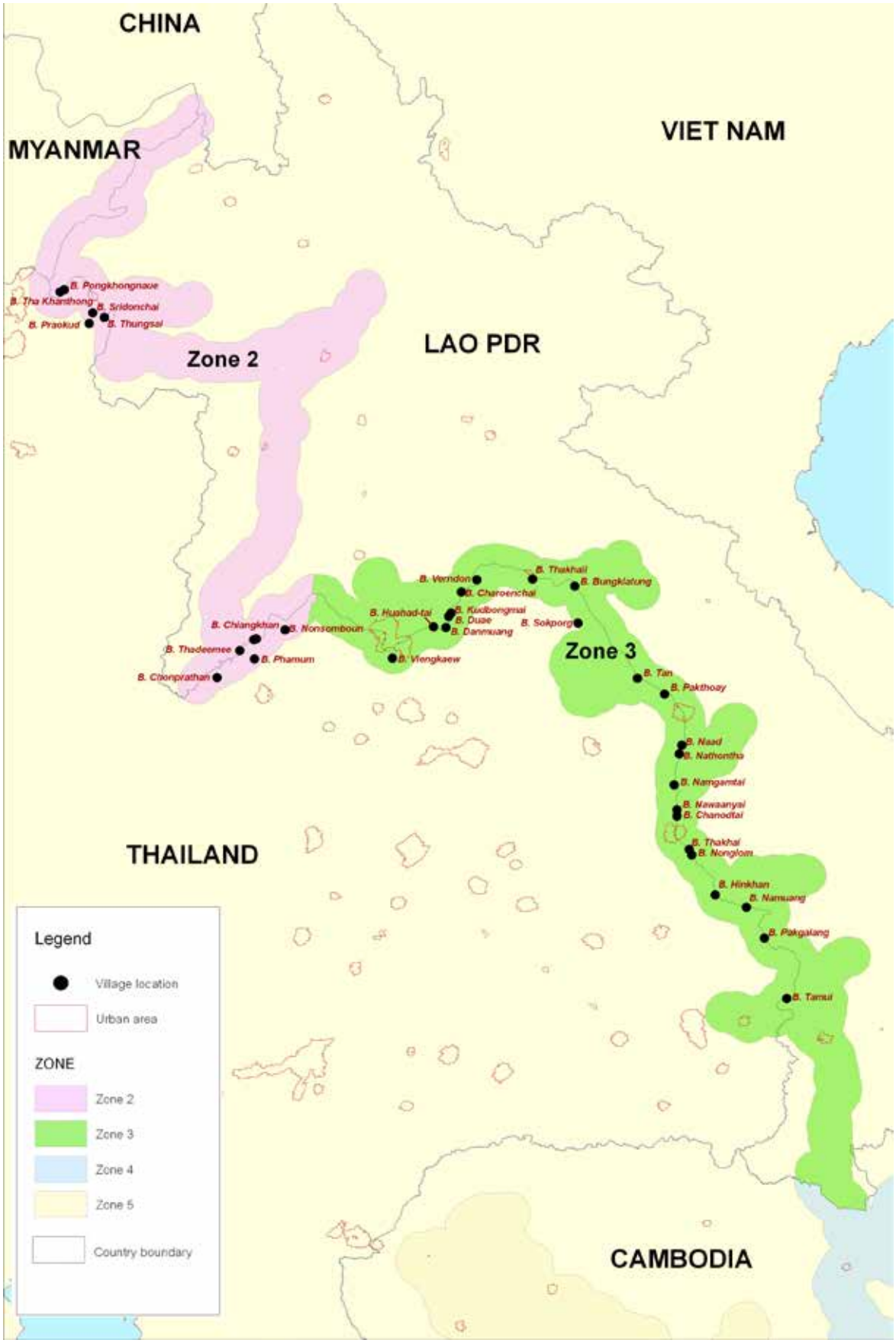


Figure 9: Distribution of sample villages in the Thailand corridor

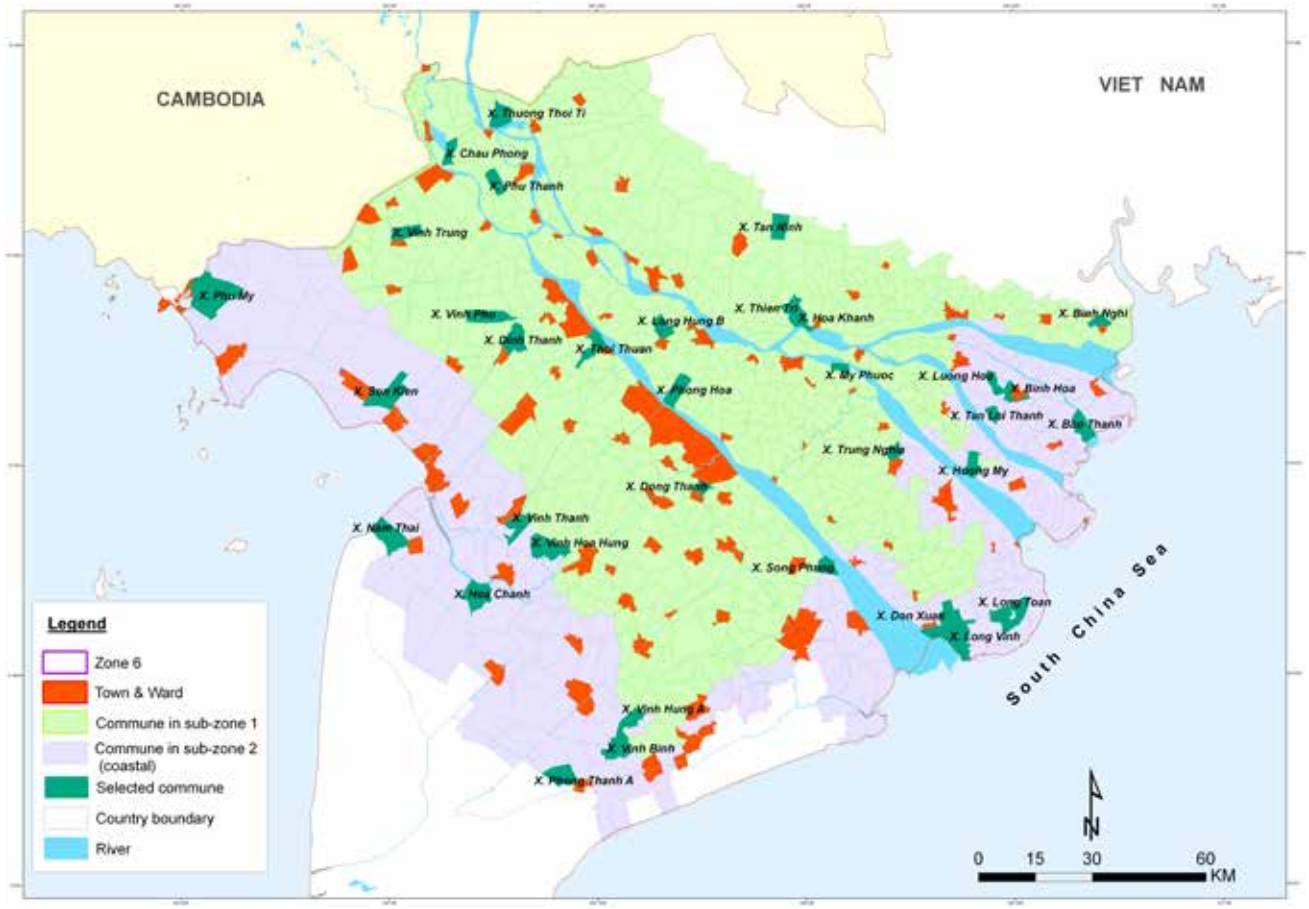


Figure 10: Distribution of sample villages/communes by zone in Viet Nam Corridor

and only a few are about individual household members, reflecting that most SIMVA indicators are based on household level data. For example, income, food, and ownership to assets are mostly relevant at household level. Assets are usually owned by the head of the household and used for the household. Land area owned or cultivated, annual rice production, and ownership of livestock applies to households. Income from the sale of these resources is also seen as household income, rather than income of individual household members. The questions about individual household members are about their age, education, primary and secondary occupation and work place in or outside the village.

• 2.2.4. Training enumerators

The survey teams were trained with the objective to build a common understanding about the survey methodology, key terms, questions, roles, responsibilities and other clarifications for all enumerators. All the survey materials, including the questionnaire and guidelines for the questionnaire, were carefully translated into national languages to maintain original concepts/meanings.

The training sessions were conducted in the national languages. The length of the training varied between the countries from 4–6 days, including classroom discussion, field practice and discussion of lessons learnt from the practice. A major part of the training involved the sampling and questionnaires. Using the technical guidelines, trainers discussed each question thoroughly with the enumerators.

• 2.2.5. Fieldwork

The field survey was undertaken from March to May 2011, although the start and end dates were not the same across countries. Each national expert organised his/her own survey team with 5 members. A national expert supervised the fieldwork, assisting the team technically and providing quality control.

Some enumeration teams encountered language problems interviewing ethnic minorities who did not speak or understand the national language very well. This difficulty was solved either by using interpreters available in the village or, in some cases, villages chiefs helping with translation. On average, one questionnaire took about one and a half hours to complete. In ethnic villages, the time taken was longer.

• 2.2.6. Data entry

The survey teams used a common template to make it easier for national data to be merged into a regional database. No changes were allowed to numbering or spelling of variables during data entry. Numbers served as codes and could replace variable names. All the databases were submitted in SPSS. Instructions on the data entry template and suggested solutions to possible problems were provided separately together with the data entry template by the software design specialist.

• 2.2.7. Quality control

Quality control was provided at each stage of the survey: preparation, fieldwork, data entry, and data analysis. Quality control of the questionnaire was done by two-way translation: from English to the national language and then back to English using different translators. The latter translation was then compared with the original version to identify any differences and corrections required. In addition, the test data gathered during enumerator training was entered into the template and checked by the national experts and MRC staff member.

During the fieldwork, completed questionnaires were randomly checked allowing the project team to identify any gaps where support was needed and to make corrections where necessary while it was still feasible to revisit the sample households.

To limit errors in data entry, the template was designed to restrict the number of digits that could be entered in a particular field. For example, digits for months in the

year could not be more than two. National experts had to clean the data before it was submitted to the international expert and MRCS in SPSS format. The regional team made a last check of the data to ensure comparability of all four datasets.

• 2.2.8. Data analysis and reporting

At the national level the national experts who supervised the survey were responsible for data analysis. Country reports were prepared using a common report template and incorporated into the regional report. Country specific explanations and interpretations of relevant indicators were provided in the national reports.

Data were stored and analysed in SPSS software, while later checks and corrections were done with the JMP software. The analysis made use mainly of custom tables, crosstabs and frequency calculations. Tests for statistical significance of variance were also done in the analysis processes.

2.3. Scope, limitation and challenges

The geographical scope of the study is limited to the survey area, and thus does not cover the whole LMB. At the same time the large survey area within the 40 km buffer zone around flooded areas, combined with the limited sample size, resulted in, on the one hand, inclusion of some villages that were very far from the Mekong mainstream or the Tonle Sap proper and thus do not use these water resources. On the other hand, there were some geographical areas within the zones, which were not represented or with only very few households, for example the area between Khone Falls and Kratie in Cambodia.

The equal sample size of 340 households within each sub-zone sets limits for the degree of statistically robust comparisons between the sub-zones. The population in each zone differs significantly and so do the expected statistical standard errors and confidence intervals. Though tests for significance were done during analysis, confidence intervals were not computed for the different variables, as this exceeded the resources available for that stage of the study. Thus, the results are reported without confidence intervals.

Application of weights that could increase statistical precision could not be calculated due to lacking information on the total number of households in the sampled villages. Acquiring and combining official statistical data from geographical areas within four countries posed many challenges and some were not overcome in the present study.

The main unit of analysis was the household while only a few indicators and data variables were at the level of individuals. Thus few indicators could be disaggregated by gender and age.

It was a limitation that the village/community level was not included in the data

collec-tion. This would be relevant for assessing access to services and community facilities.

It could be considered a limitation that the study did not investigate vulnerability from changes in resource availability further down the value chain, which, however, would increase the complexity of the study even further. Similarly, the collected data for resilience assessments were relatively simple considering the complexity of this concept.

The questionnaire used was designed with the participation of a wide range of stakeholders, including National Mekong Committees, relevant line agencies, and MRC Programmes, resulting in a lengthy questionnaire. There were instances of interview fatigue reported from the fieldwork, resulting in a reduced precision in responses. Logistically, the long interviews took on average 1.5 hours and longer for ethnic groups, which made it difficult to reach field-work targets within the planned schedule.

At the same time, some of the questions were not detailed enough to elicit the information needed for precise and accurate calculation. For example, to calculate calorie intake from fish, details about the type of fish, such as dried, fresh, black fish, white fish, etc. must be recorded with the amounts that a household consume. This level of detail was not possible to attain due to budget and time constraints.

Some of the respondents did not speak or understand the national language well. Although translators were provided, they were not always available for the interviews.

To obtain monetary values for certain indicators at the regional level for comparison purposes, national currencies were converted to US$. The conversion was based on the MRC exchange rate, rather than the local market exchange rate.

Secondary data in the form of updated official statistics on vulnerability indicators were difficult to obtain. The secondary data are presented mainly in the form of maps that show data from different years, which should be kept in mind when interpreting these. Further, some indicators were not available for some provinces.

Population data were available at different administrative levels: village level was only available for Cambodia and the Lao PDR, while only province level was available for Thailand and Viet Nam; however, data for Cambodia and the Lao PDR could be summarised to provincial level. The basin and zone level population data were based on count per cell derived from LandScan Global Population data.

Because of the incomparability of available secondary data at the time and in order to create basin thematic maps, it was decided to use the MRC Social Atlas, which are based on data from year 1998–2000 and cover the whole Basin and these were updated with more recent information from national datasets where possible.

3. Baseline Vulnerability

This section presents secondary data on vulnerability measured by eight indicators across countries and provinces, namely:

- Average household size
- Dependency ratio
- Access to clean drinking water
- Access to sanitation
- Access to electricity grid
- Rural poverty rate
- Infant mortality
- Child malnutrition (underweight)
- Completion of secondary education

A basic assumption of SIMVA is that people whose livelihoods are dependent on the water resources are more vulnerable to changes in these if they are also vulnerable in other ways. For example, resource-users with low education levels find it harder to adapt to reductions in the productivity of their natural resource-based livelihoods than the better educated who would have more alternative work opportunities. Equally, households with members who are already malnourished would likely be relatively more affected if their access to natural resources diminished. Conversely, households living in 'supportive contexts', with access to services such as water, electricity and roads, are likely to be more resilient.

The following maps show each of the indicators for vulnerability. Please note that the data sources are from different years, some are quite old, and in some cases use different methods for calculation. The maps should therefore only be considered indicative for assessing vulnerability.

The main data source is MRC Social Atlas data, 2003 with the following updates:

- Dependency ratio of Cambodia and Viet Nam 2009 (Cambodia Socio-Economic Survey 2009 and Viet Nam General Census 2009), Lao PDR and Thailand 2005 (National Census 2005).
- Poverty rate of Viet Nam 2009 (Department of Social Affairs).
- Cambodia 2008 (General Population Census 2008), percentage of households getting light from city power provider as measure of access to electricity grid.
- Infant mortality rate of Cambodia and Lao PDR in 2005 (Cambodia Health Survey 2005 and Lao PDR National Census 2005), Thailand and Viet Nam 2009 (Thailand Health Report 2009 and Viet Nam General Census 2009).
- Child malnutrition prevalence: Cambodia (Small-area Estimation of Poverty and Malnutrition in Cambodia, National Institute of Statistics, Ministry of Planning, Royal Government of Cambodia, and the United Nations World Food Programme, April 2013), child malnutrition measured as underweight of 2 Standard Deviations. Lao PDR (Social Indicator Survey (LSIS), 2011 – 12, Multiple Indicator Cluster Survey /Demographic and Health Survey, December 2012), child malnutrition measured as underweight.
- Proportion of population who finished lower secondary school of Cambodia 2008 (General Population Census 2008), Thai report on indicators that reach or do not reach target in 2010 (Department of Community Development, Ministry of Interior), Viet Nam 2009 (General Census of Population 2009).

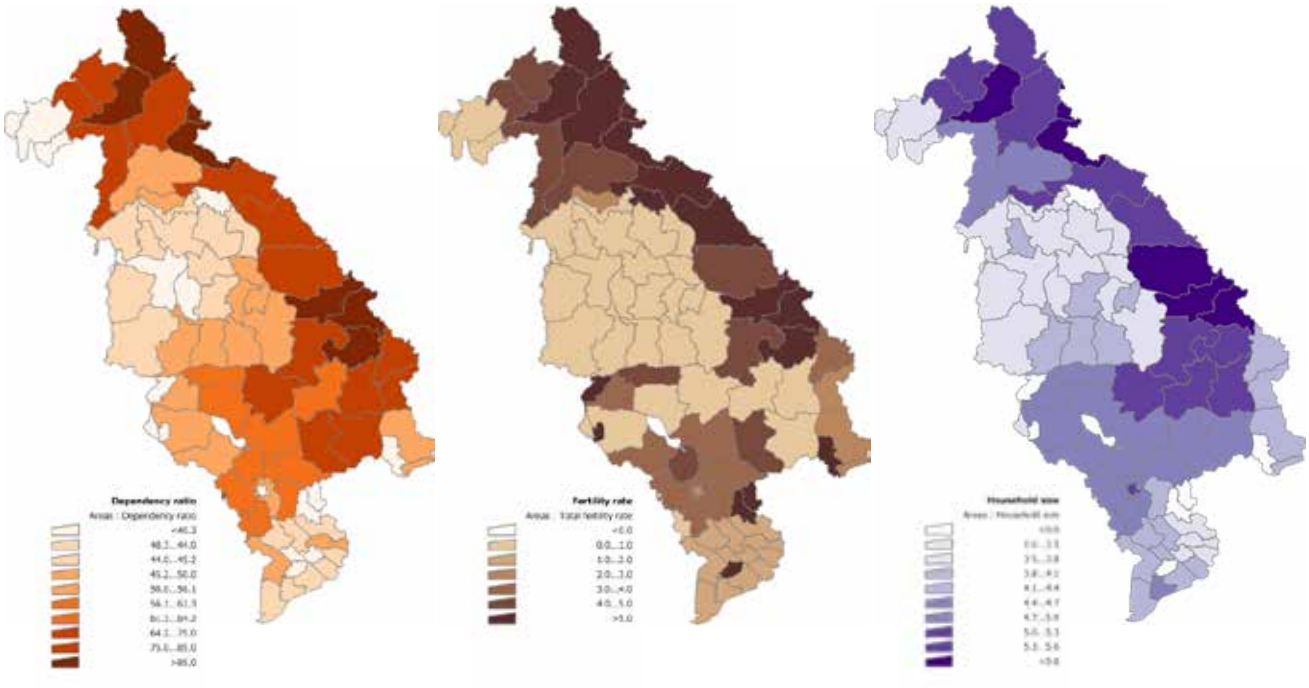


Figure 11: Household size, dependency ratio and fertility rate

3.1. Dependency ratio, household size and fertility rate

Dependency ratio is the proportion of household members in the working age to those who are considered too young (below 15 years) or too old to work (above 64 years). A high dependency ratio indicates a general vulnerability that also applies to a decline in natural resources, if reliance on these resources is high. For example, if one person has to provide for five young and old people in a household, for example from fishing, the household will be more vulnerable to a reduction in fish resources, especially if the person has no other skills or options.

Dependency ratio was highest in Cambodia, Lao PDR and Central Highlands of Viet Nam. This correlates to the high fertility rates and relatively large households, indicating more traditional extended family structures. Households in Thailand had the lowest dependency ratio and fertility rates, reflecting a more advanced stage in the demographic transition towards modernization. The data from the Mekong Delta could be interpreted as showing a stage in the transition from traditional extended families to modern nuclear families.

3.2. Access to clean drinking water, sanitation and grid electricity

The level of access to basic services such as clean drinking water, sanitation and grid based electricity are the general indicators of vulnerability for households.

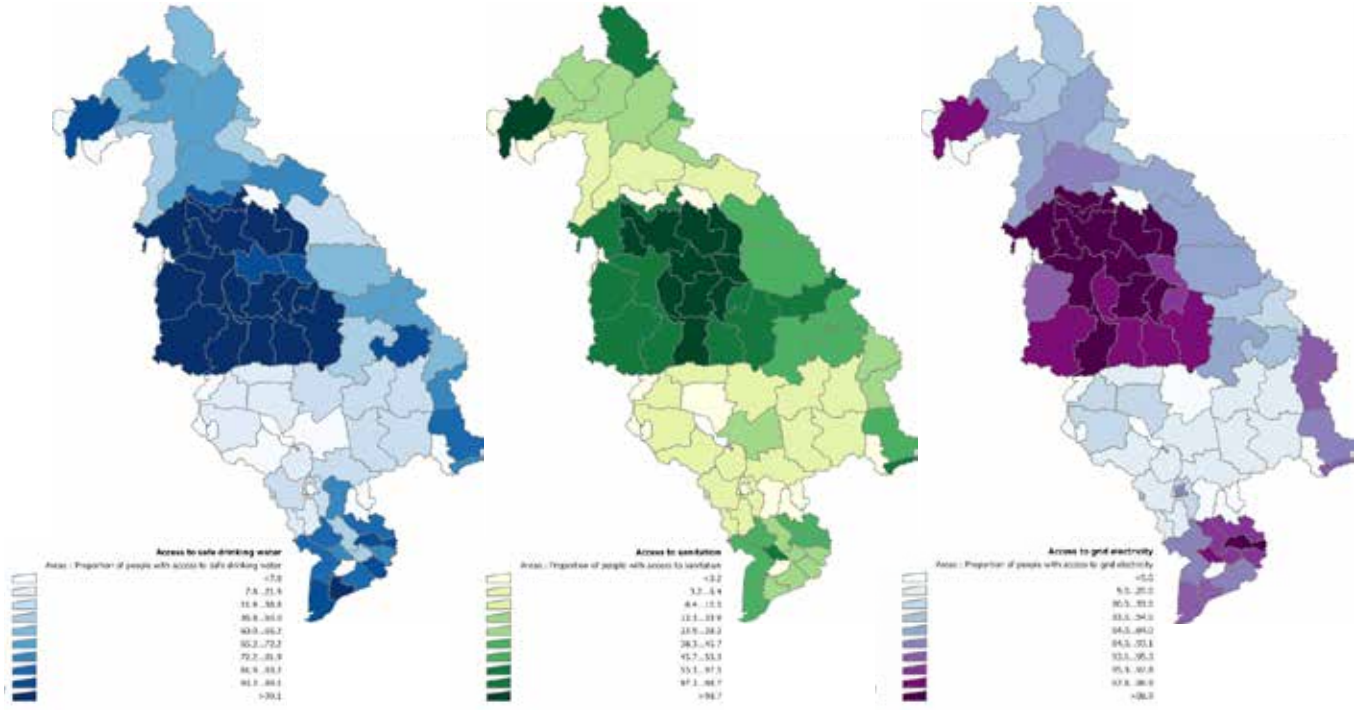


Figure 12: Access to safe drinking water, sanitation, grid electricity

Without access to clean drinking water the incidence of water related diseases is typically higher, and fetching water typically takes up a significant amount of time for household members.

Access to sanitation is important for public health, and lack of sanitation indicates vulnerability to various diseases, especially in areas with higher population density. The risk of disease increases in times of flooding. Access to electricity from the common grid is normally more reliable and cheaper than other options. Access to stable electricity is important for lighting to read by, running electric machines, and for access to media and news. Cambodia had the lowest level of access to grid-based electricity, whereas Thailand, Viet Nam and Lao PDR had high grid-based electrification rates.

3.3. Poverty, infant mortality, malnutrition and education

In Lao PDR, rural poverty rates were highest in the mountainous areas further from the Mekong, where the poverty rate reached 40% and even beyond. In Cambodia, the highest rural poverty rates were concentrated around the Tonle Sap Lake, with Siem Reap province standing out as significantly poorer than others.

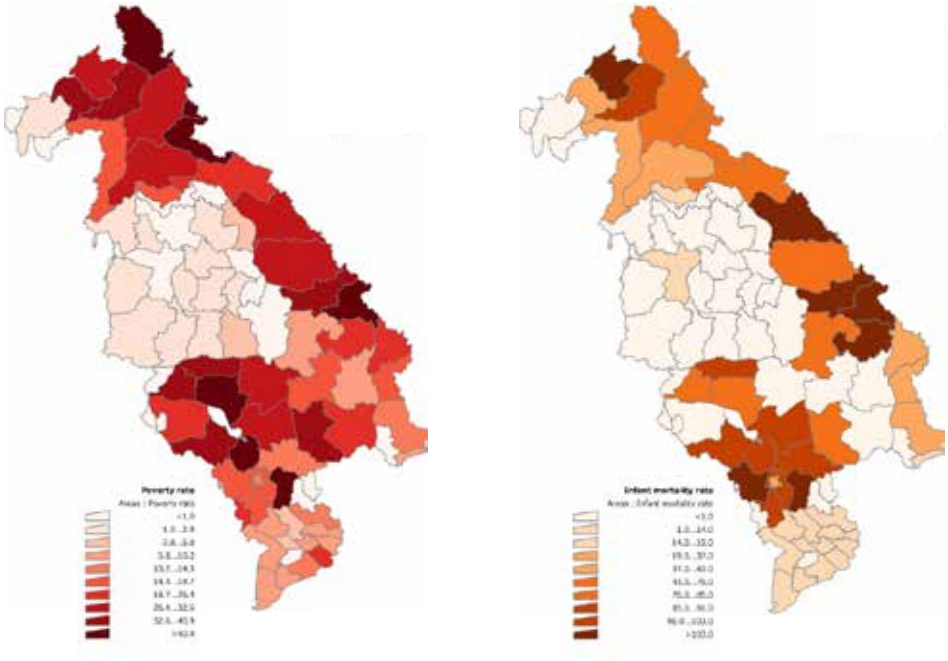


Figure 13: Poverty rate and infant mortality rate

A similar pattern can be observed with regard to infant mortality. Provinces of Lao PDR had the highest rates, while Thailand had the lowest. Note that where poverty and child malnutrition levels were high, so too was infant mortality. Usually, mortality rates are also highest in situations where maternal and child health care services are poor.

The general education level is an indicator for resilience and ability to adapt to changing circumstances. The proportion of the population that has completed lower secondary educations was the lowest in the Lao PDR, followed by Cambodia. This again suggests that households in these countries were vulnerable to a decline in available natural resources that sustain their livelihoods.

In summary, all the baseline vulnerability indicators were lowest for Thailand and highest for Cambodia and Lao PDR, while Viet Nam was in between. Further a very high proportion of the population in Cambodia, Lao PDR, and Viet Nam were employed in the agricultural sector (not shown in map) implying a higher degree of dependence on water resources.

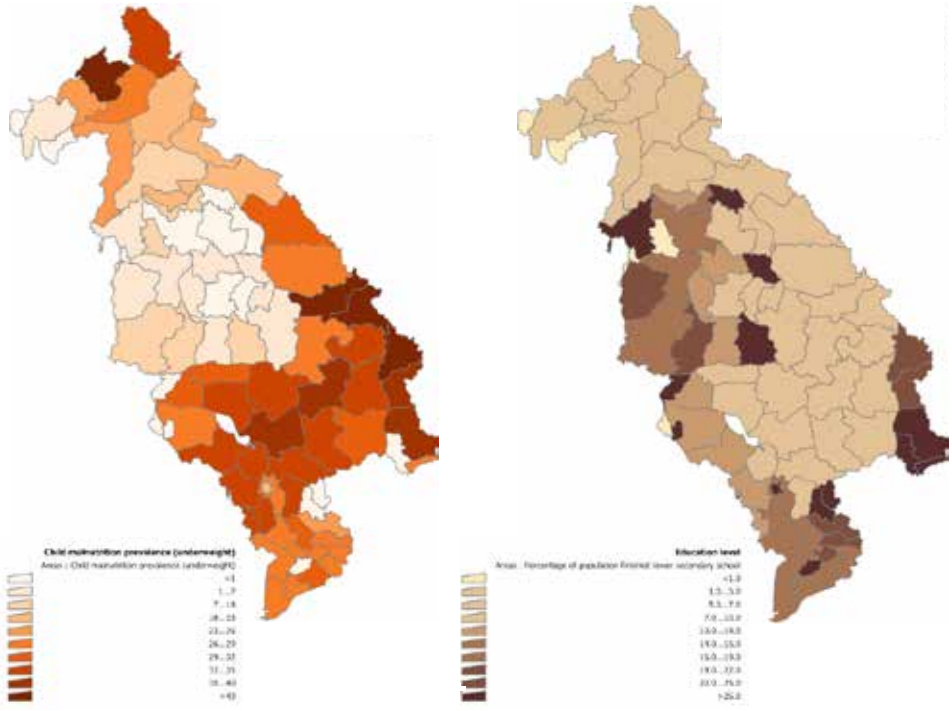


Figure 14: Child malnutrition prevalence (underweight) and education level

4. Demographic information on the SIMVA zones

Data presented in this section are based on primary data from the SIMVA baseline survey with additions from LandScan population data in 2010. The section includes analysis of household size, ethnicity, gender, population pyramid and population by SIMVA zones.

4.1 Household size

Household size can be considered a proxy indicator for family structures and, by extension, the level of socio-economic development. In general, a high proportion of larger households in a society typically indicates presence of traditional family structures and a lower level of modernization. A high proportion of nuclear families indicates the presence of public services for child nurture, which is related to women's involvement in the labour market and thus opportunities for employment, especially for women (for example, in USA the average household size went down from 3.5 in 1960 to 2.54 in 2013 (Statista.com)).

Note that the household sizes discussed here are for rural areas, whereas the secondary data in Section 3 include urban areas. Figure 15 shows the quartile distribution of household sizes by social survey zone, with the average shown in the diamond shape. The average household size in

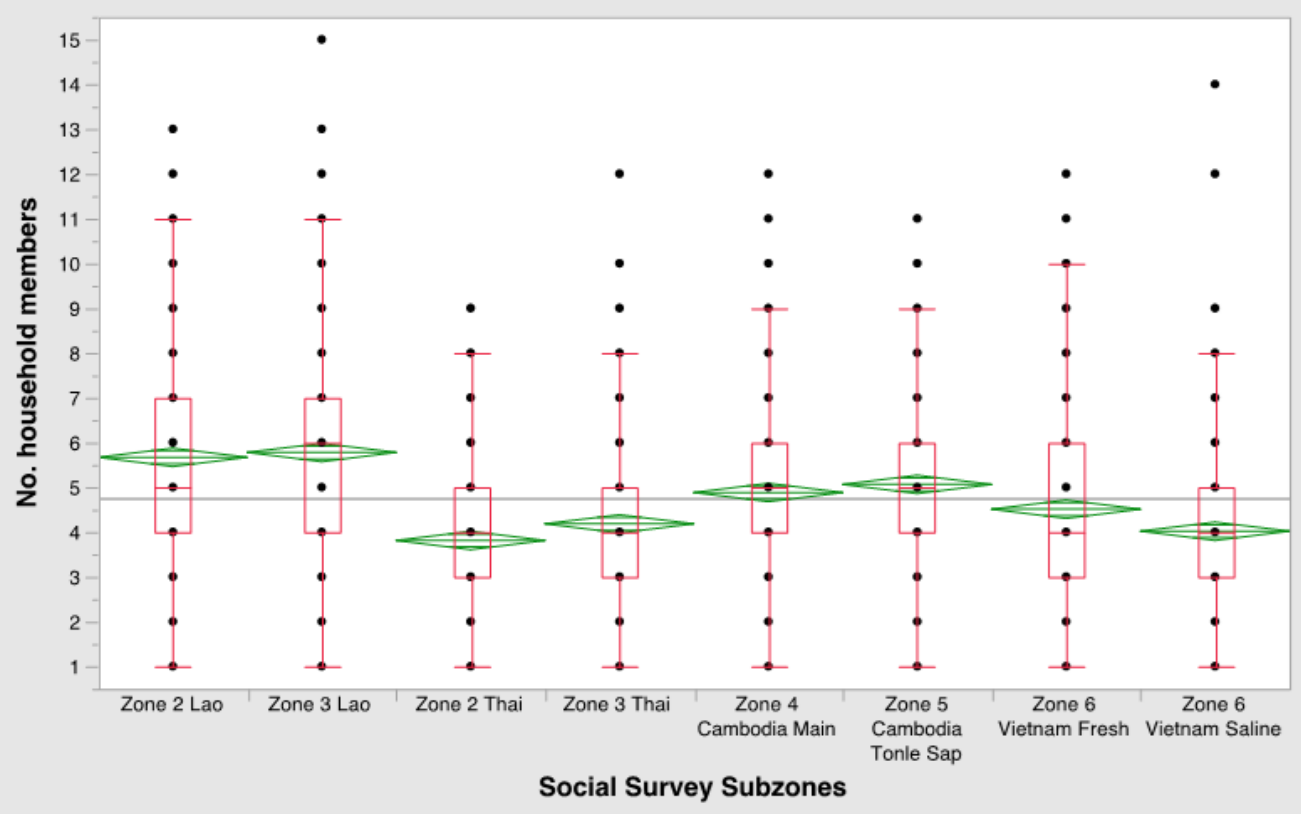


Figure 15: Distribution of household sizes by survey subzone
Source: Household survey, March-May, 2011

the survey area was 4.7 persons. Lao PDR had the highest household size of 5.7, followed by Cambodia with 5.0, Viet Nam with 4.3, and Thailand having the lowest household size of 4.0. Thailand and Viet Nam had a similar distribution of household sizes with 23% of the households having 4 people, and more than 62% of households having between 1 and 4 household members. Cambodia and the Lao PDR had larger households, and a greater percentage of households with 4 people and more.

Thailand's zone 2 had the smallest households with only 3.8 members on average, followed by the saline water zone 6 of Viet Nam with average 4.0 persons. By contrast, in Lao PDR the average was nearly 5.8 persons in zone 3, and 5.7 persons in zone 2. Thai zone 3, the freshwater zone 6 in Viet Nam, and Cambodian zones 4 and 5 had household sizes ranging from 4.3 to 5.1 persons..

4.2. Ethnicity

Ethnicity is linked to vulnerability because some ethnic groups are very dependent on natural resources. The LMB has a many ethnic groups of different sizes, and this makes correlation between ethnicity and vulnerability complex. In general, it is assumed that smaller ethnic groups, often living in remote areas, are more vulnerable to changes in access to natural resources on which their livelihoods depend. Other ethnic groups base their livelihoods on a specialized niche of resource exploitation that makes them vulnerable to changes in that specific niche. Some ethnic groups in LMB do not have equal access to education and other services. The size and locality of ethnic groups is thus a proxy indicator for their vulnerability to changes in the aquatic resources and their access to them. The proportion of the population belonging to ethnic groups in the various zones (Table 4) indicates a general vulnerability level.

Table 4: Ethnicity - surveyed population by study sites

	Cambodia	Lao PDR	Thailand	Viet Nam	Total
Cham	1.2%				0.3%
Chinese				1.0%	0.2%
Hmong		0.2%			0.1%
Lu Mien		2.1%			0.6%
Kaloeng			0.7%		0.2%
Meuang/Nyuan			5.9%		1.2%
Khmer	98.8%			6.0%	27.3%
Khmou		22.9%			6.9%
Kinh				93.0%	20.9%
Lahu		1.3%			0.4%
Lamet		2.1%			0.6%
Lao		56.1%			16.9%
Lao Isan			82.5%		17.4%
Nyo			3.7%		0.8%
Phou Thay		2.3%	1.4%		1.0%
Phuan			0.2%		0.0%
Suay		6.1%			1.9%
Ta-oy		1.3%			0.4%
Tai		0.8%			0.3%
Tai Lue		4.8%	4.8%		2.5%
Tai Nyay			0.2%		0.0%
Thai			0.6%		0.1%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source:Household survey, March-May, 2011

The four large groups Khmer in Cambodia, Kinh in Viet Nam, Lao Isan in Thailand and Lao in Lao PDR made up 82.5% of the surveyed population. In addition, there were 18 other smaller ethnic groups each accounting for less than 0.1% and up to 6.9% of the total, including (from low to high) Khmou, Tai Lue, Suay and Meuang people (Table 4). The ethnic groups Cham, Chinese, Hmong, Lu Mien, Kaloeng, Lahu, Lamet, Nyo, Phou Thay, Phuan, Ta-oy, Tai, Tai Nyay and Thai each accounted for less than 1% of the total surveyed population. Most of the ethnic groups in the LMB were present only in one country, but the Khmer, Tai Lue and Phou Thay had populations in two of the four LMB countries. Of the surveyed group 59% of the Tai Lue and 71% of the Phau Thay people were in Lao PDR and in Thailand.

4.3. Gender

Gender is a significant aspect of vulnerability. Traditional gender roles are in force in many areas of LMB, and women and men do not have the same opportunities for employment and pay. A female-headed household is vulnerable in a number of ways – legally, socially, and economically since it is typically also a single parent household.

The survey found that 82 % of the households were headed by men and 18% by females. Zone 2 in the Lao PDR had the lowest rate of female household heads with only 3.2%, while zone 3 in Thailand had the highest rate of 28.5%, which indicates a high level of out-migration of men from Issan. In all countries and zones female headed households tended to have fewer members than households with a male head.

Overall women made up 51.0% of the population, i.e. a sex ratio of 96.0 (96 men per 100 women). In Cambodia and Thailand the sex ratios were 91.8 and 91.5 respectively, which also indicates outmigration of men. In Lao PDR and Viet Nam the sex ratio was 100.7 and 99.4 respectively. In the subzones, the highest sex ratio of 103.7 was found in zone 2 in Lao PDR and in the freshwater sub-zone

Table 5: Gender by country and zone

	By countries and sub-zones								
	2 L	3 L	2T	3T	4C	5C	6V-F	6V-S	LMB
Percentage of men	50.9%	49.5%	46.8%	49.2%	46.8%	48.8%	50.2%	49.4%	48.9%
Percentage of women	49.1%	50.5%	53.2%	50.8%	53.2%	51.2%	49.8%	50.6%	51.1%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Sex ratio	**103.7**	**97.8**	**88.1**	**96.6**	**88.1**	**95.4**	**100.7**	**97.8**	**96.0**

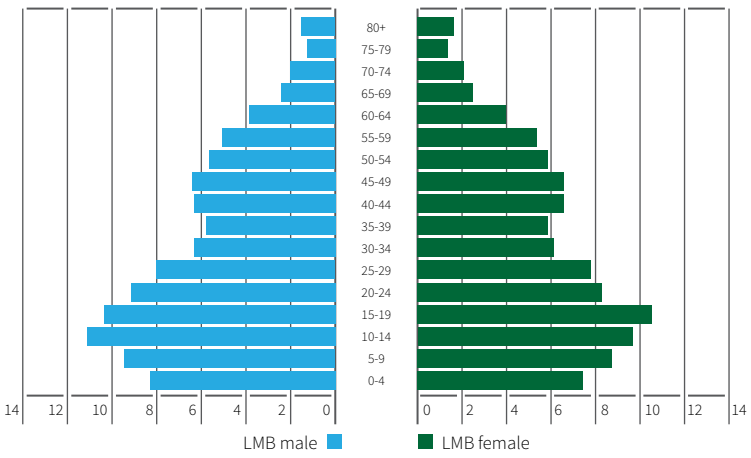


Figure 16: Gender by country and zone

6 in Viet Nam (100.8). The ratios were lowest in Thailand's subzone 2 and Cambodia's subzone 4 at 88.1 (Table 5).

4.4. Population pyramid

The shape of population pyramids shows the age distribution and the overall present dependency ratio from which the future dependency ratio can be assessed.

Figure 16 shows that the population pyramid for the survey area was characterised by a large base, bulging body and narrow top. The population increases gradually from 7.8% in the 0–4 age group to 10.3% at 10–14 and 10.5% in the 15–19 age group. This indicates that the total fertility rate has declined continuously over 10 years and the total mortality rate is relatively low. The population consists of 54.1% people aged from 0 to 29, 35.4% people aged from 30 to 59, and 10.5% people aged 60 and over, which is often described as a transitional age structure. This is a stage in a transformation from an agricultural, rural economy to an industrialized, urban society. A transitional population pyramid shows a period of rapid population growth where

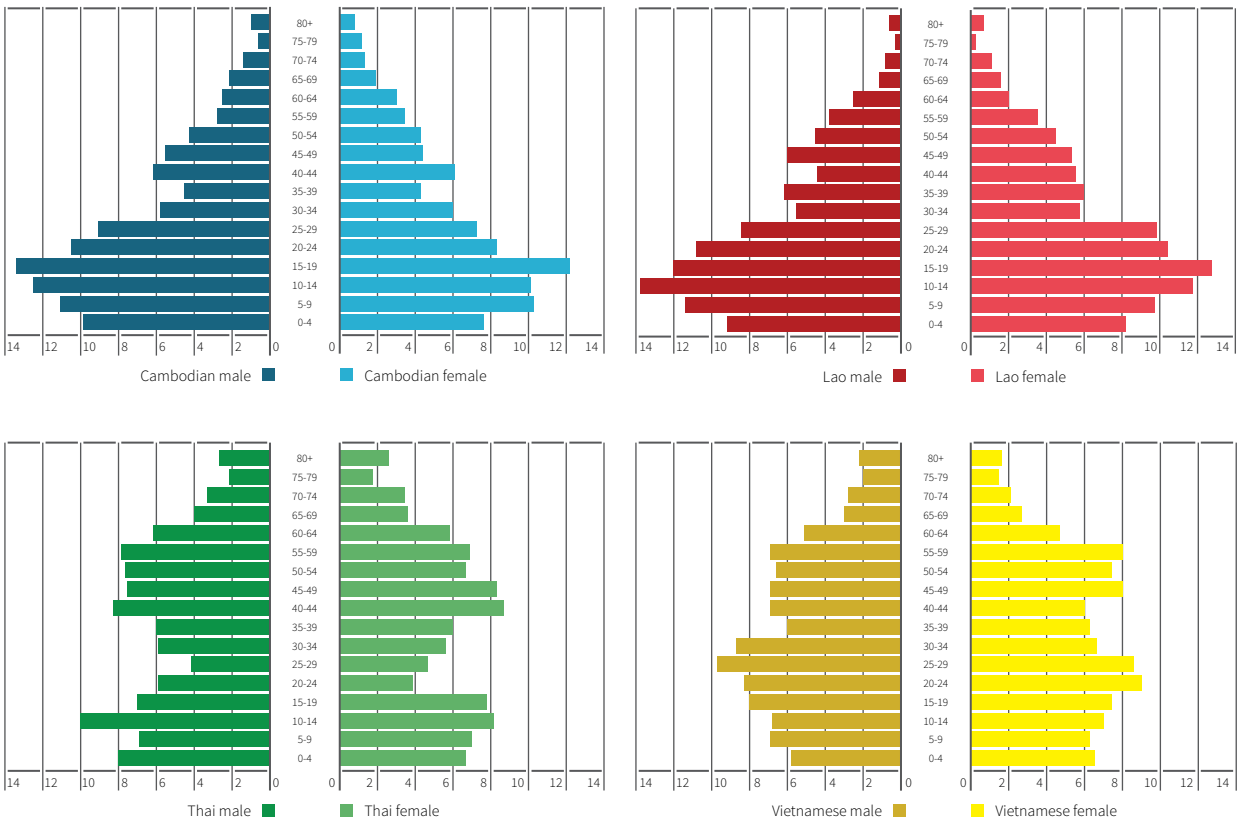


Figure 17: Population pyramid by country

declining mortality rates move faster than slowly declining fertility rates.

As seen in Figure 17 the population pyramids for the survey area in each country were different. For Cambodia and the Lao PDR, the pyramids had larger bases and narrower tops, as typical for agrarian less developed societies. The proportion of people younger than 30 years of age was more than 60% of the total population, 62.4% in Cambodia and 63.9% in the Lao PDR. The proportion of middle-aged people 30–59 years old were 29.6% in Cambodia and 30.4% in Lao PDR. The proportion of people aged 60 and above was only 8% in Cambodia and 5.7% in Lao PDR.

In contrast, the population pyramid for Thailand had a narrower base and the widest top, the body shrinking in the 20–24 and 25–29 year age groups. The Thai population pyramid can be described as a mature population structure. Viet Nam's population pyramid had the narrowest base, a gradual expansive body and a slowly decreasing top. The proportion in each population group, youth: 44.4%; middle aged: 42.2%; and elderly: 13.4%, indicates that Viet Nam was towards the end of a transitional population age structure.

The total, population in the LMB corridor was about 33.7 million people (Table 6). Eigthy-five per cent of the population live in rural areas with only 14.6% in urban areas. Viet Nam and Cambodia had the highest proportion of rural population at 88.2% and 86%, respectively, Thailand at 83.1% and in Lao PDR the proportion was only 71.5%.

Table 6: Rural and urban population in the LMB corridor by country

		Number		Percentage	
Country	Total	Urban	Rural	Urban	Rural
Cambodia	11,162,981	1,559,973	9,603,008	14.0%	86.0%
Lao PDR	3,277,733	934,082	2,343,651	28.5%	71.5%
Thailand	2,607,136	441,473	2,165,663	16.9%	83.1%
Viet Nam	16,732,081	1,982,318	14,749,763	11.8%	88.2%
Total	**33,779,931**	**4,917,846**	**28,862,085**	**14.6%**	**85.4%**

Sources:
SIMVA zone (15 km maximum buffer distance)
Population 2010 from LandScan Global Population data - as grid - created by Oak Ridge National Lab (ORNL) and distributed by East View Companies (USA)
Urban area boundary – Global Rural-Urban Mapping Project – Urban/Rural Extents (http://sedac.ciesin.columnbia.edu/gpw/)

Table 7: Rural and urban population in the LMB corridor by zone

		Number		Percentage	
Zone	Total	Urban	Rural	Urban	Rural
Zone 2	1,327,300	330,893	996,407	24.9%	75.1%
Zone 3	4,557,311	1,044,662	3,512,649	22.9%	77.1%
Zone 4	7,372,095	1,274,782	6,097,313	17.3%	82.7%
Zone 5	3,843,302	285,191	3,558,111	7.4%	92.6%
Zone 6	16,679,923	1,982,318	14,697,605	11.9%	88.1%
Total	**33,779,931**	**4,917,846**	**28,862,085**	**14.6%**	**85.4%**

Sources:
SIMVA zone (15 km maximum buffer distance)
Population 2010 from LandScan Global Population data - as grid - created by Oak Ridge National Lab (ORNL) and distributed by East View Companies (USA)
Urban area boundary – Global Rural-Urban Mapping Project – Urban/Rural Extents (http://sedac.ciesin.columnbia.edu/gpw/)

Note:
Urban area boundary applied here is the same boundary used in SIMVA previous phase. Calculation of rural population based on assumption that area outside urban boundary is considered as rural area. Therefore, Rural Pop = Total Pop - Urban Pop

Table 7 shows the population by zone in the LMB study area. Zone 5, Cambodia had a high proportion of rural population, accounting for 92.6%, followed by zone 6 in the Viet Nam Mekong Delta, where the proportion was 88.1%. The zones with the lowest proportion of rural dwellers were zones 2 and 3, in Lao PDR and Thailand at 75.1% and 77.1% respectively.

4.5. Population by SIMVA zone

About 54% of the LMB population (almost 33.8 million people) lived within the survey area (table 6 and table 7). The population in the Mekong Delta of Viet Nam, zone 6, accounted for almost half (49.5%) of the total survey area population, while the population in zone 4 in Cambodia accounted for 21.7%. This indicates the magnitude of potential effects from a population perspective. In a worst case scenario, for example, the number of people potentially affected by an environmental disaster along the Mekong that would be evenly felt throughout the survey area would be 30 times more in zone 6 compared to zone 2 in Thailand and twice as many in zone 4 than in zone 5.

The rural population accounted for more than 85% of the survey area population (See table 6). The proportion of the rural population ranged from 71.5% in Lao PDR to 88.2% in the Mekong Delta. By zone, the proportion of the rural population ranged from 75.1% in zone 2 to 92.6% in zone 5 (Table 6).

4.6. Summary

More than half of the total LMB population, 33.8 million people lived within in the survey area. The population in the Mekong Delta in Viet Nam and on the flood-plains of Cambodia accounted for 71% of the total population in the survey area.

Household size in the survey area ranged from 4.0 people in Thailand to 5.7 people in Lao PDR. Eighty-one percent of the sample households were headed by males.

Thailand's zone 3 had 28.5% female-headed house-holds, which is the highest in the sample, while zone 2 in Lao PDR had the lowest rate of female household heads, at 3.2%. In the four countries of the LMB, females accounted for 51.1% of the population – a population sex ratio of 96. The ratio was 100.7 in Lao PDR and 99 in Viet Nam.

Overall the LMB's population pyramid shows a transitional age structure. The population pyramids for Cambodia and Lao PDR show a young population; Thailand's has a mature population age structure and Viet Nam a transitional age structure.

5. Livelihood dependence on water resources

5.1. Introduction

This section presents the results of analysis of the primary data on indicators for dependence on water related activities and aquatic resources. Resource dependence was measured by the availability of water related resources, which include fish, OAAs, irrigation, aquaculture and riverbank cultivation. The study examined to what extent the population use the resources and their importance for household economy.

5.2. Occupations

The main or primary occupation of an adult is defined as the activity she or he spends most time on. Diversification of livelihoods helps rural people meet basic needs, generate income and reduces their economic vulnerability. In 1995–96 a socioeconomic survey of households in eight fishing provinces in Cambodia found that households combined farming, fishing, selling fish, fish processing and other different activities for

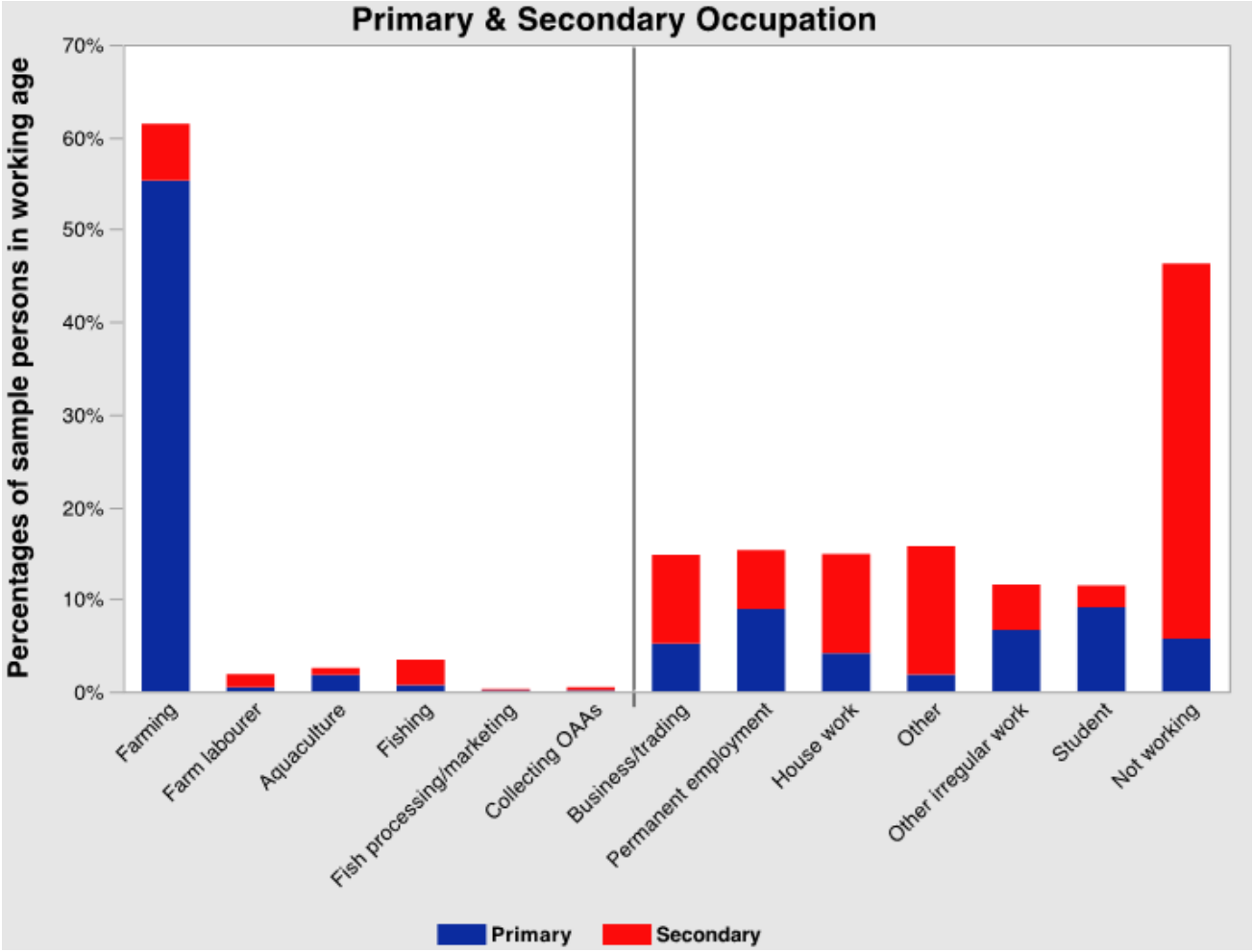


Figure 18: Primary and secondary occupations whole sample
Source: Household survey, March-May, 2011

employment, income and food (Ahmed et al. 1998). The present survey found that this is still the case. Similarly, in the Songkram River Basin in Thailand, a survey done by the Fisheries Programme of MRC in 2001 found that men and women were engaged in a range of occupations (Hortle & Suntornratana, 2008). MRC (2003) reported that in Viet Nam, non-farm income increased more than 30% between 1993 and 1998.

To capture the diversity in occupations, the survey obtained data on the main/primary and secondary occupations in the past 12 months of household members in the working age between 15 and 65 years of age (Figure 18 and 19). The graphs have a line that separates the water resource dependent occupations on the left from other occupations. The water resource dependent occupations are considered to be: farming, farm labourer, aquaculture, fishing and fish processing, and collection of Other Aquatic Animals (OAAs). The primary occupations are shown in blue, the secondary occupations in red.

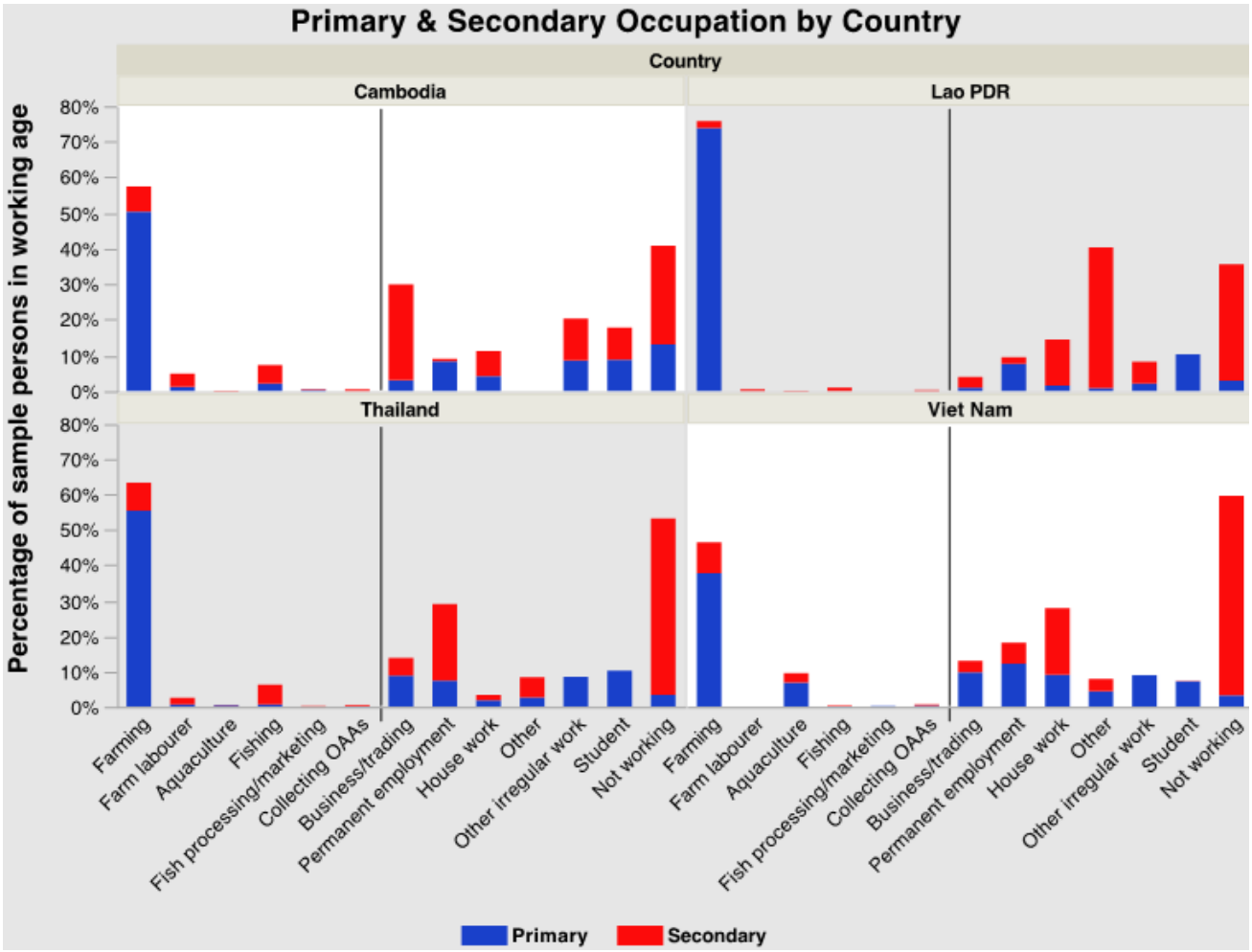


Figure 19: Primary and secondary occupations by country
Source: Household survey, March-May, 2011

Farming was by far the most common primary occupation, while 'not working' was the most common secondary 'occupation'. Permanent employment was the second most common primary occupation; housework was third, and business and trading fourth. Aquaculture was firstly a primary occupation with less people doing this activity as secondary occupation, while fishing was a relatively small secondary occupation.

The distribution of occupations by country showed some interesting differences. Lao PDR had most households with farming as primary occupation combined with 'other' as secondary occupation, perhaps indicating a flexible situation with a range of possible economic activities available to household members. Cambodia had a slightly higher number of primary occupations in the non-water resource dependent sectors, but still many secondary

Figure 18: Importance of occupations for livelihood
Source: Household survey, March-May, 2011

occupations in those. The profile for Thailand was similar but showing a lower frequency of secondary occupations. The sample households in Viet Nam had the lowest ratio of farming households, but the highest number of aquaculture as primary occupation, which confirms that the sample was a good representation of the overall situation in the countries. Interestingly, the sample from Viet Nam had the highest number of household members in the 'not working' category.

The households were asked which of the occupations of household members they considered the most and secondmost important for the livelihood of the household as a whole. Figure 18 shows the results in the form of a 'heat map', and Table 8 presents the percentages of households responding to the question. The water resource dependent occupations have been marked with light blue colour. Farming clearly stood out as the most important occupation for the livelihoods for most of the sample households, however with significant differences between the countries, from 90% in Lao PDR to 56% in Viet Nam. Fishing, collecting OAAs, aquaculture and fish processing were only considered the most important occupation for a relatively small proportion of the sample households, with fishing in Cambodia at 3% and aquaculture in Viet Nam at 9% of the households being highest. In Cambodia and Thailand 9-10% of the households mentioned fishing as the second most important occupation.

Table 8: Importance of occupations for livelihoods

Most important occupation for livelihood	Percentage of households			
	Cambodia	Lao PDR	Thailand	Viet Nam
Farming	60.9%	90.0%	68.7%	56.0%
Fishing	3.1%	0.1%	1.6%	0.3%
Collecting OAAs	0.1%	0.0%	0.0%	0.1%
Aquaculture	0.0%	0.1%	0.3%	9.1%
Fish processing/marketing	0.6%	0.0%	0.0%	0.1%
Business/trading	12.1%	1.5%	9.6%	10.1%
Farm labourer	1.5%	0.1%	1.2%	0.0%
Other irregular work	8.8%	2.5%	7.1%	7.2%
Permanent employment	6.5%	3.5%	5.1%	10.7%
House work	0.7%	0.7%	0.9%	0.9%
Not working	0.0%	0.6%	2.8%	0.9%
Other	5.7%	0.7%	2.8%	4.4%
Second most important	**Cambodia**	**Lao PDR**	**Thailand**	**Viet Nam**
Farming	10.4%	4.0%	7.8%	12.9%
Fishing	10.0%	1.9%	9.0%	0.0%
Collecting OAAs	0.4%	0.3%	0.0%	1.2%
Aquaculture	0.1%	0.1%	0.1%	3.5%
Fish processing/marketing	0.7%	0.0%	0.1%	0.3%
Business/trading	20.4%	4.6%	9.3%	13.5%
Farm labourer	4.9%	0.4%	2.1%	0.0%
Other irregular work	18.8%	10.3%	20.0%	14.3%
Permanent employment	7.2%	4.3%	2.9%	12.2%
House work	9.4%	3.2%	1.6%	16.5%
No second occupation	6.5%	20.7%	31.2%	18.7%
Other	11.0%	50.1%	15.6%	6.2%
Student	0.0%	0.0%	0.1%	0.1%
Don't Know	0.0%	0.0%	0.1%	0.6%

Source: Household survey, March-May, 2011

5.3. Household Income

Household income is an important measure of vulnerability. When comparing household income between countries it should be recognized that price and expenditure levels differ significantly, due to the difference in proportions between subsistence and monetary economy. In Lao PDR subsistence economy, with barter and sharing, was probably higher than in Thailand and Viet Nam. Secondary data on such aspects of the economy are however not readily available to allow for a detailed analysis of the economic systems in the survey area.

The average annual income per capita of the surveyed households ranged from $98 in zone 3 in Lao PDR, to $826 in zone 6 fresh-water in Viet Nam. In Cambodia the figures were $303 and $246 in zone 4 along the mainstream and zone 5 around Tonle Sap, respectively. In zone 2 in Thailand average annual income per capita was $665 while zone 3 in Thailand it was much lower at $362.

The standard deviations for per capita income were high, but the standard error of the mean (SEM) relatively low, and the relative standard error (RSE) also low at around 7%, indicating robust findings, even including high-income outliers up to US$ 10,000.

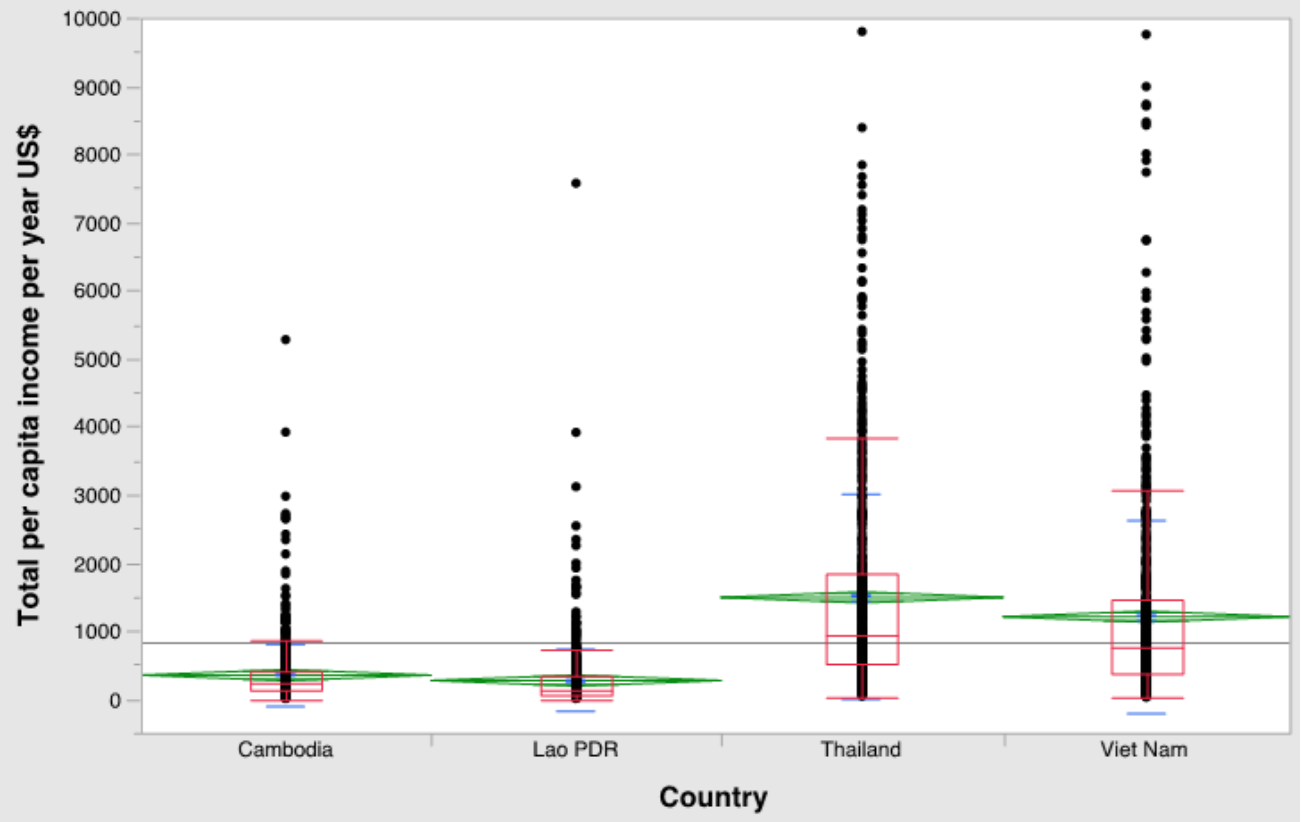


Figure 21: Income distribution by zone
Source: Household survey, March-May, 2011
Note: Excluding 33 outlier households with incomes per capita above US$ 10,000 per annum

Table 9: Mean and median percentage of total average household income by main source of incomes

Type of income	Cambodia			Lao PDR			Thailand			Viet Nam			Viet Nam		
	% of household income		% of respondents	% of household income		% of respondents	% of household income		% of respondents	% of household income		% of respondents	% of household income		N
	Mean	Median		Mean	Median		Mean	Median		Mean	Median		Mean	Median	
Water resource dependent	20.0%	10.0%	10.3%	23.1%	10.0%	10.0%	20.7%	10.8%	12.3%	32.1%	18.8%	12.1%	23.9%	11.6%	678
Agriculture and livestock	25.0%	16.1%	31.1%	35.6%	25.5%	45.5%	29.2%	20.0%	26.0%	44.8%	41.0%	33.8%	33.7%	24.4%	648
Business and employment	41.1%	33.9%	36.5%	47.7%	42.3%	25.5%	43.2%	39.2%	27.9%	40.1%	33.3%	33.4%	42.4%	36.5%	677
Pensions, loans, remittances, savings and interest earned	27.7%	20.8%	22.2%	35.1%	23.7%	19.0%	24.9%	16.2%	33.8%	29.6%	21.6%	20.6%	28.1%	19.5%	678
All	31.2%	22.2%	99,11%	37.3%	26.8%	99,10%	30.6%	21.4%	98,20%	38.6%	30.6%	98,19%	34.0%	24.6%	

Source: Household survey, March-May, 2011

Figure 21 shows the distribution of the annual income per capita, with the means inside the diamond shapes in the graph.

Table 9 presents the percentage of total average household income by main source of income.

• 5.3.1. Water resource dependent income

Various sources of household incomes were assessed and grouped into the following four main categories:

- Water resource dependent income, include sale of fish (from own catch and others), sale of fish from aquaculture, and sale of OAAs
- Agriculture and livestock income, include sale of rice and other crops, sale of crops from riverbanks, sale of livestock
- Business and employment income, include business profit, permanent and seasonal employment
- Pensions, loans, remittances, savings and interest earned

Overall, for the whole sample water resource dependent income accounted for a mean of 23.9% of household income, with a median of 11.6%. Viet Nam had a mean of 32.1% (median 18.8%), which was the highest, while Cambodia had the lowest mean of 20% (median 10%) of household income. In terms of the percentage of households that had water resources dependent income, it was between 10% and 12% in all four countries. Income from business and employment was the largest source of household income overall, with a mean of 42.4% for the whole sample. In Lao PDR the mean was 47.7%, in Thailand at 43.2%, Cambodia at 41.1%, and Viet Nam at 40.1%. Agriculture and livestock was the second largest source of income. In Viet Nam agriculture and livestock accounted for 44.8%, and in Lao PDR for 35.6% of household income. Pensions, loans and remittances also

Table 10: All sources of household income by country

Source of income	Variables	Cambodia	Lao PDR	Thailand	Viet Nam
1. Sales own fish catch	Mean Income yearly in US$	297.7	230.3	677.6	346.2
	Mean percent of total household income	24.7%	25.9%	21.2%	16.1%
	% of sample households	18%	15%	20%	4%
2. Sales other fish catch	Mean Income yearly in US$	398.5	51.3	1,518.1	428.5
	Mean percent of total household income	25.7%	27.3%	22.6%	10.2%
	% of sample households	1%	1%	0%	1%
3. Sale of fish from aquaculture	Mean Income yearly in US$	32.4	128.9	4,303.9	4,181.1
	Mean percent of total household income	1.9%	14.1%	16.4%	14.4%
	% of sample households	1%	2%	3%	8%
4. Sale of OAA	Mean Income yearly in US$	105.7	37.9	88.4	4,372.8
	Mean percent of total household income	10.3%	23.2%	2.6%	50.7%
	% of sample households	9%	1%	1%	15%
5. Sale of rice	Mean Income yearly in US$	521.3	436.7	888.2	4,765.8
	Mean percent of total household income	32.8%	39.5%	23.7%	58.3%
	% of sample households	36%	41%	35%	43%
6. Sale of other crops	Mean Income yearly in US$	387.2	261.9	3,048.2	1,653
	Mean percent of total household income	26.1%	29.5%	38.5%	36%
	% of sample households	22%	19%	37%	29%
7. Sale of crops from riverbanks	Mean Income yearly in US$	382	106.6	1,033.80	273.9
	Mean percent of total household income	26.1%	14.4%	22.9%	14%
	% of sample households	3%	3%	14%	3%
8. Sale of livestock	Mean Income yearly in US$	294	315.4	875.1	1,361.1
	Mean percent of total household income	18.9%	34.4%	14.6%	22.4%
	% of sample households	38%	40%	10%	14%
9. Business profit	Mean Income yearly in US$	1,146.7	1,332.6	7,726.7	2,188.7
	Mean percent of total household income	45.4%	38.6%	45.8%	37.8%
	% of sample households	41%	15%	24%	29%
10. Employment	Mean Income yearly in US$	1,170.7	1,577.2	4,422.8	1,624.7
	Mean percent of total household income	53.9%	64.9%	54.2%	46.3%
	% of sample households	18%	12%	26%	29%
11. Employment-seasonal/ irregular	Mean Income yearly in US$	288.9	415.6	1,637.90	718.9
	Mean percent of total household income	33.6%	45.3%	33.9%	36.0%
	% of sample households	55%	30%	38%	27%
12. Pensions	Mean Income yearly in US$	510.9	694.6	581	1,907.6
	Mean percent of total household income	34.8%	36.9%	14.0%	29.5%
	% of sample households	1%	2%	22%	10%
13. Credit loans	Mean Income yearly in US$	433.4	433	4,749.7	2,807.6
	Mean percent of total household income	7.4%	15.4%	10.0%	25.6%
	% of sample households	4%	10%	20%	1%
15. Remittances	Mean Income yearly in US$	572.3	873.6	1,523.70	798.8
	Mean percent of total household income	29.8%	52.0%	35.9%	30.5%
	% of sample households	25%	22%	33%	16%
16. Interest	Mean Income yearly in US$	304.5	90.2	784.7	2,891.6
	Mean percent of total household income	11.3%	6.7%	24%	30.9%
	% of sample households	1%	5%	2%	3%

Source: Household survey, March-May, 2011

provided important income for households in all four countries - from 22.6% of total household income in Thailand to 29.9% in Lao PDR.

Table 10 shows source of income in more detail. The data are shown by country, with the mean yearly income in US Dollar, the mean percentage of total household income, and the percentage of sample households by the source of income.

5.4. Dependence on fish and fishing

Households' dependence on fish and fishing can be measured by the occupations of household members, the livelihood activities in which they are engaged, and their sources of food and income. There are 14 indicators for households' dependence on fish and fishing (Table 11).

5.4.1. Fishing as occupation, engagement and income from fishing

In the survey area, less than 1% of adults listed fishing as their main occupation and only 1.3% of households described fishing as the most important occupation for their household income, ranging from 3.1% in Thailand to 0.1% in Lao PDR.

Table 11: Indicators for dependence on fish and fishing by country

	Cambodia	Lao PDR	Thailand	Viet Nam	Survey area
1. Percentage of adults whose main occupation is fishing (%)	2.0%	0.1%	0.6%	0.1%	0.7%
2. Percentage of households that list most important occupation as fishing (%)	3.1%	0.1%	1.6%	0.3%	1.3%
3. Percentage of households that list second most important occupation as fishing (%)	10.0%	1.9%	9.0%	0.0%	5.2%
4. Percentage of households with members who fished in last 12 months (%)	55.9%	61.2%	49.7%	10.7%	44.4%
5. Percentage of households with income from fish sales (%)	19.3%	15.7%	20.4%	4.6%	15.0%
6. Fishing effort and catch (CPUE - mean kg catch per hours spent fishing)	0.9	0.7	0.9	0.8	0.8
7. Percentage of last fish catch sold (%)	25.5%	5.9%	32.4%	24.1%	23.0%
8. Percentage of last fish catch consumed (%)	57.4%	87.9%	62.1%	69.8%	66.9%
9. Percentage of last fish catch preserved (%)	17.2%	6.2%	5.6%	6.1%	10.0%
10. Mean monthly income per capita from fish sales (US$)	$4.6	$4.2	$14	$11	$8.1
11. Percentage of households using mainstream/Tonle Sap in the last 12 months (%) for fishing	5.9%	10.9%	28.2%	3.5%	12.1%
12. Percentage of households migrating seasonally to fish from mainstream/Tonle Sap (%)	16.2%	6.3%	28.6%	0.0%	15.5%
13. Percentage of household income per capita from fish sales (%)	24.7%	26.7%	21.4%	17.0%	23.5%
14. Percentage of household food (calorie intake) per capita from fish (%)	8.0%	7.7%	11.5%	12.4%	10.1%

Source: Household survey, March-May, 2011

Table 12: Average monthly income per capita from fish sales

Sub-zones	Average monthly income per capita from fish sales (in US$)
Zone 2 Lao PDR	3.6
Zone 3 Lao PDR	4.9
Zone 2 Thailand	8.8
Zone 3 Thailand	18
Zone 4 Cambodia Mainstream	6.3
Zone 5 Cambodia Tonle Sap	4.4
Zone 6 Viet Nam Fresh Water	15.8
Zone 6 Viet Nam Saline	9.2

Source: Household survey, March-May, 2011

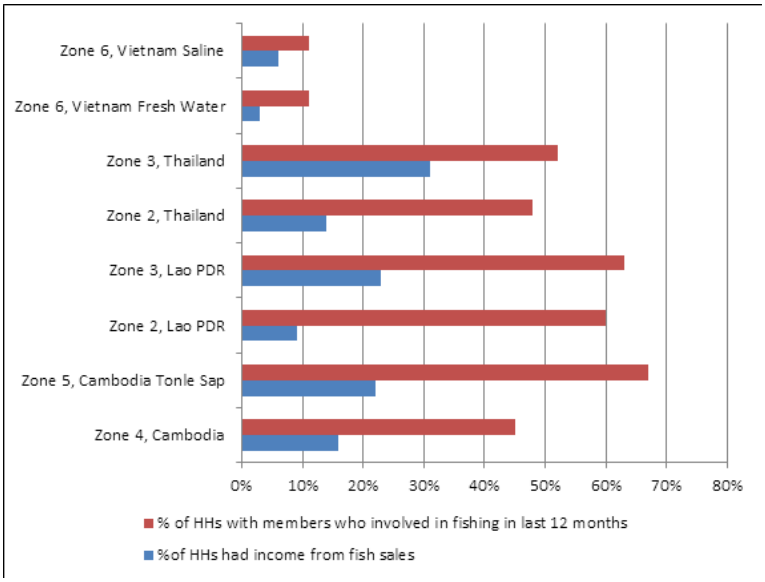


Figure 22: Dependence on fish by sub-zone
Source: Household survey, March-May, 2011

However, 5.2% of the surveyed households described fishing as the second most important occupation for adults, ranging from 10% in Cambodia, 9% in Thailand to 1.9% in Lao PDR and 0% in Viet Nam.

Fishing was in general regarded as a part-time activity rather than an occupation. Asked whether any household member had fished in the last 12 months, 44% of all households responded positively. The highest percentage of households with members who fished but did not consider it their main occupation was in Lao PDR at 61.2%, followed by Cambodia at 55.9% and Thailand at 49.7%. In Viet Nam, the percentage was only 10.7%.

About 15% of households generated income from fish sales (Table 11), ranging from 20.4% in Thailand and 19.3% in Cambodia to 15.7% in Lao PDR, and only 4.6% in Viet Nam. The proportion of households varied according to sub-zone, for example, in zone 3, Lao PDR, 23% of households generated income from fish sales, but in zone 2, Northern Lao PDR, the proportion was only 9% (Figure 22).

The average monthly income per capita from fish sales was computed based on annual household income from selling own and others fish catch. The figure excluded income from aquaculture and OAAs. On average, monthly income per capita from fish sales was US$8.14 (Table 11).

Table 12 shows the average monthly income per capita from fish sales by subzone. The

amount is highest in Zone 3, Thailand at US$18, followed by Zone 6, Viet Nam fresh water at US$15.8. At the other end of the scale, average income from fish sales was only US$3.6 per month in zone 2, Lao PDR.

5.4.2. Most frequently used fishing ecosystems

Fishing households frequently fish in multiple ecosystems/ fish habitats. Respondents were asked to identify the most common fish habitat or preferred fishing area.

The survey found that 12% of the households had used the Mekong mainstream for fishing during the past 12 months. The largest proportion of households who fished in the Mekong mainstream was in Thailand at 28% (Table 11). The preferred fishing habitat changed according to season and differed between countries (Figure 23). In Thailand, the peak season for fishing in the Mekong mainstream is April- May; in Cambodia fishing in rice paddies is very common from July to October. This pattern is similar in the Mekong Delta. In Lao PDR, other rivers and streams are commonly used for fishing during March-April.

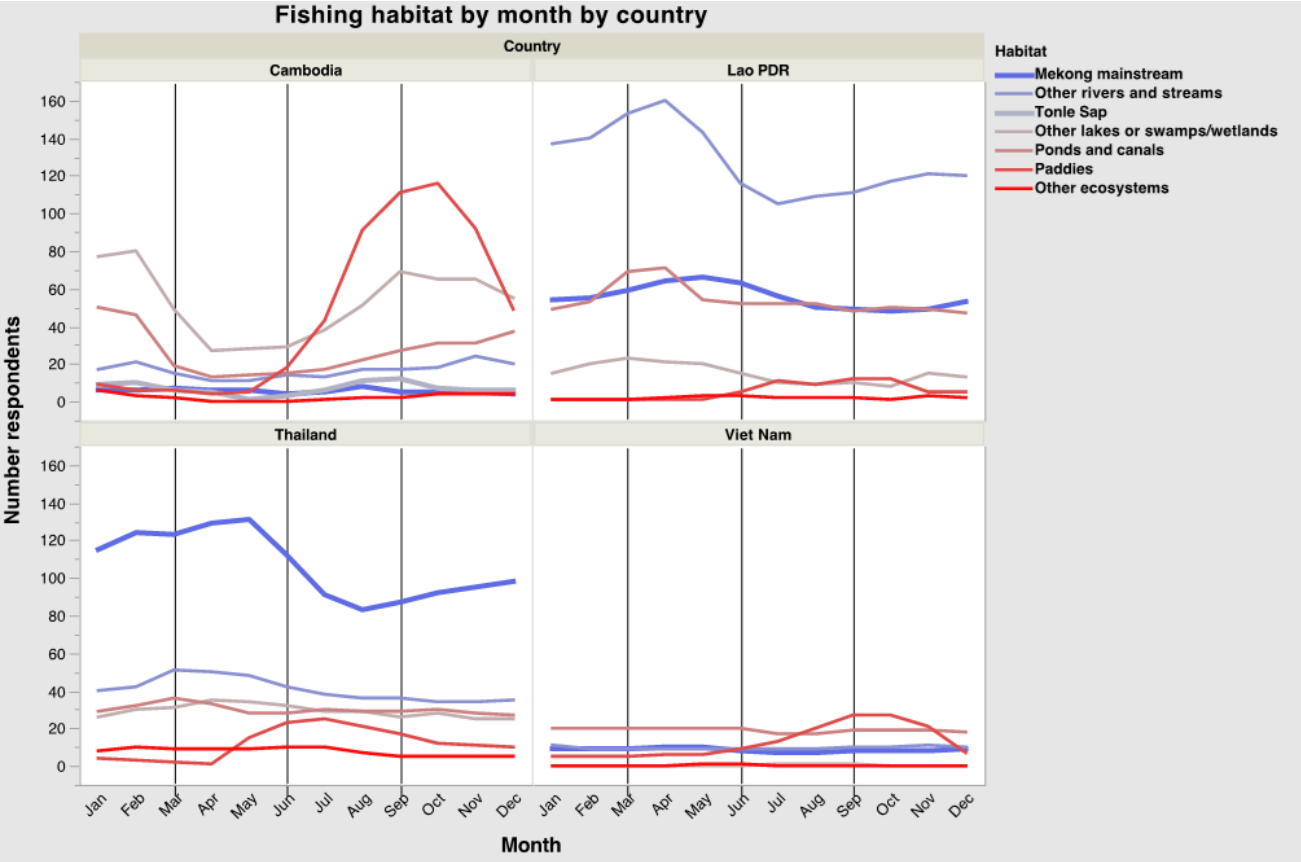


Figure 23: Fishing habitat by month by country
Source: Household survey, March-May, 2011

Table 13: Fishing location in the 24 hours before the interviews, by country

	Cambodia	Lao PDR	Thailand	Viet Nam	Survey area
Mekong mainstream	2.1%	32.3%	56.8%	16.1%	28.5%
Other rivers and streams	14.4%	46.2%	9.5%	9.7%	19.4%
Tonle Sap	4.1%	-	-	-	1.4%
Other lakes or swamps/ wetlands	45.4%	4.6%	11.6%	3.2%	20.5%
Ponds and canals	25.8%	12.3%	5.3%	48.4%	18.4%
Paddies	4.1%	3.1%	1.1%	19.4%	4.5%
Other ecosystems	4.1%	1.5%	6.3%	3.2%	4.2%
Don't know	-	-	9.4%	-	3.1%
Total	100%	100%	100%	100%	100%

Source: Household survey, March-May, 2011

Table 13 shows the fishing locations used in the previous 24 hours (before interview) by country. The survey was conducted during the dry season from March to May and only 10.6% of the surveyed households reported having family members that had fished in that short period. Overall, 28.5% of these households reported fishing in the Mekong mainstream, while 20.5% had fished in other lakes or swamp/wetland areas. In Thailand 56.8% had fished in the Mekong mainstream.

In Cambodia 45.4% had fished in other lakes or swamp/wetland areas; in Lao PDR, about 46.2% had fished in other rivers and streams, while in Viet Nam the most popular fishing habitat was ponds and canals at 48.4% of the respondents.

5.4.3. Seasonal migration for fishing

Of the households which were engaged in fishing activities, only 15.5% migrated seasonally to fish in the Mekong mainstream; in Thailand, the figure was 28.6%, followed by Cambodia at 16% and Lao PDR at 6.3%.

5.4.4. Fishing effort and disposal of catch

Respondents were asked to describe how much time they spent and the amount of fish caught in each month of the year. As this was based on recall over a year, the results should be considered rough estimates. Fishing effort was computed by dividing the average fish catch per day with the average hours fishing per day in the year.

During the pilot study, fishers had no difficulty in recalling their recent fish catches, or in giving average weights for catches in different months in the year. A part of the catch is sold and sales are based on weight, so household estimates are considered reasonably accurate. However, the uncertainty in the estimates should be kept in mind.

The survey found that the average catch per unit of effort (CPUE) ranges from 0.7kg/hour to 0.9 kg/hour at the country level (Table 11).

Figure 24 shows the CPUE over the year by country. The graph presents the standard

error in the data. It shows that there is large variation of CPUE over the year and some difference among the four countries. These variations are results of the fish migration and spawning cycles, which are dependent on the river pulse and the hydrological and topographical conditions.

In Lao PDR and Thailand, the graphs have a similar shape, though they differ slightly in terms of the months, with the highest CPUE in June in Lao PDR and in May in Thailand.

In Cambodia and Viet Nam, the graphs reflect that the floodplains are downstream from Thailand and Lao PDR and the flooding cycle in these areas. CPUE was high in December in Cambodia and in October in Viet Nam's Mekong Delta.

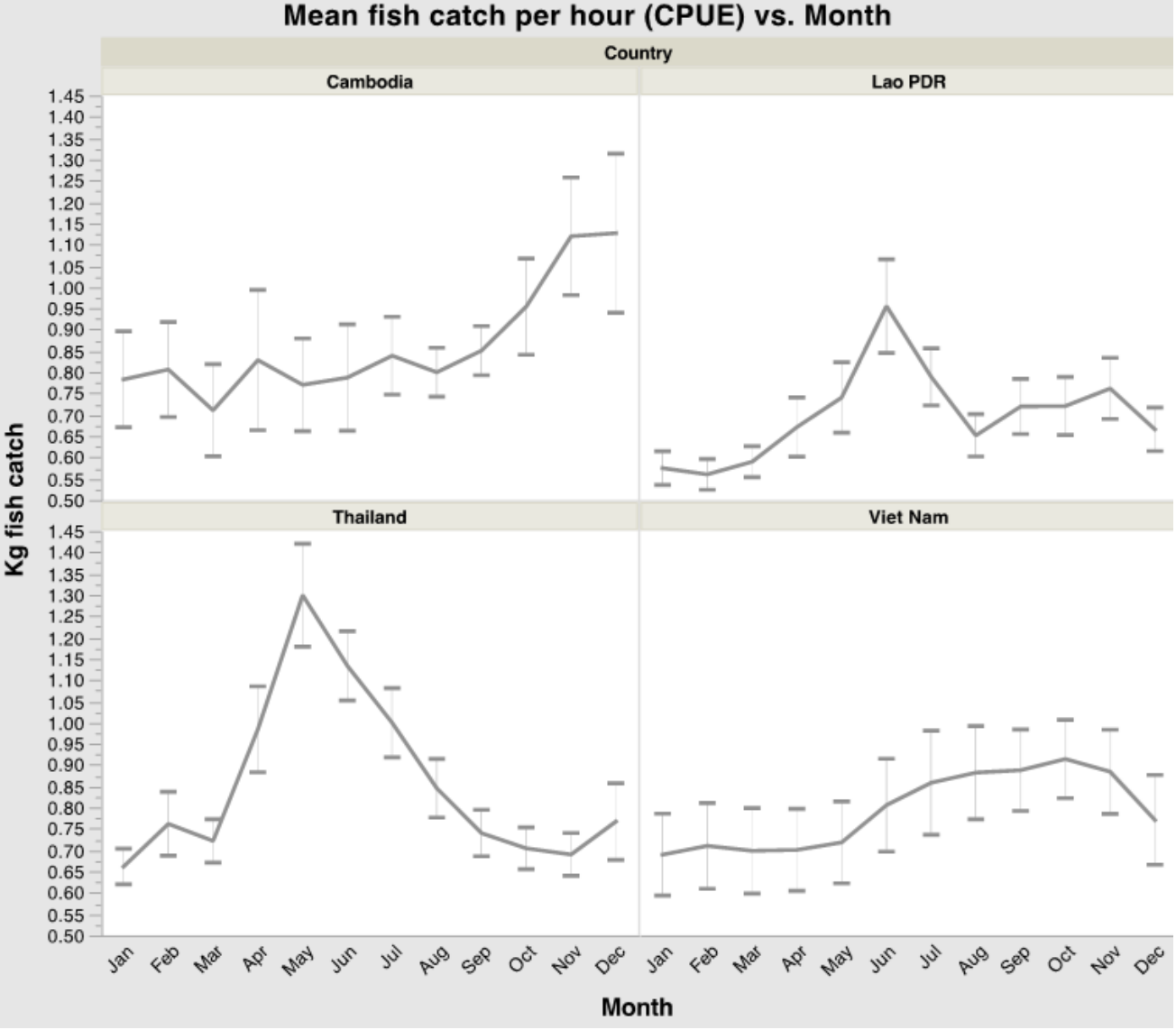


Figure 24: Catch per unit of effort by month by country
Source: Household survey, March-May, 2011

Table 14: Average disposal of last fish catches by sub-zone

Disposal	Cambodia			Lao PDR			Thailand			Viet Nam			All
	Zone 4 Cambodia Main	Zone 5 Cambodia Tonle Sap	All	Zone 2 Lao	Zone 3 Lao	All	Zone 2 Thai	Zone 3 Thai	All	Zone 6 Vietnam Fresh	Zone 6 Vietnam Saline	All	
Percent sold	34.7%	20.8%	25.4%	2.6%	8.0%	5.9%	11.6%	39.8%	32.3%	25.5%	22.8%	24.1%	23.0%
Percent eaten in HH	56.1%	58.0%	57.4%	93.6%	84.1%	87.9%	76.6%	56.8%	62.0%	68.5%	70.9%	69.8%	67.0%
Percent preserved	9.2%	21.2%	17.2%	3.8%	7.9%	6.2%	11.7%	3.4%	5.6%	6.0%	6.3%	6.1%	10.0%
All	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Household survey, March-May, 2011

Table 15: Calorific values of food items

Food items	Kcal/kg
Rice	3,590.8
Fish	1,070.3
OAA	840.6
Egg	1,420.9
Red meat	2,250.2
White meat	1,350.1
Vegetables	1,110.3

Source: Adapted from Bureau of Statistics, Ministry of Planning and Investment, Lao PDR

Table 16: Average per capita calorie intake by food source

Food source	Cambodia	Lao PDR	Thailand	Viet Nam	All
Rice	88.6%	87.2%	75.5%	81.4%	83.2%
Fish	8.0%	7.7%	11.5%	12.4%	10.1%
OAA	5.6%	5.0%	8.0%	6.7%	6.4%
Red Meat	10.8%	16.3%	16.7%	16.8%	15.8%
White Meat	11.9%	11.9%	12.3%	18.0%	12.6%
Eggs	3.4%	3.1%	4.2%	4.1%	3.9%
Vegetables	1.0%	1.5%	1.2%	1.4%	1.3%

Mean per capita calorie intake

For disposal of the catch in the last 12 hours before the interview, the survey found that, on average, 67% of the fish catch was used for household consumption, 23% for sale and 10% for preservation or fish processing (Table 14).

However, there was a large variation between the sub-zones related to disposal of catch for sale. In zone 3, Thailand an average of 39.8% of the catch was sold, while in zone 2, Lao PDR the figure was only 2.6%.

Fish processing or preservation is also important. The data shows that there was a high proportion of fish preservation in zone 5 in Tonle Sap, Cambodia, reflecting the high volumes of fish catch by season in that zone.

5.4.5. Food consumption per capita from fish

Table 16 presents the analysis of food consumption, which measures the proportion of calories from different food sources using standard calorific values. The amount of

each item is multiplied by its calorific value. The value of daily per capita calorie intake is calculated from total household calorie intake divided by number of household members who had meals.

However, the survey did not distinguish between fresh and smoked or dried fish; nor was the weight of different types of fish and fish products taken into account. These changes could be suggested for future monitoring.

Table 16 shows the average proportion of per capita calorie intake from fish. It ranges from 7.7% in Lao PDR to 12.4% in Viet Nam, with the averagee mean for the survey area at 10.1%. Rice is the most important source of food, providing 83.2% of per capita calorie intake in the surveyed households. OAAs contribute with 6.4% average across the survey area. Together fish and OAAs contribute on average 16.5% of per capita calorie intake, and higher in Thailand and Viet Nam, up to 19.5%.

5.5. Dependence on Other Aquatic Animals (OAAs)

Other aquatic animals (OAAs) include frogs, tadpoles, crabs, snails, clams/shells, shrimps, eels, turtles, and other local aquatic creatures. OAAs are often collected together with fish and it requires a specialized survey to distinguish this activity from fishing. However, information on each type of OAA that was collected by households was obtained during the survey. Therefore, the data is presented as an estimated value of the total OAAs collected.

Table 17 shows the proportion of households with family members collecting OAAs.

Table 17: Percentage of households collecting OAAs in the last 12 months

Food items	Kcal/kg
Cambodia	69.4%
Lao PDR	61.0%
Thailand	44.6%
Viet Nam	36.8%

Source: Household survey, March-May, 2011

Table 18: Indicators for dependence on OAAs by country

	Cambodia	Lao PDR	Thailand	Viet Nam	Survey area
1. % of households that collected OAAs in last 12 months	69.4%	61.0%	44.6%	36.8%	52.9%
2. % of households with income from OAAs	8.7%	1.5%	0.9%	5.9%	8.6%
3. % of households with income from aquaculture	NA	NA	0.6%	9.1%	2.6%
4. Average of household monthly income per capita from OAAs from selling OAA (US$)	$2.0	$0.73	$1.9	$64.0	$24.7
5. Average monthly income per capita from aquaculture	NA	NA	$ 9.1	$119.0	
6. % of households collected OAAs from Mekong mainstream in the last 12 months	0.8%	1.5%	11.6%	2.4%	4.1%
7. % of income per capita from OAA	0.9%	23.0%	0.0%	7.6%	2.9%
8. % of food (per capita) from OAAs (measured by calorie intake)	5.6%	5.0%	8.0%	6.7%	6.4%

Source: Household survey, March-May, 2011

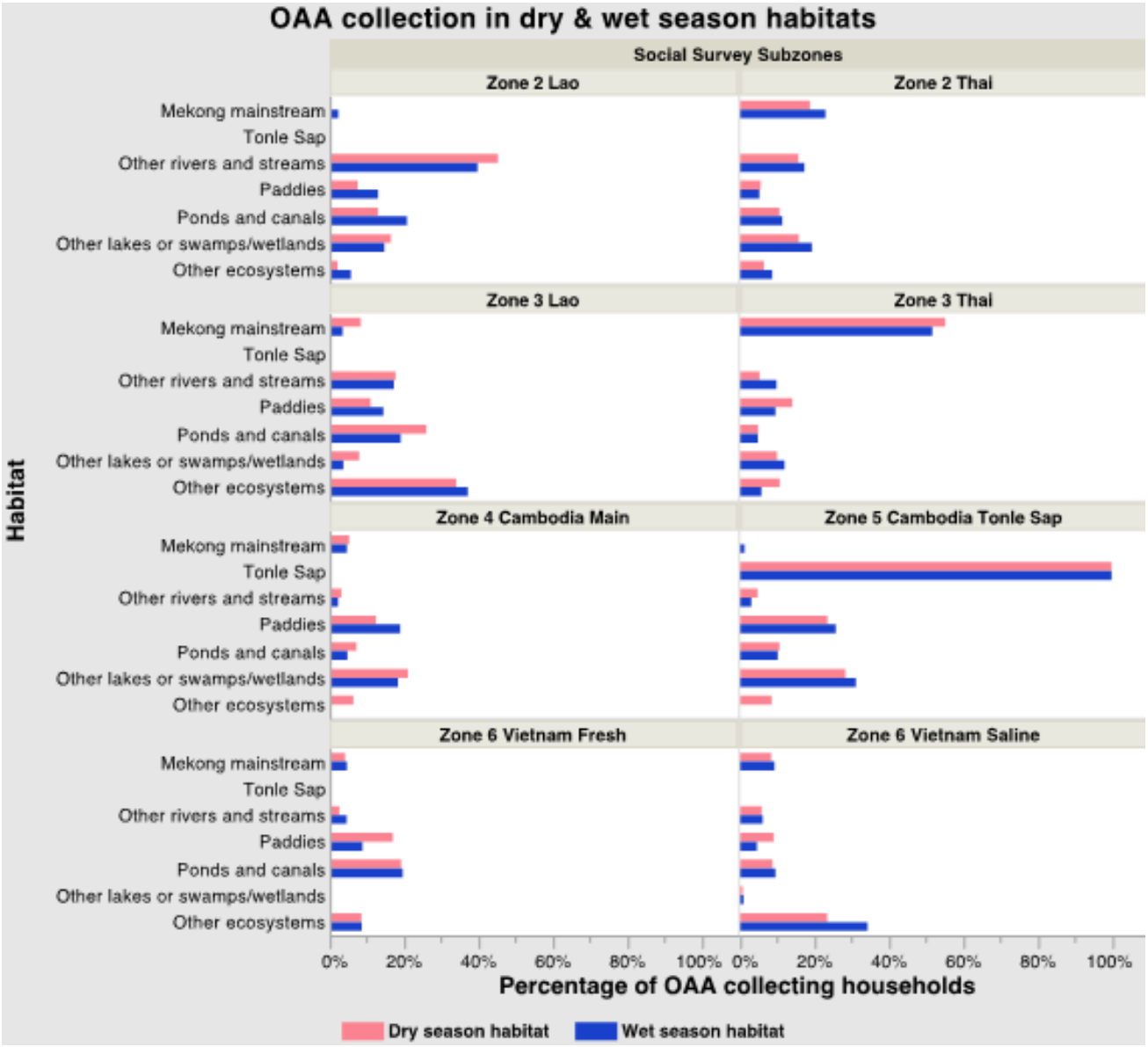


Figure 25: Habitats for OAAs collection in dry and wet season
Source: Household survey, March-May, 2011

Table 19: Proportion of households collecting OAAs by type of OAAs and by sub-zone

Social Survey Subzones	Frogs	Tadpoles	Crabs	Snails	Clams/ Shells	Shrimps	Eels	Turtles	Other
Zone 4 Cambodia Main	25.9%	1.7%	33.9%	21.3%	4.7%	10.3%	2.0%	0.0%	0.33%
Zone 5 Cambodia Tonle Sap	28.1%	1.0%	35.2%	20.5%	0.7%	6.0%	8.1%	0.0%	0.48%
Zone 2 Lao	34%	0.8%	28.7%	23.8%	0.0%	2.9%	0.0%	0.0%	9.8%
Zone 3 Lao	41.1%	2.2%	2.2%	15.1%	0.5%	28.1%	0.5%	0.0%	10.3%
Zone 2 Thai	57.7%	0.0%	2.3%	18.5%	0.0%	15.8%	0.5%	0.5%	0.5%
Zone 3 Thai	48.4%	0.0%	7.5%	18.1%	0.0%	18.9%	1.2%	0.0%	1.2%
Zone 6 Viet Nam Fresh	4.5%	32.7%	26.3%	27.6%	0.0%	1.3%	2.6%	0.0%	5.1%
Zone 6 Viet Nam Saline	4.5%	30.6%	17.1%	14.4%	2.7%	15.3%	4.5%	0.0%	10.8%

Source: Household survey, March-May, 2011

Cambodia and Lao PDR had the highest proportion at 69.4% and 61% respectively, followed by Thailand at 44.6% and Viet Nam at 36.8%.

Table 18 presents eight main indicators to measure the dependence on OAAs. Aquaculture was not included in this category. Overall, 8.6% of the surveyed households obtained cash income from sale of OAAs. In Lao PDR and Thailand most households clearly did not depend on this source for cash income. In Cambodia, 5.9-8.7% of the sample households had income from OAAs. Overall, the proportion of households collecting OAAs from the Mekong mainstream was 4.1%.

Figure 25 shows the habitats where people went to collect OAAs in the dry and wet season. The Mekong mainstream in zone 3, Thailand and in zone 5, Tonle Sap in Cambodia were the most important habitats for collecting OAAs. There was only a marginal difference between wet and dry seasons in terms of habitats.

Frogs, crabs and snails are the most important types of OAAs for food and cash for the surveyed households. Table 19 shows that there was a high proportion in Thailand, Zones 2 & 3 with 57.7% and 48.4% respec-tively, Zone 3, Lao PDR (41.1%) and Zone 2, Lao PDR at 34%.

5.6. Dependence on irrigation and riverbank cultivation

Rain-fed agriculture is still the most common practice and rain is the main water source for crop cultivation for 63% of the households in the LMB corridor (Figure 26). Only 18% of the surveyed households depend on water extracted from the Mekong to irrigate their crops. Of these, 66% were in the Mekong Delta, Viet Nam. Fewer households in the other countries depend on irrigation from the Mekong - about 12% in Thailand and only about 1% of households in the northern part of Lao

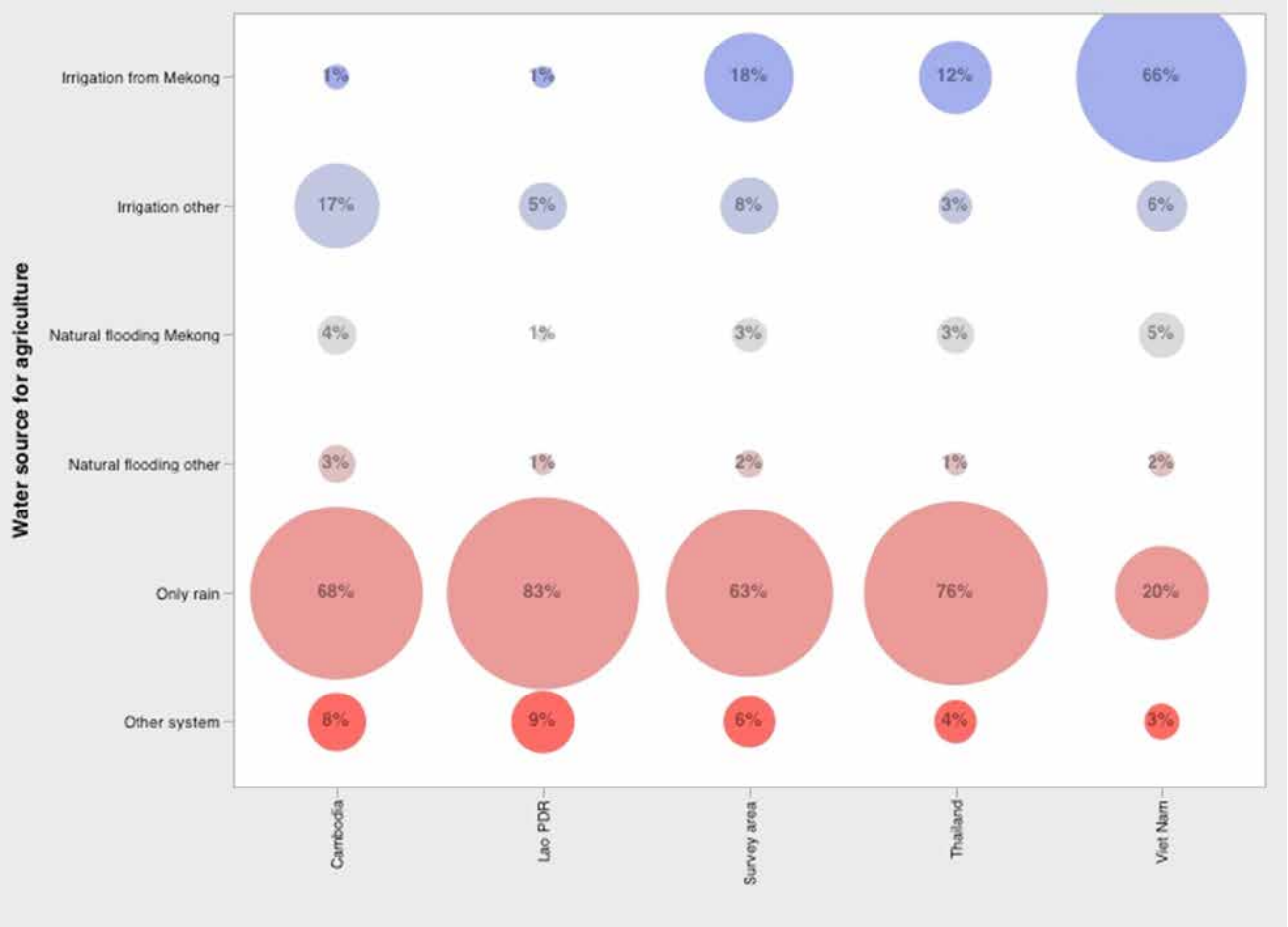


Figure 26: Water sources for crop cultivation
Source: Household survey, March-May, 2011

PDR, Zone 2 and in Cambodia. Only about 8% of surveyed households use other water sources for irrigation.

The average area of cultivated land available to households in the survey area was 1.8 hectares, with households in Thailand having the most land at 2.8 ha, followed by Lao PDR at 2.2 ha. Households in Viet Nam possessed the smallest area of cultivated land at 0.8 ha. There was a high proportion of households - 86.5% - that cultivated rice in the dry season in Viet Nam, and in Lao PDR 62.1%.

Average monthly income per capita from selling rice was by far the highest in Viet Nam at US100, followed by Thailand at US$20.7. Also in Viet Nam, about half of total average household income came from irrigated crops, including rice. By contrast, in Cambodia, the average monthly income per capita from rice cultivation was only US$9.4 and in Lao PDR US$7.2.

Riverbank cultivation was widespread in Thailand with 29% of households engaging, followed by Cambodia with 15.8%. It was

Table 20: Dependence on irrigation

Dependence on irrigation	Cambodia	Lao PDR	Thailand	Viet Nam	Survey area
1. Average area of cultivated land available to household (ha)	1.4	2.2	2.8	0.8	1.8
2. % of cultivated land with rice in wet season in the last 12 months	92.9%	84.6%	84.7%	98.3%	89.1%
3. % of cultivated land with rice in dry season in the last 12 months	14.4%	62.1%	28.9%	86.5%	39.3%
4. % of households dependent on water extracted from the Mekong for irrigation	1.4%	1.1%	12.1%	65.7%	18.1%
5. Average monthly household income per capita from rice sales (US$)	$9.4	$7.2	$20.7	$100.0	$36.5
6. Average percentage of households' income from irrigated crops including rice.	18%	11%	17%	49%	17.9%

Source: Household survey, March-May, 2011

Table 21: Dependence on riverbank cultivation

Dependence on riverbank cultivation	Cambodia	Lao PDR	Thailand	Viet Nam	Survey area
1 % of households with riverbank cultivation	15.8%	6.6%	28.9%	6.2%	14.2%
2. Average size of riverbank cultivation area (ha)	0.92	0.39	0.35	0.86	0.56
3. Average income per annum from riverbank cultivation (US$) *	$382	$107	$1,034	$274	$717
4. % of household income from riverbank cultivation*	26.1%	14.4%	22.9%	14.0%	22.3%

Source: Household survey, March-May, 2011
Note: Only some households report income from riverbank cultivation (n=156).

less widely practised in the Mekong Delta, Viet Nam and Lao PDR by only around 6% of households (Table 21). Overall, the average area of riverbank cultivation was 0.56 hectare. The largest average area of riverbank cultivation was in Cambodia at 0.92 ha and Viet Nam at 0.86 ha, while in Thailand and Lao PDR it was only 0.35 and 0.39 ha respectively.

Overall income from river-bank cultivation contributed about 22.3% of household income for those households engaging in the activity. In Cambodia, it comprised 26.1% and in Thailand, 22.9%. However, in Lao PDR and Viet Nam riverbank cultivation only contributed 14% of household income. Overall, households earned an average of US$717 per year from riverbank cultivation, with the highest earnings in Thailand at US$1,034, followed by Cambodia at US$382.

5.7. Summary

The assessment of livelihood dependence on water resources is based on the distribution of primary and secondary occupations and their importance for household livelihoods; analysis of water resource dependent income, dependence on fish and fishing and collection of OAAs and aquaculture; and dependence on irrigation and riverbank cultivation.

Farming is by far the most common primary occupation, accounting for 90% of households in Lao PDR, 69% in Thailand, 61% in Cambodia and 56% in Viet Nam.

Farming is by far the most common primary occupation, with 90% of the survey households in Lao PDR, 69% in Thailand, 61% in Cambodia and 56% in Viet Nam doing farming. Fishing and collecting of OAAs are directly dependent on water resources. Fishing was only considered as the most important source of income for a small percentage of households: 3.1% in Cambodia, 1.6% in Thailand, 0.3% in Viet Nam and 0.1% in Lao PDR. A slightly greater proportion considered fishing the second most important occupation: about 10% in Cambodia, 9% in Thailand, but only 2% in Lao PDR and there were no respondents in Viet Nam.

Collecting OAAs was the most important occupation for only 0.1% of the surveyed households in Cambodia and Viet Nam. Yet, a higher proportion of households considered it as the second most important occupation: 1.2% in Viet Nam, 0.4% in Cambodia and 0.3% in Lao PDR. Aquaculture is only considered a primary occupation in Viet Nam where it accounted for 7% of the surveyed households and for 3% of households as their secondary occupation. Fish trading and processing was not significantly represented as an occupation by respondents.

The survey showed that there was a significant difference between average household incomes between countries. The average annual income per capita was US$1,487 in Thailand, followed by Viet Nam at US $1,204. However, there was low annual income per capita in Cambodia at US$344 and in Lao PDR at US$265.

Household incomes were grouped into four main sources of income: 1) Water resource dependent income, which includes sale of fish (own and others' catch), sale of fish from aquaculture, sale of crops from riverbank gardens. 2) Income from agriculture and livestock. 3) Income from business and employment. 4) Income from pensions, loans, remittances, interest earned & savings. The data showed that 10% of the surveyed households in Cambodia had water resource dependent income with a mean of 20% of average total household income from this category. In Viet Nam, the proportion of households was 12%, but income accounted for a higher proportion of average total household incomes at 32.1%. In Thailand, 12.3% of the surveyed households received water resource dependent income, which covered 20.7% of average total household income. In Lao PDR, 10% of sample households had water resource dependent income contributing 23% of average total household income.

The survey found that fishing was mostly a part-time activity, and was not considered an occupation. Part-time, occasional fishing was very common, with 44% of the surveyed households having a member who had fished in the past 12 months. This percentage was highest in Lao PDR at 61% of households, second in Cambodia at 56%, third in Thailand at 50% and lowest in Viet Nam at 11%.

Fifteen percent of the households had income from fishing; the highest percentage

in Thailand at 20%, second Cambodia at 19%, third in Lao PDR at 16%, and in Viet Nam only 5%. Overall, the average percentage of total household income per capita coming from fish sales, excluding aquaculture, was 23.5%, or almost a quarter of total household income. This implies that fishing households living just above US$1.25 per day easily could fall below this conventional poverty line if income from fish declines.

Some 12% of the households used the Mekong mainstream for fishing during the previous 12 months, with the highest proportion in Thailand (28% in April-May). In Cambodia, fishing in rice paddies was very common from July to October, with a similar pattern observed in the Mekong Delta. In Lao PDR, other rivers and streams were the most fished habitats in March- April.

The survey found remarkably even distribution of the average catch per unit of effort (CPUE) across countries and zones, ranging from 0.7kg/hour to 1 kg/hour at the country level. However there was large variation over the year. On average, 67% of the fish catch was consumed, 23% sold and 10% preserved.

Rice was the most important source of calories, ranging from 75% of calorific intake in Thailand to 89% in Cambodia, with Lao PDR and Viet Nam in the same range. Fish accounts for 10% of per capita calorific intake across the survey area, with 7% in Lao PDR, 8% in Cambodia, 12% in Viet Nam, and 11% in Thailand. Calories from OAA comprise 6% of per capita intake across in the survey area.

Overall, 18% of households used water from the Mekong for irrigation. However, in Viet Nam the proportion was 66%. The average percentage of household income from irrigated crops including rice was 18%, but in Viet Nam irrigated crops accounted for 49% of household income and in Lao PDR, 11%. Overall, 14% of households practised riverbank cultivation, with the highest proportion in Thailand at 29%.

In summary, the proportion of households that depended on water resources for their main occupation was relatively small. Yet, water resources are widely used as a source of additional income and food. Fishing and collection of OAAs as well as riverbank cultivation provides a buffer to people's livelihoods.

6. Resilience

6.1. Introduction

This section presents households' resilience to changes in river water resources. Resilience in this context refers to consumption, expenditure, and livelihood assets.It is assumed that households are more resilient to changes if they have a higher level of:

(i) Diverse livelihood assets and sources of income;
(ii) Consumption and spending;
(iii) Food stored, and
(iv) Access to healthcare and social capital.

Livelihood vulnerability has been described as a balance between sensitivity and resilience of livelihood systems (Alwang et al., 2001). In the context of the SIMVA baseline survey, sensitivity refers to people's dependence on water resources, which might be affected by changes in natural resources in the LMB. Highly vulnerable systems are characterised by low resilience and high sensitivity, while less vulnerable systems have low sensitivity with high resilience. Livelihood resilience allows households that make up social systems, to absorb, utilise and even benefit from change. In short, to assess vulnerability, information on resilience must be assessed, as the concepts can be considered as two sides of the same coin.

Twelve indicators for household resilience were assessed in the survey. The results, by country, are summarized in Table 22.

Table 22: Resilience indicators by country

Resilience	Cambodia	Lao PDR	Thailand	Viet Nam	Survey area
1. % of households with non-aquatic sources of income	98.7%	94.3%	98.4%	89.3%	97.4%
2. Average monthly per capita income from non-aquatic sources, (US$)	$26	$18	$193	$68	$78
3. % of adult household members working outside the village	29.5%	10.5%	13.5%	16.5%	17.4%
4. Average expenditure per capita in the last 3 months before the survey (US$)	$122	$59	$487	$523	$298
5. % of expenditure on non-food items	66.4%	57.8%	65.8%	83.1%	66.3%
6. % of households engaged in aquaculture	1.0%	7.5%	13.8%	33.2%	13.8%
7. % of households with alternative livelihood options	77%	54%	52%	37%	55.1%
8. % of households belonging to [specified] social groups	5%	20%	13%	13%	13%
9. % of households able to produce more than half their own food	69.4%	91.8%	69.5%	31.6%	65.6%
10. Number of livestock units per capita	0.28	1.18	0.28	0.04	0.36
11. Average value of productive assets (US$)	$6,961	$7,387	$47,386	$35,587	$24,447
12. Average value of non-productive assets (US$)	$6,598	$7,133	$43,782	$35,587	$23,281

Source: Household survey, March-May, 2011

6.2. Non-aquatic sources of income, work location and expenditure

Income from non-aquatic sources includes sale of other crops, livestock, business, employment, pensions, savings, remittances and interest. The survey found that the majority of households (97.4%) earned income from non-aquatic sources. Average monthly per capita income from non-aquatic sources was US$78 in the whole survey area. It was relatively low in Lao PDR at US$18.2 and highest in Thailand at US$ 193.

Households, which have members working outside their village are considered more resilient to reduced water dependent resources. Overall, 17.4% of households had family members working outside their village. Cambodia had the highest proportion at 29.5%, Viet Nam at 16.5%, Thailand at 13.5% and Lao PDR 10.5%.

Expenditure is often considered as an important indicator to measure wealth and resilience, whereas income information might be understated by respondents, particularly in countries where a large proportion of the population are engaged in farming and/or the informal sector (International Labour Organization, 2003). Expenditure is also sometimes used as a proxy for income – assuming expenditure equals income. The average expenditure per capita in the last 3 months was examined. Overall, the average expenditure per capita was US$298 in the LMB. It was low in Lao PDR at US$59 and in Cambodia (US$122) but high in Viet Nam (US$523), followed by Thailand (US$487).

The resilience of households in Viet Nam, in terms of mean expenditure per capita in the last three months and percentage of expenditure on non-food items, was much higher than in Lao PDR and Cambodia. However, country-by-country comparisons solely on economic parameters should be taken with caution due to different economic conditions such as price levels and buying power, taxes, inflation etc.

A low percentage of expenditure on non-food items suggests high expenditure on food. Poorer households often spend a large part of their income on food and spend little on things such as investment in education, medical care, boat, nets, fishing gear, farming inputs, labour hire, and business. A higher expenditure on non-food items tends to imply a greater resilience to shocks or declining water resources.

It has been suggested that two distinct types of poverty are identified: consumption and investment poverty. People who are not consumption-poor may still be investment-poor due to the decline of their asset bases over time and because of their inability to generate sufficient surpluses to protect, maintain, or enhance their assets (Alwang et al., 2001, p. 10). The lowest average percentage of expenditure on non-food items was in Lao PDR at 58% and the highest was in Viet Nam at 83%. In Cambodia and Thailand about 66% of household expenditure was spent on nonfood items.

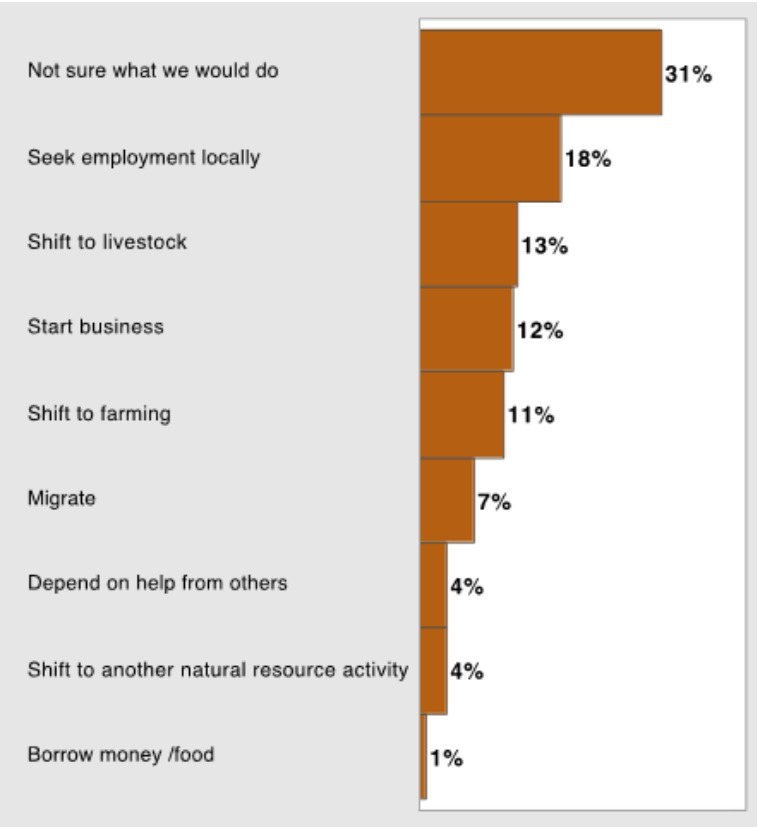


Figure 27: Alternative livelihood options
Source: Household survey, March-May, 2011

Aquaculture as a livelihood activity is an indicator of resilience to changes in natural river water resources though some forms of aquaculture could be affected by such. The survey assessed raising of fish, shrimps and any other aquatic species. Thirty-three percent of households in Viet Nam were engaged in aquaculture, while the level in Cambodia was only 1.4% and in Lao PDR 7.5%. In the saline zone of the Mekong Delta, the proportion of households engaged in aquaculture was 40%.

6.3. Alternative livelihood options

Alternative livelihood options are an important indicator of household resilience, even if these are only perceived options. Overall only 2% of households had family

Table 23: Percentage of responses to alternative livelihood options by country

Alternative	Country				Survey area
	Cambodia	Lao PDR	Thailand	Viet Nam	
Shift to another natural resource activity	5.1%	3.6%	3.7%	0.4%	3.5%
Shift to livestock	11.7%	24.5%	2.5%	13.1%	12.7%
Shift to farming	6.5%	10.6%	20.0%	8.3%	10.9%
Seek employment locally	22.9%	19.8%	15.8%	10.7%	18.1%
Migrate	19.3%	0.0%	0.7%	1.4%	7.0%
Start business	13.5%	6.4%	9.2%	19.1%	12.0%
Borrow money /food	2.1%	0.5%	0.2%	0.8%	1.0%
Depend on help from others	3.4%	1.7%	7.2%	1.6%	3.5%
Not sure what we would do	15.6%	32.8%	40.8%	44.5%	31.1%

Source: Household survey, March-May, 2011

Table 24: Membership in social groups - percentage of households

Country	Religious	Women's union	Youth union	Elderly	Savings/ Credit	Farmers	Fishers	Shared labour group	Veterans	Other	Total
Cambodia	0.7%	0.0%	0.3%	0.4%	1.0%	0.4%	0.3%	0.0%	0.3%	1.3%	4.9%
Lao PDR	0.7%	6.2%	5.3%	2.6%	0.4%	0.3%	0.0%	0.4%	0.4%	3.8%	20.3%
Thailand	1.8%	2.1%	1.2%	1.5%	3.8%	1.2%	0.1%	0.1%	0.1%	1.0%	12.9%
Viet Nam	0.3%	3.7%	1.5%	1.2%	0.4%	2.2%	0.0%	0.0%	0.7%	2.9%	12.9%
Survey area	0.9%	3.0%	2.1%	1.4%	1.4%	1.0%	0.1%	0.1%	0.4%	2.3%	12.8%

Source: Household survey, March-May, 2011

members who have changed occupations or livelihood activities because of declining productivity of natural resources such as fish, OAAs or collected plants in the last five years. However, respondents were asked, what they would do if they were no longer able to practise their current occupation.

About half the respondents said that they had at least one livelihood alternative in their community. Among them, 18% would seek employment locally and 13% would shift to livestock. Only 12% would start a business and 11% would shift to farming. Still, 31% of households were not sure what they would do in such circumstances (Figure 27, Table 23).

Table 23 shows, in Cambodia, 22.9% would seek employment locally and 19.3% would migrate[2]. In Lao PDR, 24.5% would shift to livestock and 19.8% would seek local employment. In Thailand, the favourite option was to shift to farming at 20%, while in Viet Nam it was to start a business at 19.1%.

6.4. Membership of social groups

Social groups include religious, women's union, youth union, elderly, savings or credit, farmers, fishers, share labour and veterans' groups. Membership of a group is often used as a proxy indicator for level of social capital and institutional support. In the context of SIMVA, this applies to adults aged 15-65 years old.

Table 24 shows, on average 13% of the surveyed households had family members involved in one or more social groups/associations. A high proportion of household members in Lao PDR were involved in social groups at 20.3%, followed by Thailand and Viet Nam at 12.9% respectively. Only 4.9% of households in Cambodia where members of social groups.

A high proportion of household members in Lao PDR were involved in social groups at 20.3%, followed by Thailand and Viet Nam

[2] For more information on why and where households in some places in the four LMB countries migrate, please see findings of the Mekong Future Project of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia.

Table 25: Resilience indicators by zone

Resilience	Cambodia		Lao PDR		Thailand		Viet Nam	
	4C	5C	2L	3L	2T	3T	Zone 6 fresh	Zone 6 saline
1. % of households with non-aquatic sources of income	98.6%	98.5%	95.9%	92.6%	99.1%	97.5%	94.5%	81.7%
2. % of adult household members working outside the village	22.3%	20.6%	4.8%	12.6%	7.3%	8.0%	12.4%	12.1%
3. Average expenditure per capita in the last 3 months before the survey (US$)	$42	$76	$632	$342	$123	$119	$532	$514
4. Average monthly per capita income from non-aquatic sources (US$)	$31	$20	$10	$26	$217	$169	$82	$53
5. % of expenditure on non-food items	65.8%	66.8%	52.5%	63.2%	68.1%	63.2%	83.2%	83.1%
6. % of households engaged in aquaculture	1.8%	0.3%	7.0%	7.9%	17.9%	9.7%	26.7%	40.0%
7. % of households with alternative livelihood options	77%	77%	35%	73%	54%	49%	37%	37%
8. % of households belonging to social groups	6%	8%	27%	23%	16%	20%	18%	17%
9. % of households able to produce more than half their own food	61.8%	77.1%	97.6%	85.8%	67.5%	72.7%	40.3%	22.9%
10. Number of livestock units per capita	0.23	0.33	1.34	1.04	0.15	0.45	0.04	0.04
11. Average value of productive assets (US$)	$6,649	$7,259	$5,263	$9,873	$54,325	$36,528	$41,379	$29,795
12. Average value of non-productive assets (US$)	$6,215	$6,981	$5,222	$9,050	$49,845	$33,989	$41,379	$29,795

Source: Household survey, March-May, 2011

at 12.9% respectively. Only 4.9% of households in Cambodia where members of social groups.

6.5. Livestock and productive assets

The survey included cattle and buffalo as the main livestock species. Livestock provide an important way of saving, because households can sell them to cover unexpected expenses. They are considered as valuable assets as well as a safety net for households (WFP, 2005). In rural Lao PDR, the income derived from the sale of one buffalo provides enough cash to buy rice for four to five people for an entire year (WFP, 2001). Raising cattle and buffalo is most common in Lao PDR. Zone 2 & 3 had more than one animal per capita (Table 25). Other countries had fewer livestock per capita (0.04 in both zones of Viet Nam to 0.45 in Zone 3, Thailand and Zones 4 and 5 in Cambodia.

On average, households in all the study areas had a slightly higher value of productive assets than non-productive assets. It is assumed that households with more productive assets are more resilient than those with non-productive assets. However, it might also depend on whether or not those productive assets were used for improving their water use related productivity. For example, households with productive assets related to fishing would be more vulnerable than those with non-fishing related assets if fish stocks decline.

6.6. Summary

The vast majority of households of the sample earn some income from non-aquatic sources, ranging from 81.7% of households in Mekong Delta to 45% in zone 3, Thailand. Overall, more than 80% of the sample working population worked in their village area. However, almost 30% of adult household members in the Cambodia survey area worked outside their village. The percentage of household expenditure on non-food items was 66% for the whole sample, lowest in Lao PDR, highest in Vietnam. Thirty-three per cent of the households in Vietnam were engaged in aquaculture, low in Cambodia at 1.4% and Lao PDR 7.5%, and high at 40% in the saline zone of the Mekong Delta.

Only 2% of the households had household members, which in the last five years had to change occupation or livelihood activity because of declining productivity of natural resources. About half of the sample had at least one livelihood alternative in their same locality. Thirty per cent of the households were not sure what they would do if they could not sustain their present livelihood. On average for the survey area, 13% of the households have members in one or more social groups/associations.

Overall, for more than half of the sample households, food produced at home comprised more than half of their total calorific value intake. In Lao PDR close to 92% of the sample households produced more than half their own food.

Raising livestock is most common in Lao PDR, while the other countries have low numbers of livestock per capita.

On average, households in all study sites possess slightly higher productive assets compared to non-productive assets.

7. Shocks and trends

7.1. Introduction

Shocks, such as floods or storms, can destroy assets directly and can force people to abandon their homes and dispose of assets such as land. Shocks and negative trends undermine people's resilience. Trends may or may not be more benign than shocks, but they occur over a longer period. Trends have an important influence on rates of return to chosen livelihood strategies (DFID, 1999). The study examined 9 indicators of shocks and trends, which were based on respondents' perceptions (Table 26).

7.2. Trends in collecting fish and OAAs

More than half of the fishing households reported a lower fish catch compared to 5 years before the survey. Table 26 shows that about 85% of fishing households in Cambodia suggested less fish catch than 5 years ago, in Thailand 84.3%, in Lao PDR 66.5%, but only 29.4% in Viet Nam. Sixtynine per cent of the fishing households in Cambodia had observed less food due to declining fish catch, in Lao PDR 60.9% and in Thailand 56.5%, but only 20.9% in Viet Nam. However, in zone 3, Lao PDR and zone 4, Cambodia the proportion was considerably higher at 73.2% and 70.9% respectively.

The survey explored several reasons for the decline in fish catch. About 25% perceived that competition from other fishers

Table 26: Shocks and trends by country

Shocks and trends	Cambodia	Lao PDR	Thailand	Viet Nam	Survey area
1. % of households whose primary domestic water source runs dry in the dry season	22.8%	15.3%	32.8%	13.2%	21.0%
2. % of fishers reporting 'less' fish catch than the last 5 years	84.6%	66.5%	84.3%	29.4%	66.2%
3. % of fishers reporting less food due to declining fish catch	69.1%	60.9%	56.5%	20.9%	52.2%
4. % of fishers reporting less income due to declining fish catch	31.6%	6.5%	12.5%	13.8%	16.0%
5. % of households that changed occupation due to decline in natural resources in the last 5 years	5.3%	1.6%	2.1%	1.8%	2.7%
6. % of households reporting less food security than the last 5 years	54.6%	41.5%	41.7%	22.6%	40.1%
7. % of households reporting less income than the last 5 years	51.5%	35.0%	39.4%	22.6%	37.1%
8. % of households reporting water shortages that resulted in crop damage in the last wet season	53.4%	46.6%	27.3%	9.0%	35.0%
--- % of households reporting water shortages that resulted in crop damage in the last dry season	56.6%	42.9%	43.1%	38.7%	42.8%
9. % of households reporting water excess that resulted in crop damage in the last wet season	9.5%	11.6%	14.7%	20.5%	13.9%
--- % of households reporting water excess that resulted in crop damage in the last dry season	0.0%	0.0%	1.60%	2.50%	1.70%

Source: Household survey, March-May, 2011

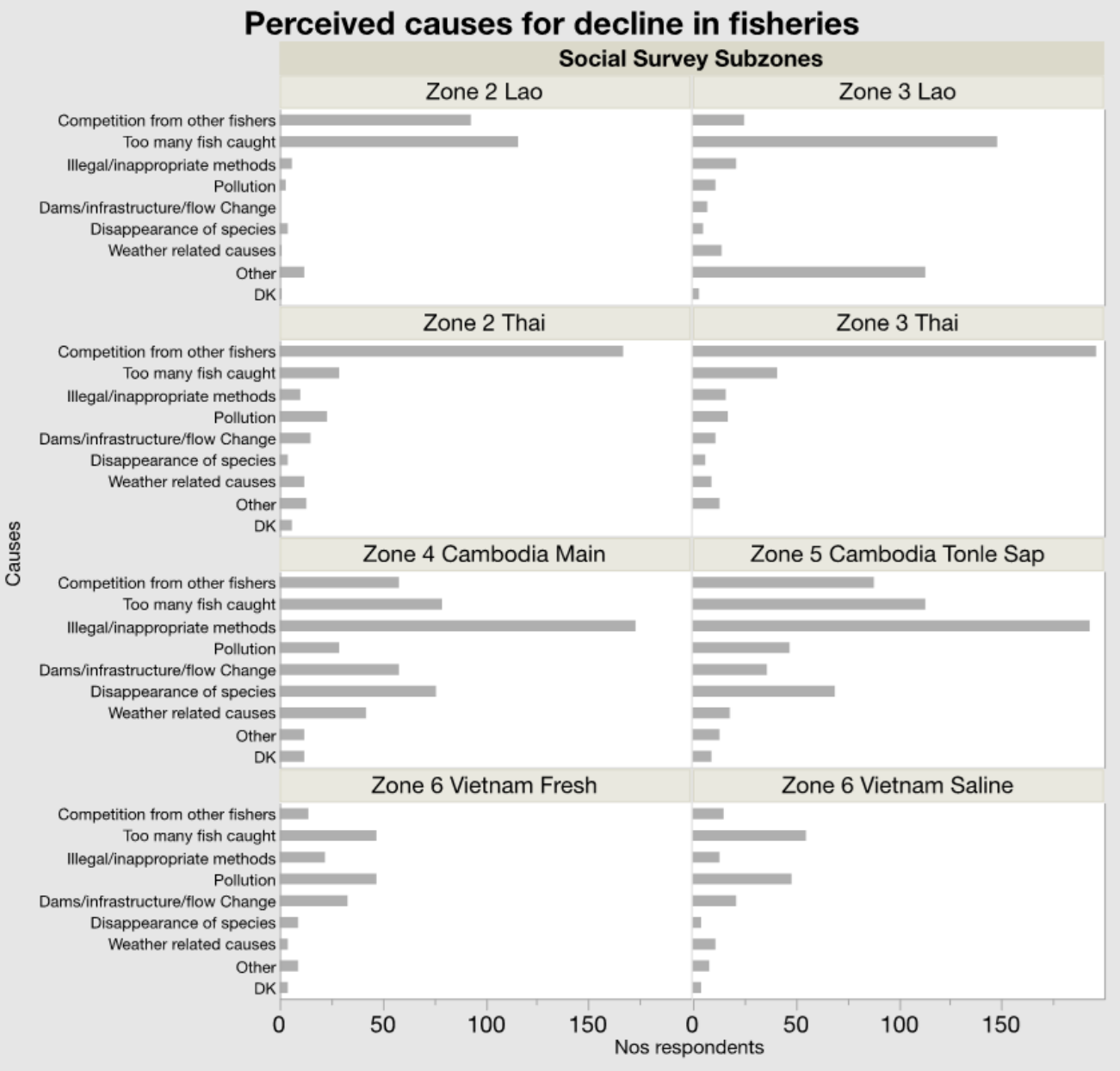


Figure 28: Reason for decline in fish catches by zone
Source: Household survey, March-May, 2011

was the most important reason; followed by 'too many fish caught' (23.6%) and 'illegal or inappropriate fishing methods' (17%). Only 7.2 % of respondents mentioned the impacts of dams or infrastructure (Table 27).

Figure 28 and Table 27 show the perceived reasons for fish catch decline by zone.

In Cambodia, illegal fishing method was thought to be the main and apparently widespread reason for lower fish catches.

Pollution was considered the main reason in the Mekong delta, Viet Nam. In Lao PDR, too many fish caught was considered the most common cause. Table 28 shows the perceived reasons for decreased yield of

Table 27: Perceived causes for decline in fish

Perceived causes	Cambodia	Lao PDR	Thailand	Viet Nam	All
Competition from other fishers	13.0%	20.2%	61.7%	7.9%	24.6%
Too many fish caught	17.1%	45.3%	11.9%	27.7%	23.6%
Illegal/inappropriate methods	32.5%	4.6%	4.4%	9.5%	17.0%
Pollution	6.8%	2.4%	6.8%	25.8%	8.4%
Other	2.2%	21.4%	4.4%	4.6%	7.2%
Dams/infrastructure/flow Change	8.4%	1.2%	4.4%	14.7%	6.8%
Disappearance of species	12.9%	1.5%	1.7%	3.5%	6.6%
Weather related causes	5.3%	2.6%	3.6%	4.1%	4.2%
DK	1.9%	0.7%	1.0%	2.2%	1.5%

Source: Household survey, March-May, 2011

Table 28: Perceived causes for decline in OAAPs

Perceived causes	Cambodia	Lao PDR	Thailand	Viet Nam	All
Too many fish caught	22.7%	48.5%	12.5%	23.3%	26.6%
Competition from other fishers	13.9%	25.3%	56.6%	9.3%	25.3%
Pollution	21.8%	2.3%	12.9%	32.1%	16.9%
Weather related causes	5.7%	16.6%	4.6%	4.3%	7.8%
Illegal/inappropriate methods	12.6%	2.3%	2.8%	9.3%	7.4%
Disappearance of species	13.4%	1.4%	2.9%	3.3%	6.6%
Dams/infrastructure/flow Change	5.5%	1.2%	3.1%	9.8%	4.7%
Other	2.0%	2.4%	2.2%	6.0%	2.8%
DK	2.4%	0.0%	2.4%	2.8%	1.9%

Source: Household survey, March-May, 2011

OAAs. Competition from other collectors was considered the most important reason by 24.6% of respondents. About 23% thought that overcatch of OAAs was the main reason for declining yields.

Other causes perceived were pollution of water by 16.6% of respondents, illegal or inappropriate methods of collecting OAAs by 7.3% and weather related causes by 7.7%, were other important reasons thought to cause decline in the amount of OAAs in the LMB.

Overall, people thought that fewer OAAs were being collected than 5 years ago. About 82% of respondents living on the Mekong mainstream zone 4, Cambodia considered the yield of OAAs was lower than 5 years ago. The responses were similar in zone 3 (80.6%) and zone 2, Thailand (77.4%).

7.3. Water shortages

Water shortages that resulted in crop damage occurred in both wet and dry seasons. The proportion of households experiencing water shortages was high in all countries. It ranged from 39% in Viet Nam to 57% in Cambodia during the dry season and from 9% in Viet Nam to 53% in Cambodia during the wet season. In Lao PDR, the percentage of households reporting water shortages during the wet season was even higher than during the dry season. This was the case in both zones 2 and 3 of the country (Table 30).

Table 29: Trends in collecting OAAs over the past 5 years by zone

OAAs collected compared to last 5 years in terms of quantity	Zone 4 Cambodia Main	Zone 5 Cambodia Tonle Sap	Lao PDR, Zone 2 Lao	Lao PDR, Zone 3 Lao	Thailand, Zone 2 Thai	Thailand, Zone 3 Thai	Zone 6 Viet Nam Fresh	Zone 6 Viet Nam Saline
Less	82.1%	76.8%	38.8%	72.9%	77.4%	80.6%	40.6%	30.9%
Same	7.7%	10.9%	24.4%	20.3%	10.6%	14.1%	1.8%	3.2%
A little more	4.4%	5.6%	1.8%	1.8%	1.5%	0.3%	2.4%	1.8%
Much more	1.8%	1.8%	0.6%	0.3%	2.1%	1.5%	0.6%	0.0%
Don't Know	4.1%	5.0%	34.4%	4.7%	8.5%	3.5%	54.7%	64.1%

Source: Household survey, March-May, 2011

Table 30: Shocks and trends by zone

Resilience	Cambodia		Lao PDR		Thailand		Viet Nam	
	Zone 4	Zone 5	Zone 2	Zone 3	Zone 2	Zone 3	Zone 6 fresh	Zone 6 saline
1. % of households whose primary domestic water source runs dry in the dry season	17.6%	27.9%	18.5%	12.1%	32.1%	33.8%	11.5%	15.0%
2. % of fishers reporting 'less' fish catch than the last 5 years	87.1%	82.1%	49.7%	83.2%	82.6%	86.9%	30.0%	28.8%
3. % of fishers reporting less food due to declining fish catch	70.9%	67.4%	48.5%	73.2%	57.6%	54.6%	23.8%	20.9%
4. % of fishers reporting less income due to declining fish catch	27.6%	35.6%	5.0%	7.9%	7.6%	20.4%	12.4%	13.8%
5. % of households who changed occupation	4.7%	5.9%	0.6%	2.6%	1.2%	3.5%	2.4%	1.2%
due to decline in natural resources in the last 5 years	57.4%	51.8%	33.8%	49.1%	41.1%	42.7%	21.2%	24.1%
6. % of households reporting less food security than the last 5 years	52.1%	50.9%	23.2%	46.8%	36.9%	43.5%	22.9%	22.4%
7. % of households reporting water shortages that resulted in crop damage in the last wet season	66.2%	43.3%	40.4%	53.4%	20.1%	37.7%	4.6%	14.3%
--- % of households reporting water shortages that resulted in crop damage in in the last dry season	44.4%	74.0%	35.9%	50.0%	37.0%	54.7%	31.3%	49.4%
9. % of households reporting water excess that resulted in crop damage in the last wet season	4.6%	13.5%	7.7%	15.8%	17.9%	10.0%	21.9%	18.9%
--- % of households reporting water excess that resulted in crop damage in the last dry season	0.0%	0.0%	0.0%	0.0%	1.90%	1.20%	2.30%	2.80%

Source: Household survey, March-May, 2011

Table 31: Percentage of households reporting changes in crop yield compared to the last 5 years by country

	Less	Same	A little more	Much more	Don't know
Cambodia	50.0 %	18.1 %	18.1 %	6.0 %	7.8 %
Lao PDR	46.5%	30.6 %	13.7 %	5.6 %	3.7 %
Thailand	38.5 %	34.6 %	15.9 %	5.6 %	5.4 %
Viet Nam	19.1 %	15.0 %	29.6 %	4.3 %	32.1 %
Survey area	38.5 %	24.6 %	19.3 %	5.4 %	12.2 %

Source: Household survey, March-May, 2011

In Cambodia, the percentage of households reporting water shortages was more than half of the surveyed households in both dry and wet seasons. In Thailand and Viet Nam, more households reported water shortages in the dry season than in the wet season.

During the wet season, excess water resulted in crop damage most often in the Mekong Delta, Viet Nam and secondly in northeast Thailand. The highest proportion of households reporting lower crop yields occurred in zone 3, Lao PDR at 63.5%, followed by zone 4, Cambodia at 52.1%. Note that these two zones are next to each other.

Table 31 shows the proportion of households reporting changes in crop yield compared to 5 years ago. Overall, more than one-third of households reported lower crop yields over the last 5 years. This view was most common in Cambodia (50%), followed by Lao PDR (46.5%) and Thailand by 38.5%. Only 19.1% thought this was the case in Viet Nam. About one-third of households in Lao PDR and Thailand reported that crop yields were the same, when compared to yields over the last 5 years. Only 4 to 6% of respondents reported a great increase in their crop yield.

7.4. Summary

In summary, a number of key comments about the shocks and trends situation of people living along LMB can be highlighted. First, 66 percent of the survey households reported a decline in catch over the past 5 years. More than half of the households in most zones reported less food due to declining fish catch. Sixteen percent of households reported less income due to declining fish catch, with 32% in Cambodia. Second, many households experienced domestic water sources running dry in the dry season in all four countries. They also experienced water shortages that resulted in crop damage in both dry and wet seasons. The severity was similar in both seasons for Cambodia and Lao PDR. In Thailand, a high proportion of households reported water excess in the last wet season resulting in crop damage. Third, 40% reported less food security than 5 years ago, particularly in Cambodia (55% of households). Thirty-seven percent reported less income than 5 years ago (52% in Cambodia). Fourth, water shortages resulted in crop damage in the last wet season for 35% of households, and for 43% in the last dry season. Water excess caused crop damage to 14% of households in the last wet season.

8. Climate change related social vulnerabilities

8.1. Introduction

SIMVA is also an instrument for monitoring social vulnerability to long-term climate change in the LMB. Climate change related livelihood activities in the study include farming, fishing, collection of OAAs and aquaculture. Indicators reflecting such aspects are grouped into 1) Livelihoods dependence on farming, fishing, collection of OAAs and aquaculture that are affected by climate change; 2) Impacts due to floods, droughts and other climate change events, and 3) Recovery from the losses. Several indicators were included in the analysis (Table 32).

8.2. Impacts of flood, drought and other climate change events

The effect of flood, drought and other weather variability on rice production, live-stock and household assets was assessed. Table 32 presents the percentages of the surveyed households that had experienced damage from floods, droughts and weather variability in the last 12 months.

Overall, about 81.3% of respondents reported loss of assets due to floods, while losses due to droughts were reported by 62.5% and losses due to other climate change

Table 32: Climate change related social vulnerabilities by country

	Cambodia	Lao PDR	Thailand	Viet Nam	Survey Area
Loss of assets due to flooding in last 12 months - % of HHs	90.3%	89.4%	70.8%	79.2%	81.3%
Loss of rice - % of usual production - mean %	58.2%	44.2%	46.3%	66.3%	50.8%
Loss of assets due to drought in last 12 months - % of HHs	95.0%	29.7%	68.8%	68.5%	62.5%
Loss of rice due to drought - mean %	41.3%	40.9%	35.7%	61.8%	41.5%
Loss of assets due to other climate related events in last 12 months - % of HHs	91.7%	95.5%	45.5%	86.6%	67.0%
Loss of rice (% of usual production) due to climate events - mean %	50.1%	35.6%	33.0%	50.1%	39.5%

Months to recover from floods - % of HH with losses	Cambodia	Lao PDR	Thailand	Viet Nam	All
0-6 months	99.5%	96.5%	72.4%	81.5%	87.3%
6 months-1 year	0.5%	3.5%	21.2%	9.9%	9.3%
1-3 years	-	-	0.5%	3.7%	0.7%
3-5 years	-	-	-	2.5%	0.3%
Still not recover	-	-	5.9%	2.5%	2.3%
Months to recover from drought - mean	2.3	3.6	3.4	2.5	2.9
Months to recover from climate and weather events - mean	2	3.3	2.6	3.3	2.7

events by 67% of the households in the survey area.

In Cambodia and Thailand, drought was a significant factor affecting 95% and 69% of households respectively. For those households that experienced loss of assets, the mean loss of rice production was 50.8% due to floods, 41.5% due to droughts, and 39.5% due to other climate related events.

8.3. Recovery and coping strategies

Duration of recovery from floods, warning of floods and other coping strategies were also assessed during the survey. Of the households that did lose assets due to flood 87.3% recovered within 6 months (Table 32).

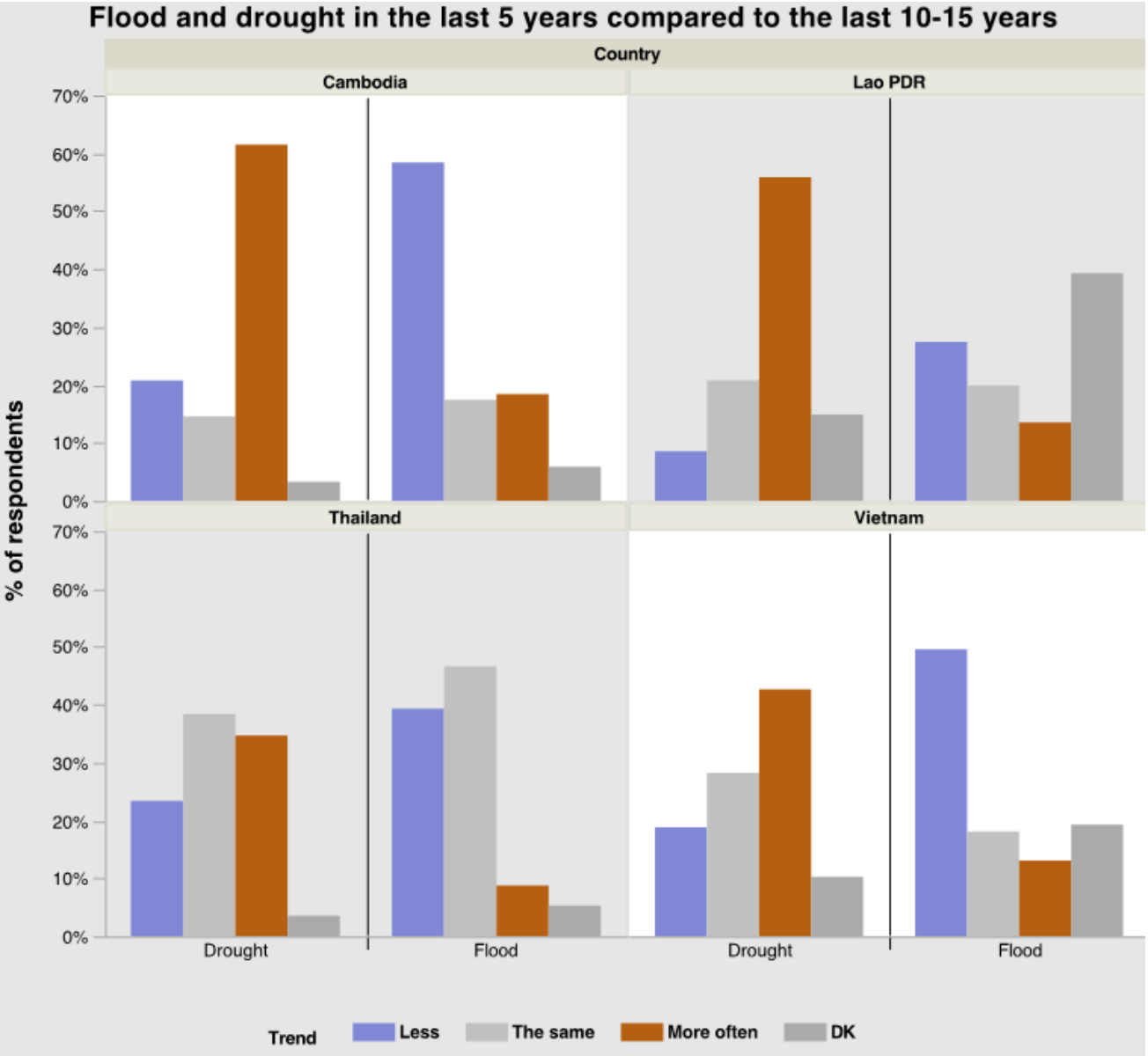


Figure 29: Flood and drought in the last 5 years

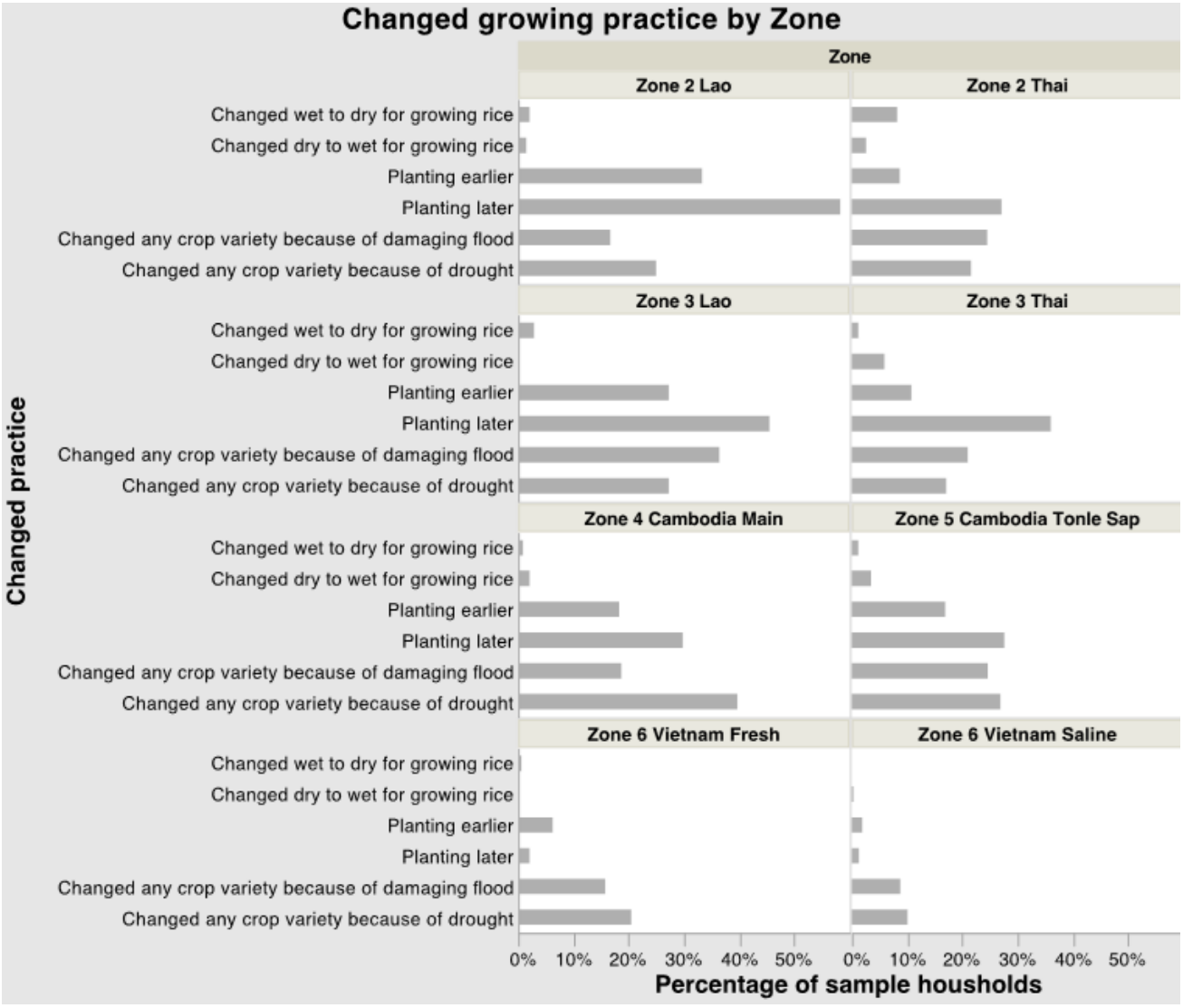


Figure 30: Change in growing practices
Source: Household survey, March-May, 2011

The mean recovery time from droughts was 2.9 months, and from climate and weather events 2.7 months.

Respondents were asked the question, "Is there a way that your family can know if flood is coming?" and "Can households be warned that a flood is coming?" Table 33 indicates that only a small proportion of households in both zones of Lao PDR (especially zone 2 in the north) had warning of flood.

Households were found to adapt to changing weather patterns and related losses in a number of ways, such as changing season or timing of planting and changing crop variety (Table 34, Figure 30). Overall, only a small proportion of households changed planting season (about 2% for both wet to dry and dry to wet seasons). The greatest percentage of households that changed from dry to wet season planting occurred in zone 3, Thailand at 5.4%, and from wet to dry season in Thailand's zone 2.

However, most households changed timing of planting. In the survey area, about one quarter of the surveyed households planted rice later than normal and about 12% planted rice earlier. The highest proportion of households planting rice earlier than normal was found in zone 2, Lao PDR at 30%, followed by zone 3, Lao PDR at 28%.

Changing crop variety is another important practice to cope with the change of climate. Overall, the data indicates a similar percentage of households that change crop variety due to both flood and drought with 20.2% and 23.6%, respectively. The highest proportion to change crop variety due to flood occurred in zone 3, Lao PDR at 36.4%, followed by zone 5, Cambodia at 24.6%. The highest proportion to change crop variety due to drought occurred in zone 4, Cambodia at almost 40% of the households.

8.4. Summary

A very high proportion of the population depends on farming, fishing, collection of OAAs, and aquaculture, which were the main livelihood activities of the people in the survey area. These livelihood activities are quite sensitive to climate change. About 87% of households recovered from flood less than 6 months. Changing crop varieties and planting time were the common coping strategies used.

Table 33: Flood early warning

Description	Is there a way that your household can know if flood is coming?	
	Yes (%)	No (%)
Zone 2-Lao PDR	4.1	95.9
Zone 3-Lao PDR	16.5	83.5
Zone 2-Thailand	60.9	39.1
Zone 3-Thailand	62.1	37.9
Zone 4-Cambodia Mainstream	74.4	25.6
Zone 5-Cambodia Tonle Sap	71.8	28.2
Zone 6-Viet Nam Fresh	74.4	25.6
Zone 6-Viet Nam Saline	65.0	35.0

Source: Household survey, March-May, 2011

Table 34: Changed season for growing rice

Changed season for growing rice - % of HHs	Cambodia	Lao PDR	Thailand	Viet Nam	All
Wet to dry	1.0%	2.5%	4.7%	0.3%	2.1%
Dry to wet	2.8%	0.7%	4.3%	0.1%	2.0%
Not applicable/no change	80.9%	95.6%	71.9%	52.8%	75.3%
DK	15.3%	1.2%	19.1%	46.8%	20.6%

Changed the timing of planting rice - % of HHs	Cambodia	Lao PDR	Thailand	Viet Nam	All
Planting earlier	17.6%	30.4%	9.7%	4.3%	11.7%
Planting later	28.6%	52.2%	31.4%	1.7%	23.9%
No change	47.6%	13.0%	0.0%	91.7%	38.6%
DK	6.2%	4.3%	58.9%	2.3%	25.8%

Changed any crop variety because of damaging flood- % of HHs	**21.8%**	**26.1%**	**22.8%**	**12.6%**	**20.2%**
Changed any crop variety because of drought - % of HHs	**32.9%**	**26.1%**	**19.5%**	**15.8%**	**23.6%**

9. Conclusions and recommendations

The objective of the baseline survey was to obtain baseline data and information on 1) Vulnerability context (baseline vulnerability); 2) Dependence of people on water resources for livelihoods, 3) Their resilient capacities to cope or recover from stresses; 4) Shocks and trends; and 5) Climate change associated vulnerability.

9.1. Conclusions

A significant proportion of the sample population in the survey area were vulnerable to declining availability of water resources, due to their dependence on these resources for food and income. Only limited livelihood alternatives were available that could compensate for loss of resources. More than half of the rural adults in the survey area were engaged in water resource related occupations, mainly farming, and a much smaller proportion of households engaged in fishing, collection of OAAs, aquaculture, and fish processing/ marketing. Water related resources (irrigated crops, fish, OAAs, and riverbank crops) contributed on average almost a quarter of total household income per year. Fish and OAAs contributed overall more than 20% of the total calorie intake of non-rice food per capita per day.

This would imply that a quarter of rural households in the survey area could be affected by changes in the related water resources, although the severity of these impacts would vary a great deal from zone to zone and country to country. The contribution of cash income from fish and OAAs to household income was very small in some zones, but it should be noted that these resources are the most readily available and easiest to sell, helping households to get by in times of hardship.

Households in the survey area were quite resilient measured by some of the indicators for resilience: the majority were able to recover from flood in less than 6 months and almost all had cash income from non-aquatic sources. However, other indicators suggested low resilience: only slightly more than half the sample households had alternative livelihood options, and a relatively high proportion of household income was spent on food, leaving less for investment in education, medical care or savings.

Resilience appeared to be threatened by decreasing livelihood assets, particularly decline in fish catch and crop damage. The baseline data confirmed that both man-made and climatic factors played a role in the damage to livelihood assets.

Data on baseline vulnerability indicators: dependency ratio, fertility rates, household size, poverty rate, child malnutrition, infant mortality, education and employment opportunities showed a low level in some countries and a high level in others. Although these data are presented at the provincial level for the LMB, these differences apply to the SIMVA zones. In other words, vulnerability to adverse changes in water resources will vary from zone to zone and country to country although the extent of

dependence on the resources might be at similar levels.

9.2. Recommendations

With the present survey a SIMVA baseline has been established. The next steps will be to regularly monitor changes in the water related livelihoods and vulnerability status of people in the survey area. This will assist the countries and MRC to put into place precautionary measures if and when such would be needed.

Based on the experiences from the survey a number of recommendations for future SIMVA have emerged. The key recommendations are summarised as follows.

To allow for a complete assessment and monitoring it is recommended that future monitoring takes into account seasonal variability to reflect the seasonal dimension of vulnerability, e.g. dependence on fish will be different in the wet and dry seasons.

The survey area, while remaining overall as it was for the present survey, should be adjusted to accommodate differences in terrain and access as well as representativeness of smaller socio-ecological sub-zones, while taking into account the size of the sample frame in view of resources available. The study would benefit from a narrower geographical focus so the survey area could be reduced to a 15 km buffer zone around maximum extent of flooded areas.

The eight sub-zones should remain unchanged in order to maintain a solid link between the social and biophysical dimensions. The SIMVA zones have been built on biophysical characteristics defined by the inter-basin flow management (IBFM), which also respects the administrative boundaries used by BDP.

This baseline survey has focused on the mainstream Mekong but expansion of SIMVA to tributaries would be useful for a more complete understanding of river dependencies.

With a limited sampling size of 340 households per zone, the present survey could not make very statistically robust comparisons between the zones, and further could not disaggregate data by ethnicity, which might be relevant for some indicators. Thus it is recommended to increase sampling size to be sufficient for analysis of the number of strata of interest. This will increase the level of reliability and representation.

The data obtained by the SIMVA survey do not distinguish between various types of food. For example, no detailed data are included about the types of fish consumed such as fresh, smoked and/or dried fish. This makes it difficult to calculate calorie intake so an average has been used, which may not be sufficiently accurate. Future monitoring could increase the level of accuracy by increasing the breakdown of species and types. In addition the protein intake from the different food types should be calculated.

The baseline survey did not distinguish between rain fed and irrigated rice. So for future monitoring the questionnaire should be redesigned to distinguish between different growing methods.

Most of the indicators analysed throughout this report remain useful and relevant. Because of the complexity and low level of frequency of some indicators, future monitoring should focus on a smaller number of indicators that are easy to monitor and have a certain level of frequency (also as a sign of the indicator's importance). For example, very few households reported losses of livestock due to flood, drought or climate variability. It is therefore recommended that these indicators be dropped from long term monitoring. Future surveys should use shorter, focused questionnaires combined with community level data collection.

While most of the indicators were useful and sufficiently detailed, there is a need for more indicators that reflect dependence on water resources as a whole. This is mainly done in the process of analysis, which could be expanded to construct indices comprising a number of variables in a single value.

It is recommended that data on the indicators above be collected and analysed every 3 years. Increased use of updated official statistics, such as Agricultural, Forestry and Fisheries Census data, is recommended.

Secondary data for baseline vulnerability data should also be updated at the same time as the primary data collection because the two types of data complement each other. LandScan Global Population data has proved to be quite useful for social analysis at the regional scale, but they are synthetic and have a number of limitations in their applicability. When high resolution data, i.e., commune and village updated population figures, become available from the member countries statistical offices these should used instead.

References

Ahmed, M., Navy, H., Vuthy, L., & Tiongco, M. (1998). Socioeconomic Assessment of Freshwater Capture Fisheries in Cambodia: Household Survey Report (pp. 186). Phnom Penh: Mekong River Commission.

Alwang, J., Paul, S. B., & Steen, J. L. (2001). Vulnerability: A view from different disciplines *Social Protection Discussion Paper Series*: Social Protection Unit, Human Development Network, The World Bank.

BDP. (2006). *Basin Development Plan Programme Phase 2*: 2006-2010. Vientiane: Mekong River Commission.

Cruze, R. V., Harasawa, H., Lal, M., Wu, S., Anokhin, Y., Batima, P., . . . Hguyen, H. N. (2007). Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. In M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. Van der Linden & C. E. Hanson (Eds.), *Climate Change 2007: Impacts, Adaptation and Vulnerability* (pp. 469-506). Cambridge: Cambridge University Press.

DFID. (1999). Sustainable Livelihood Guidance Sheets: Department for International Development

Hall, D., & Bouapao, L. (2010). *Social Impact Monitoring and Vulnerability Assessment: Regional Report*. Vientiane: Mekong River Commission.

Hirsh, P. (2011). Cascade effect: The Mekong River and China's Hydropower Ambitions.

Hortle, K. G. (2007). Consumption and the Yield of Fish and Other Aquatic Animals from the Lower Mekong Basin *MRC Technical Report No.16* (pp. 87). Vientiane: Mekong River Commission

Hortle, K. G., & Suntornratana, U. (2008). Socio-economics of the fisheries of the Lower Songkhram River Basin, Northeast Thailand. *MRC Technical Repor tNo. 17*. Vientiane: Mekong River Commission.

International Labour Organization. (2003). *Household Income and Expenditure Statistics*. Paper presented at the Seventeenth International Conference of Labour Statisticians http://www.ilo.org/public/english/bureau/stat/download/17thicls/r2hies.pdf. Accessed on 26 August 2010

IPCC. (2001). Climate Change 2001: Synthesis Report. . In R. T. Waston & the Core Writing Team (Eds.), *A Contribution of Working Group I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 398). Cambridge, UK, and New York, USA: Cambridge University Press

IPCCWG2. (2007). Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. In M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. Van der Linden & C. E. Hanson (Eds.), *Climate Change 2007: Impacts, Adaptation and Vulnerability* Cambridge: Cambridge University Press.

MRC. (2003). *State of the Basin Report, 2003*. Phnom Penh: Mekong River Commission

Osborne, M. (2000). *The Mekong: Turbulent Past, Uncertain Future*. New York: Grove Press.

UNFCCC. (2007). Climate Change: Impacts, Vulnerability, and Adaptation in Developing Countries: UNFCCC.

Verbruggen, A., Moomaw, W., & Nyboer, J. (2011). Annex 1: Glossary, Acronyms, Chemical Symbols and Prefixes. In O. Edenhofer, Y. Pichsmadruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlomer & V. S. C. (Eds.), *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation* Cambridge, UK & NY, USA: Cambridge University Press.

WFP. (2001). Lao PDR District Vulnerability Analysis: A First Look. Vientiane: World Food Programme.

WFP. (2005). Lao PDR: District Vulnerability Analysis. Vientiane: World Food Programme.

WFP. (2007). Comprehensive Food Insecurity and Vulnerability Analysis (CFSVA). Vientiane: United Nations World Food Programme.

Questionnaire Number ___|___|___|___|___|___|___|___|___|___|

ANNEX 1: Household Questionnaire

Mekong River Commission
Social Impact Monitoring and Vulnerability Assessment
Round 1
Household Questionnaire

Date: ___|___ ___|___ ___|___|___|___

Carried out by: ___|___|___|___|___|___|___|___|___|___ on behalf of MRC

Contact: ___|___|___|___|___|___|___|___|___|___

I. IDENTIFIERS, QUALITY CONTROLS AND INTRODUCTION

No.	Check/Question	Response/Name	Code	Go To	Sup
1	**Country** [Circle]	Cambodia	1		
		Lao PDR	2		
		Thailand	3		
		Viet Nam	4		
2	**Province** [Write name. Add code from list]				
3	**District** [As above]				
4	**Commune** [As above]				
5	**Village** [As above]				
6	**Household No.**				
6.1	**Ethnicity of the household**				

7	**Name of interviewee**	
8	**Name of interviewer**	
9	**Signature of interviewer**	

QUALITY CONTROL

10	**Date of 1st visit**			**day**			**month**
11	Outcome of 1st visit	Interview completed	1				
		Interviewee not at home	2				
		Interview refused	3				

12	**Date of 2nd visit**			**day**			**month**
13	Outcome of 2nd visit	Interview completed	1				
		Interviewee not at home	2				
		Interview refused	3				

14	**Date of 3rd visit**			**day**			**month**
15	Outcome of 3rd visit	Interview completed	1				
		Interviewee not at home	2				
		Interview refused	3				

SUPERVISOR

16	**Name of supervisor**					
17	**Date of check**		**day**			**month**
18	**Signature of team supervisor**					

DATA MANAGER CODING CHECK (TEAM)

19	**Name of data manager**					
20	**Data manager check date**		**day**			**month**
21	**Signature of data manager**					

DATA ENTRY OPERATOR # 1

22	**1ST Data entry operator**					
23	**Date of first data entry**		**day**			**month**
24	**Signature of first data entry operator**					

DATA ENTRY OPERATOR # 2

25	**2nd data entry operator**							
26	**Date of second data entry**			**day**			**month**	
27	**Signature of second data entry operator**							

DATABASE MANAGER (TEAM)

28	**Name of database manager**							
29	**Data validation check date**			**day**			**month**	
30	**Signature of database manager**							

ENUMERATOR (SELF-CHECK)

31	**The total number of unexpected missing/incorrect values**				
1.31.1	The question # with unexpected missing/incorrect values				
1.31.2	The question # with unexpected missing/incorrect values				
1.31.3	The question # with unexpected missing/incorrect values				
1.31.4	The question # with unexpected missing/incorrect values				
1.31.5	The question # with unexpected missing/incorrect values				
1.31.6	The question # with unexpected missing/incorrect values				
1.31.7	The question # with unexpected missing/incorrect values				
1.31.8	The question # with unexpected missing/incorrect values				
1.31.9	The question # with unexpected missing/incorrect values				
1.31.10	The question # with unexpected missing/incorrect values				

SUPERVISOR

32	**Interviewer review of unexpected missing/incorrect values**			
33	The total number of unexpected missing/incorrect values			
34	Out of which:	Number of unexpected missing/incorrect values resolved		
35		Number of unexpected missing/incorrect values unresolved		

DATA ENTRY OPERATOR CHECK (TEAM)

36	**Review of unexpected missing/incorrect values**			
37	The total number of unexpected missing/incorrect values			
38	Out of which:	Number of unexpected missing/incorrect values resolved		
39		Number of unexpected missing/incorrect values unresolved		

DATABASE MANAGER CHECK (TEAM)

40	**Review of unexpected missing/incorrect values**			
41	The total number of unexpected missing/incorrect values			
42	Out of which:	Number of unexpected missing/incorrect values resolved		
43		Number of unexpected missing/incorrect values unresolved		

INTRODUCTION

[**ENUM: READ OUT**] Hello. My name is _____. I am here doing some work for the Mekong River Commission, an international organisation that coordinates planning for sustainable development. We are here to study people's livelihoods and use of water resources. The information collected during our discussions will be used for planning purposes for the benefit of people living in the Mekong Basin. I hope you don't mind if I ask you a few questions about your life and activities. We will not record your name and nothing you say will be linked directly to you. The interviews will take about 1 hour of your time. Your contribution will be highly appreciated, but unfortunately no cash payment can be made. Is it OK to continue? _____ 1. Yes 2. No

[**Enumerator**: If no, move on to next household. Please spend some time chatting a little with the household to relax them before staring the formal questions.]

No.	Check/Question	Number
44	Total household members	

[Take one question at a time and ask for all household members. Complete by circling the appropriate response for each person. Only use names for recall. Put member's initials at top of column].

No.	Question/instruction	Response/instruction	Codes [circle]														
44.1		[Put initial of all household members]	1 [HHH]	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			____	____	____	____	____	____	____	____	____	____	____	____	____	____	____
45	Sex	Male	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Female	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
46	What is the age of [name]?	[Write age last birthday]															
47	What is the relationship of [name] to household head?	Head	1	1	5	1	1	1	1	1	1	1	1	1	1	1	1
		Spouse	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Parent	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		Child	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Other relative	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Not related	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		DK	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99
	No.	[Put initial of all adults only]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
48	What level of education did/has [name] completed?	None	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Primary	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Lower secondary	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		Upper secondary	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Tertiary	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		DK	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99
49	What is [name's] main occupation in the last 12 months? By main occupation we mean what [name] spends most of his/her time doing.	Not working	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Farming	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Fishing	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		Collecting OAAs	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Aquaculture	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Fish processing/marketing	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		Farm labourer	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
		Other irregular work	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
		Permanent employment	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
		Student	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
		Business/trading	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
		House work	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
		Other	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
		DK	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99
	No.	[Put initial of all adults only]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

50	What is **[name's]** second occupation?	Not working	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Farming	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Fishing	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		Collecting OAAs	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Aquaculture	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Fish processing/marketing	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		Farm labourer	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
		Other irregular work	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
		Permanent employment	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Student	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
		Business/trading	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
		House work	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
		Other	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
		DK	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99
51	Is **[name]** a member of any association?	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		(If no, go to q53) No	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		DK	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99
	No.	**[Put initial of all adults only]**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**

52	What kind of group?	Religious	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Women	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Youth	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		Elderly	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Savings/Credit	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Farmers	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		Fishers	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
		Shared labour group	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
		Veterans	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
		Other	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		DK	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99
53	Where does **[name]** work?	In the village	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Outside the village	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Cross-border	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		DK	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99

III. MOST IMPORTANT OCCUPATIONS OF THE HOUSEHOLD

No.	Check/Question	Response	Number	Go To	Sup
54	Of the occupations you mentioned earlier in the household, which would you say is the most important in terms of sustaining your livelihoods? [**Read the ones they mentioned and ask the respondent to select one only**]	Not working	1		
		Farming	2		
		Fishing	3		
		Collecting OAAs	4		
		Aquaculture	5		
		Fish processing/marketing	6		
		Farm labourer	7		
		Other irregular work	8		
		Permanent employment	9		
		Student	10		
		Business/trading	11		
		Housework	12		
		Other	13		
		DK	99		
55	Of the occupations you mentioned earlier in the household, which would you say is the second most important in terms of sustaining your livelihoods?	No second occupation	1		
		Farming	2		
		Fishing	3		
		Collecting OAAs	4		
		Aquaculture	5		
		Fish processing/marketing	6		
		Farm labourer	7		
		Other irregular work	8		
		Permanent employment	9		
		Student	10		
		Business/trading	11		
		Housework	12		
		Other	13		
		DK	99		

IV. LIVE LIHOOD ACITIVITIES

[ENUM: READ OUT] I would now like to ask you specifically about different activities related to water resources. Could you confirm whether or not any household members engaged in the following activities in the last 12 months:

[**Enum**: READ the list, but don't repeat the ones that are already known from occupation sections]

No.	Activity	Response	Code	Go To	Sup
56	Fishing	Yes	1		
		No	2		
57	Collecting OAAs	Yes	1		
		No	2		
58	Aquaculture	Yes	1		
		No	2		
59	Irrigated farming	Yes	1		
		No	2		
60	None irrigated farming	Yes	1		
		No	2		
61	River bank cultivation	Yes	1		
		No	2		
62	Have any household members had to change occupation or livelihood activity in the last five years because of declining productivity of natural resouces, such as fish, other aquatic animals or collected plants? [**Prompt to make sure change was due to declining productivity and not other factors.**]	Yes	1		
		No	2	**q64**	
		DK	99		
63	If yes for **q62**, how many	Number of people			

VI. ALTERNATIVE LIVELIHOODS

No.	Question	Response	Code	Go To	Sup
64	If your household members were no longer able to engage in the occupations activities you have just mentioned due to a decline in their productivity what would you do? [**Circle up to three responses**]	Shift to another natural resource activity	1		
		Shift to livestock	2		
		Shift to farming	3		
		Seek employment locally	4		
		Migrate	5		
		Start business	6		
		Borrow money/food	7		
		Depend on help from others	8		
		Not sure what we would do	9		
		Not applicable	10		
		DK	99		

VI. DEPENDENCE ON FISH

No.	Question	Response	Code	Go To	Sup
65	Could I please confirm. Has any household member fished in the last 12 months?	Yes	1		
		No	2	**q73**	

[ENUM: READ] I would like to learn more about how much time you spend fishing over the year and how much you usually catch of whatever species. Perhaps we can do this by looking first at your busiest months, and then look at your quietest months.

[**Enumerator**: Work with the respondent to complete the table below. If need be, visualize the discussion with a graph on scrap paper first. Please make sure each cell as a number. Use "8888" for any month when no time was spent on fishing. Do not use lines. Leave no blanks. 0 for when no catch was made. Circle main ecosystem that fish came from in that month.]

No.	Time Spent and Amounts Caught	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
66	Average number of days per week [e.g. 0 to 7 days]?												
67	Average number of hours fishing per day?												
68	Average amount caught per day [kgs]?												
69	How much was sold [kgs]?												
70	How much was eaten [kgs]?												
71	How much was preserved [kgs]?												

No.	Main ecosystem that month:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
72	Mekong mainstream	1	1	1	1	1	1	1	1	1	1	1	1
	Other rivers and streams	2	2	2	2	2	2	2	2	2	2	2	2
	Tonle Sap	3	3	3	3	3	3	3	3	3	3	3	3
	Other lakes or swamps/wetlands	4	4	4	4	4	4	4	4	4	4	4	4
	Ponds and canals	5	5	5	5	5	5	5	5	5	5	5	5
	Paddies	6	6	6	6	6	6	6	6	6	6	6	6
	Other ecosystems	7	7	7	7	7	7	7	7	7	7	7	7
	DK	99	99	99	99	99	99	99	99	99	99	99	99

No.	Question	Response	Code	Go To	Sup
73	Are there any special places some distance from the village where you [or your HH members] migrate to temporarily to catch fish on a seasonal basis [e.g. during fish migrations]?	Yes	1		
		No	2	**q76**	
		DK	99		
74	For how many days in the year do you move to that place? **[Convert weeks or months to days]**	[Write number of days]			
75	In what ecosystem do you do this seasonal fishing ?	Mekong mainstream	1		
		Other rivers and streams	2		
		Tonle Sap	3		
		Other lakes or swamps/wetlands	4		
		Ponds and canals	5		
		Paddies	6		
		Other ecosystems	7		
		DK	99		
76	Did anyone in the household catch any fish in the last 24 hrs (yesterday)?	Yes	1		
		No	2	**q82**	

77	From what ecosystem?	Mekong mainstream	1		
		Other rivers and streams	2		
		Tonle Sap	3		
		Other lakes or swamps/wetlands	4		
		Ponds and canals	5		
		Paddies	6		
		Other ecosystems	7		
		DK	99		
78	What was the weight in kilograms of the total catch?	[Write total kgs]			
79	How much was sold?	[Write total kgs]			
80	How much was eaten in the household?	[Write total kgs]			
81	How much was preserved?	[Write total kgs]			

PERCEPTIONS OF TRENDS OF FISH

No.	Question	Activity	Code	Go To	Sup
82	Overall, how would you say your fish catch compares in terms of quantity with five years ago? **[Member of household, sometime/usually, fishing from nature]**	Less	1		
		Same	2	**q86**	
		A little more	3	**q85**	
		Much more	4	**q85**	
		DK	99	**q86**	
83	If less, what do you believe are the causes of having less fish in your catch?	Competition from other fishers	1		
		Too many fish caught	2		
		Illegal/inappropriate methods	3		
		Pollution	4		
		Dams/infrastructure/flow change	5		
		Disappearance of species	6		
		Weather related causes	7		
		Other	8		
		DK	99		
84	If less, what have the consequences of less catch been for your household?	Less food	1		
		Less income	2		
		Less bartering	3		
		Boredom/frustration	4		
		Other	5		
		DK	99		
85	If more, what do you believe are the causes of having more fish in your catch?	Use of modern technologies	1		
		More fish	2		
		Other	3		
		DK	99		

VII. DEPENDENCE ON OAAs AND OTHER OAPs.

No.	Question	Activity	Code	Go To	Sup
86	Could I please confirm, has any household members collected OAAs and/or OAPs in the last 12 months?	Yes	1		
		No	2	**q93**	
87	What is the most important type of OAA for your household, from the point of view of food or sales, that you collected in the last 12 months? [**Please circle up to two answers and then write 1 to indicate most important and 2 for the second most important**]	Frogs	1		
		Tadpoles	2		
		Crabs	3		
		Snails	4		
		Clams/ Shells	5		
		Shrimps	6		
		Eels	7		
		Turtles	8		
		Other	9		
		DK	99		
88	What is the main ecosystem where you got [**name of most important type**] in the dry season?	Mekong mainstream	1		
		Other rivers and streams	2		
		Tonle Sap	3		
		Other lakes or swamps/wetlands	4		
		Ponds and canals	5		
		Paddies	6		
		Other ecosystems	7		
		Don't collect in this season	8		
		DK	99		
89	What is the main ecosystem where you got [**name of most important type**] in the wet season?	Mekong mainstream	1		
		Other rivers and streams	2		
		Tonle Sap	3		
		Other lakes or swamps/wetlands	4		
		Ponds and canals	5		
		Paddies	6		
		Other ecosystems	7		
		Don't collect in this season	8		
		DK	99		
90	What is the most important type of OAPs for your household, from the point of view of food or sales, that you collected in the last 12 months?	Morning glory	1		
		Water hyacinth	2		
		Algae	3		
		Lotus	4		
		Water lilly	5		
		Water mimosa	6		
		Other	7		
		DK	99		

No.	Question	Activity	Code	Go To	Sup
91	What is the main ecosystem where you got [**name of most important type**] in the dry season?	Mekong mainstream	1		
		Other rivers and streams	2		
		Tonle Sap	3		
		Other lakes or swamps/wetlands	4		
		Ponds and canals	5		
		Paddies	6		
		Other ecosystems	7		
		Don't collect in this season	8		
		DK	99		
92	What is the main ecosystem where you got [**name of most important type**] in the wet season?	Mekong mainstream	1		
		Other rivers and streams	2		
		Tonle Sap	3		
		Other lakes or swamps/wetlands	4		
		Ponds and canals	5		
		Paddies	6		
		Other ecosystems	7		
		Don't collect in this season	8		
		DK	99		

PERCEPTIONS OF TRENDS OF OAAs AND OAPs

No.	Question	Activity	Code	Go To	Sup
93	Overall, how would you say your OAA catch collected compares in terms of quantity with five years ago? [**Member of household, sometime/usually, fishing from nature**]	Less	1		
		Same	2	**q93a**	
		A little more	3	**q93a**	
		Much more	4	**q93a**	
		DK	99	**q93a**	
94	If less, what do you believe are the causes of having less OAAs in your catch?	Competition from other fishers	1		
		Too many fish caught	2		
		Illegal/inappropriate methods	3		
		Pollution	4		
		Dams/infrastructure/flow change	5		
		Disappearance of species	6		
		Weather related causes	7		
		Other	8		
		DK	99		
95	If less, what have the consequences of less OAAs catch been for your household?	Less food	1		
		Less income	2		
		Less bartering	3		
		Boredom/frustration	4		
		Other	5		
		DK	99		
93a.	Overall, how would you say your OAPs collected compares in terms of quantity with five years ago?	Less	1		
		Same	2	**q96**	
		A little more	3	**q96**	
		Much more	4	**q96**	
		DK	99	**q96**	

No.	Question	Activity	Code	Go To	Sup
94a.	If less, what do you believe are the causes of having less OAPs in your catch?	Competition from other users	1		
		Too many OAPs collected	2		
		Illegal/inappropriate methods	3		
		Pollution	4		
		Dams/infrastructure/flow change	5		
		Disappearance of species	6		
		Weather related causes	7		
		Other	8		
		DK	99		
95a.	If less, what have the consequences of less OAPs been for your household?	Less food	1		
		Less income	2		
		Less bartering	3		
		Boredom/frustration	4		
		Other	5		
		DK	99		

VIII. DEPENDENCE ON CULTIVATED CROPS

No.	Question	Activity	Code	Go To	Sup
96	Could I please confirm, does you household cultivate any crops?	Yes	1		
		No	2	**q110**	
97	What is the most important crops for the households	Rice	1		
		Other crops	2		
		Industrial plants	3		
		Other plants	4		
		DK	99		
98	How many hectares of land does your household have for cultivation in total?	[Write hectares]			
99	How many hectares of the most important crop (as in q.97) did your household cultivate in the last wet season? [**Owned and hired land**]	[Write hectares]			
100	In the wet season, did you experience any water shortages or excesses that resulted in crop damage?	Water shortages	1		
		Excess water	2		
		Both	3		
		Neither	4		
		DK	99		
101	How many hectares of the most important crop [**as in q.97**] did your household cultivate in the last dry season?	[Write hectares]			
102	In the dry season, did you experience any water shortages or excesses that resulted in crop damage?	Water shortages	1		
		Excess water	2		
		Both	3		
		Neither	4		
		DK	99		
103	What is the value of the most important crops or industrial trees [**as in q.97**] did you harvest last year in total?	[Local currency]			
104	Of these, what is the value [**as in q.97**] came from an area that you irrigated?	[Local currency]			
105	How many percent did you sell?	[Percentage]			
106	What sources of water do you have [**for q.104**]? [**Circle up to 3 respsonses**]	Only rain	1		
		Natural flooding Mekong	2		
		Natural flooding other	3		
		Irrigation from Mekong	4		
		Irrigation other	5		
		Other system	6		
		DK	99		
107	Could I please confirm, does your household cultivate any crops on the banks of the Mekong?	Yes	1		
		No	2	**q110**	
108	If yes, what is the size of the land on the river bank that you cultivate?	[Write size in hectares]			
109	If yes, approximately what percent of your river bank produce did you sell last season? [**Help respondent to approximate if necessary**]	[Percentage]			

PERCEPTIONS OF TRENDS OF CULTIVATED CROPS

No.	Question	Responses	Code	Go To	Sup
110	Overall, how would you say your crop yield compares in terms of quantity with five years ago?	Less	1		
		Same	2	**q114**	
		A little more	3	**q113**	
		Much more	4	**q113**	
		DK	99	**q114**	
111	If less, what do you believe are the causes of having less crop yield? [**Circle up to 3 respsonses**]	Water shortages	1		
		Excess water	2		
		Declining fertility	3		
		Cost of inputs	4		
		Shortage of labour	5		
		Less demand	7		
		Lower prices	8		
		Pests	9		
		Flood	10		
		Drought	11		
		Weather Varibality	12		
		Other	13		
		DK	99		
112	If less, what have the consequences of less yield been for your household? [**Circle up to 3 respsonses**]	Less food	1		
		Less income	2		
		Less bartering	3		
		Boredom/frustration	4		
		Other	5		
		DK	99		
113	If more what do you believe are the causes of having more crop production? [**Circle up to 3 respsonses**]	Irrigation	1		
		Market opportunities	2		
		Fertiliser	3		
		Pest control	4		
		Extension advice	5		
		Fertile land	6		
		Enough water	7		
		High yield varieties	8		
		Other	9		
		DK	99		

IX. AQUACULTURE

114	Do you raise fish/shrimps or any other species at all?	Yes	1		
		No	2	**q115**	

A	B	C	D	E	F	G	H	I	J	K	L
Aqua-culture type	Holding facility	Size of area (m^2)	Location	Production last year (kgs)	Months with water shortages	Percentage eaten in last year	Percentage bartered or gifted last year	Percentage sold in last year	Value of sales in last year	Change in yields in the last five years	Perceived cause for change

Aquaculture type: 1.Exotic Fish 2.Native Fish 3.Shrimps 4.Frogs 5.Eels 6.Crocodile 7.Other (Specify _____)

Holding facility type: 1.Pond 2. Pen 3. Cage/tank 4. Others (in the case of Cambodia)

Location: 1.River 2.Lake 3.Rice field 4.Channel 5.Canal 6.Well 7.Rainfall/ponds. 8.Reservoir 9.Others

Months with water shortage: 0=None. For other months use calendar months, e.g. 1-4 = Jan to April

Value: Use local currency

Change in yields: 1.Much more 2.More 3.Little more 4.Same 5.Little less 6.Less 7.Much less

Perceived causes:

FOR LESS: 1. Water shortages 2. Pollution 3. Capital 4. Disease 5. Feed problems

FOR MORE: 6.Good management 7.Good fingerlings 8.Pest control 9.Extension advice

FOR EITHER: 10.Other (Specify)_____ 11.Other (Specify)_____

X. CONSUMPTION

No.	Question	Response/Instruction	Code	Go To	Sup
115	How many people had breakfast at home yesterday? If eaten in the homestead **[eg. Rice field]**, please consider as eaten at home This applies also to q116-q117	[Write number of people]			
116	How many people had lunch at home yesterday?	[Write number of people]			
117	How many had dinner at home yesterday?	[Write number of people]			

[**ENUM: READ OUT**] Please indicate how much was eaten yesterday and the source

[**Enumerator:** READ list. Use conversion guide agreed in training to estimate quantities eaten the day before the interview. Use 0 kgs for anything not eaten. Exclude any food cooked but not eaten in the home that day.

No.	Question	Response/Instruction	Code/ amount	Go To	Sup
118	How much rice was cooked in the home yesterday?	[Write kgs cooked]			
119	What proportion of the rice that was cooked yesterday was given away, feed to animals, used for fishing or thrown away?	[Write approximate percent]			
120	What was the source of the rice?	Own production	1	**q122**	
		Purchased	2		
		Other	3		
		DK	99		
121	If purchased, how much?	Local currency			
122	How much fish was eaten in the home yesterday? **[If alll the household members eat outside home, please ask for the last meal at home]**	[Write kgs eaten]			
123	What was the source of the fish yesterday ?	Caught	1		
		Purchased	2		
		Received from others	3		
		DK	99		
124	If purchased, how much of the amount eaten yesterday? **[Calculate the amount that was eaten yesterday. Please don't include what was not eaten]**	Local currency			
125	How much OAAs were eaten in the home yesterday?	[Write kgs eaten]			
126	If OAAs were eaten, what kind of OAAs were eaten yesterday?	Frogs	1		
		Tadpoles	2		
		Crabs	3		
		Snails	4		
		Clams/Shells	5		
		Shrimps	6		
		Eels	7		
		Turtles	9		
		Other	10		
		DK	99		
127	What was the source of the OAAs yesterday? **[Circle up to 3 respsonses]**	Caught	1	**q129**	
		Purchased	2		
		Received from others	3	**q130**	
		DK	99		

No.	Question	Response/Instruction	Code/ amount	Go To	Sup
128	If purchased, how much? (sum of all the OAAs eaten yesterday)	Local currency			
129	If caught, from what ecosystem?	Mekong mainstream	1		
		Other rivers and streams	2		
		Tonle Sap	3		
		Other lakes or swamps	4		
		Ponds and canals	5		
		Paddies	6		
		Other ecosystems	7		
		DK	99		
130	How many eggs were eaten in the home yesterday?	[Write number eaten]			
131	What was the source of the eggs yesterday?	Own production	1		
		Purchased	2		
	[Circle up to 3 respsonses]	Received from others	3		
		DK	99		
132	If purchased, how much?	Local currency			
133	How much red meat **[cow, buffalo, sheep, goat, pig]** was eaten in the home yesterday?	[Write kgs eaten]			
134	What was the source of the red meat yesterday?	Own production	1		
		Purchased	2		
	[Circle up to 3 respsonses]	Received from others	3		
		DK	99		
135	If purchased, how much	Local currency			
136	How much white meat **[chicken, duck, bird]** was eaten in the home yesterday?	[Write kgs eaten]			
137	What was the source of the white meat yesterday?	Own production	1		
	[Circle up to 3 respsonses]	Purchased	2		
		Received from others	3		
		DK	99		
138	If purchased, how much?	Local currency			
139	How much vegetable (include all plants, e.g. bamboo shoots, cabbage, mushrooms) in total were eaten in the home yesterday?	[Write kgs eaten]			
140	What was the main source of the vegetables yesterday?	Own production riverbank	1		
	[Circle up to 3 respsonses]	Own production elsewhere	2		
		Wild/gathered	3		
		Purchased	4		
		Received from others	5		
		DK	99		
141	If purchased, how much?	Local currency			

No.	Question	Response/Instruction	Code/ amount	Go To	Sup
142	Looking back over the 7 days [**but excluding yesterday**] which of the following items were eaten? [**Circle all positive responses**]	Rice	1		
		Fish	2		
		OAAs	3		
		Eggs	4		
		Red meat	5		
		White meat	6		
		Vegetables	7		
		Other	8		
		DK	99		
143	Overall, how would you say your household food security situation [**own production/collection**] compares with 5 years ago?	Less food secure	1		
		Same	2		
		A little more food secure	3		
		Much more food secure	4		
		DK	99		

XI. FOOD STORAGE AND PURCHASING

No.	Question	Response/Instruction	Code	Go To	Sup
144	Do you have rice in the store?	Yes	1		
		No	2	**q147**	
		DK	99	**q147**	
145	How many kgs of rice are in your store now for replanting?	Write kg			
146	How many kgs of rice are in your store now for consumption?	Write kg			
147	How many kgs of processed fish [**dried, fermented**]?	Write kg			
148	Have any household members changed occupation because of food shortages?	Yes	1		
		No	2	**q150**	
		DK	99	**q150**	
149	If yes, what was the main reason?	Food stocks ran out completely	1		
		Stock was low	2		
		Food too expensive	3		
		Sometimes not enough for all	4		
		Always not enough for all	5		
		DK	99		

150	Please indicate in which months you had to do any of the following (if at all)? [**Use a cross to indicate the month when the action took place. If none, leave blank.**]

Action	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
a. Buy rice												
b. Borrow rice												
c. Borrow money to buy rice												
d. Substitute rice with other starch												

XII. EXPENDITURE

No.	Question	Instruction	Value	Sup
151	Overall, last week how much cash do you estimate you spent on food in total?	[Write amount in local currency]		
152	Please indicate how much you spent on the following non-food items in the last three months	[Read out all items]		
153	Clothes			
154	Education			
155	Travel and transport			
156	Medical care			
157	Electricity and water			
158	Telephone and Mobible phone [**include value and operation**]			
159	Electrical appliances			
160	Building/repairs			
161	Land rental			
162	Boats, nets, fishing gear			
163	Farming inputs			

164	Hired labour			
165	Business			
166	Repayment of loans in cash			
167	Donations and events			
168	Land tax [**and other taxes**]			

XIII. KEY SOURCE OF INCOME

[**Eum. READ**] Looking at your expenditure could you indicate what your sources of income were in the last year. This information will be kept confidential. We simply need it to have a full understanding of your livelihood.

[**Enumerator:** (i) Using information from past sections on occupations, livelihood activites, fish, OAAs and crop, ask for amounts from sources already know; (ii) then read other possible sources; (iii) then prompt for any other source. For each source determine the frequency of income and how many times this is obtained in the year to compute an annual total, using the examples in the top row (e.g. salary is monthly, so received 12 times a year; vegetables sales in the example were weekly for four months in the wet season].

No.	Source of income	Amount	Number of times in the year income obtained from source	Annual Total
E.g.	SALARY	$1000	12	$12,000
E.g.	SALE OF VEGETABLES	$30	16	$480
169	Sales of own fish catch			
170	Sales of others fish catch			
171	Sale of fish from aquaculture			
172	Sale of OAA			
173	Sale of rice			
174	Sale of other crops			
175	Sale of crops from riverbank			
176	Sale of livestock			
177	Business (profit)			
178	Employment (full-time)			
179	Employment (irregular/seasonal)			
180	Pensions			
181	Credit/loans			
182	Savings (in bank or not)			
183	Remittances (money sent by HH members)			
184	Interest			
185	Other_____			

186	Overall, how would you say you household income compares with five years ago?	Less	1
		Same	2
		A little more	3
		Much more	4
		DK	99

XIV. ASSETS

[Enum. READ] I would now like to ask you about the household assets. Please indicate the approximate value of asset, assuming you tried to sell it how much would you ask.

No.	**Asset** [READ list]	**Number** [Write number of assets]	**Total sale value** [Write value of all assets in national currency]	**Productive** [Tick]	**Non-Productive** [Tick]
187	TV				
188	Mobile phone included telephone				
189	Fridge				
190	Motorbike				
191	Car/truck				
192	Tractor				
193	Ox cart				
194	Boat with no engine				
195	Boat with engine				
196	Fish equipment				
197	Water tank				
198	Dug well				
199	Drill well:handpump				
200	Drill well:electric				
201	Irrigation equipment				
202	Rice mill				
203	Thresher				
204	Cattle/Buffalo/Goat				
205	Pigs				
206	Poultry				
207	Residential lands (m^2)				
208	Agriculatural lands including grazing lands (m^2)				

XV. WATER SUPPLY AND ROAD ACCESS

No.	Question	Response/Instruction	Code	Go To	Sup
209	What are sources of water for drinking and washing do you have?	Dug Well	1		
		Drilled well	2		
		Spring	3		
		River	4		
		Pipe	5		
		Other (including purchased)	6		
		DK	99		
210	Did your main household water supply run dry at all during the last dry season?	Yes	1		
		No	2	**q212**	
		Not dry, but not enough	3		
		DK	99	**q212**	
211	**[If yes or not dry but not enough]** For how many months in the year?	[Write number of months]			
212	How many kilometers is your home from a road?	[Write kilometers]			
213	Can a truck acess to your home during the rainy season?	Yes	1		
		No	2		
		DK	99		
214	Can a truck acess to your home during the dry season?	Yes	1		
		No	2		
		DK	99		

XVI. FLOODING

No.	Question	Response/Instruction	Code	Go To	Sup
215	How often damaging floods occurred in the last 5 years, compard to the last 10-15 years	The same	1		
		Less	2		
		More often	3		
		DK	99		
216	Has your household experienced damage from flooding in the last 5 years?	Yes	1		
		No	2	**q218**	
		DK	99	**q218**	
217	If yes, how many months did it take you to recover from the losses?	0-6 months	1		
		6 months-1 year	2		
		1-3 years	3		
		3-5 years	4		
		Still not recover	5		
218	Has your household experienced any flooding in the last 12 months?	Yes	1		
		No	2	**q238**	
		DK	99	**q238**	
219	If yes, was there any loss of assets?	Yes	1		
		No	2	**q238**	
		DK	99		
220	Loss of paddy lands	Hectares			
221		Percentage of total land area			
222		Percentage of usual production			
223	Loss of cows	Number			
224		Value			
225	Loss of buffalos	Number			
226		Value			
227	Loss of pigs and goats	Number			
228		Value			
229	Loss of chicken and ducks	Number			
230		Value			
231	Loss of other properties	Value			
232	Loss of working days:	Number of days			
233	Loss of life	Number of people			
234	Number of days of lack of access to safe drinking water.	Number of days			
235	Lack sanitation caused by floods	Number of days			
236	Injuries by floods	Number of people injured			

No.	Question	Response/Instruction	Code	Go To	Sup
237	Coping strategies, switching to:	Fishing	1		
		Farming	2		
		Hired labour in the village	3		
		Find job outside the village (eg. Towns/cities)	4		
		Making goods for sale	5		
		Selling of livelihoods assets (eg. Cattles, land, etc).	6		
		Turning to family, relatives, friends	7		
		Received assistance from the gorvenment	8		
		Received assistance from other organizations	9		
		Going into dept	10		
		Relying on NTFPs	11		
		Other: please specify_____	12		

XVII. DROUGHT

No.	Question	Response/Instruction	Code	Go To	Sup
238	How often drought occurred in the last 5 years, compared to the last 10-15 years	The same	1		
		Less	2		
		More often	3		
		DK	99		
239	Has your household experienced damage from drought in the last 5 years?	Yes	1		
		No	2	**q241**	
		DK	99		
240	If yes, how many months did it take you to recover from the losses?	[Write number of months]			
241	Has your household experienced any drought in the last 12 months?	Yes	1		
		No	2	**q254**	
		DK	99		
242	If yes, was there any loss of assets?	Yes	1		
		No	2		
		DK	99		
243	Loss of rice	Percentage of usual production			
244	Loss of cows	Number			
245		Value			
246	Loss of buffalos	Number			
247		Value			
248	Loss of pigs and goats	Number			
249		Value			
250	Loss of chicken and ducks	Number			
251		Value			
252	Loss of other properties	Value			

253	Coping strategies, switching to:	No change	0		
		Fishing	1		
		Farming	2		
		Hired labour in the village	3		
		Find job outside the village (eg. Towns/cities)	4		
		Making goods for sale	5		
		Selling of livelihoods assets (eg. Cattle, land, etc).	6		
		Turning to family, relatives, friends	7		
		Received assistance from the gorvenment	8		
		Received assistance from other organizations	9		
		Going into dept	10		
		Relying on NTFPs	11		
		Other: please specify_____	12		

XVIII. CLIMATE CHANGE

No.	Question	Response/Instruction	Code	Go To	Sup
254	Has your household experienced damage from other weather varibility (eg. Changing temperature, changing rainfall patterns, shorter but more intense rainy season) in the last 5 years?	Yes	1		
		No	2	**q256**	
		DK	99	**q256**	
255	If yes, how many months did it take you to recover from the losses?	[months]			
256	Has your household experienced in damage from other climate change events in the last 12 months?	Yes	1		
		No	2	**q269**	
		DK	99		
257	If yes, was there any loss of assets?	Yes	1		
		No	2	**q269**	
		DK	99		
258	Loss of rice	Percentage of usual production			
259	Loss of cows	Number			
260		Value			
261	Loss of buffalos	Number			
262		Value			
263	Loss of pigs and goats	Number			
264		Value			
265	Loss of chicken and ducks	Number			
266		Value			
267	Loss of other properties	Value			

268	Coping strategies, switching to:	No change	0		
		Fishing	1		
		Farming	2		
		Hired labour in the village	3		
		Find job outside the village (eg. Towns/cities)	4		
		Making goods for sale	5		
		Selling of livelihoods assets (eg. Cattles, land, etc).	6		
		Turning to family, relatives, friends	7		
		Received assistance from the gorvenment	8		
		Received assistance from other organizations	9		
		Going into dept	10		
		Other: please specify_____	11		

ADAPTATION

No.	Question	Response/Instruction	Code	Go To	Sup
269	Has your household changed season for growing rice?	Wet to dry	1		
		Dry to wet	2		
		Not applicable/no change	3		
		DK	99		
270	Has your household changed the timing of growing rice?	Planting earlier	1		
		Planting later	2		
		No change	3		
		DK	99		
271	Has your household changed any crop variety because of damaging flood? [**From one type to another, or one crop to another crop**]	Yes	1		
		No	2		
272	Has your househol changed any crop variety because of drought?	1. yes	1		
		2. no	2		

EARLY WARNING AND PREPAREDNESS

No.	Question	Response/Instruction	Code	Go To	Sup
273	Is there a way that your household can know if flood is coming?	Yes	1		
		No	2	**q275**	
274	If yes, how reliable it is? **1. not reliable** **2. reliable** **3. highly reliable** **4. don't know**	Radio	(_____)		
		SMS	(_____)		
		TV	(_____)		
		Radio speaker in the village or rural communities.	(_____)		
		Local knowledge	(_____)		
		Person-to-person	(_____)		
		Others, specify_____	(_____)		
275	To prevent impacts from flood or drought, what would your household do? [**preparedness/expectation**] [**Select three options only**]	Shelter and sanitation Food storage including drink Transportation and communication Support or intervention (including health, outside support) No preparation Don't know	1 2 3 4 5 99		

THANK YOU FOR TAKING THE TIME TO PARTAKE IN THE SURVEY

ANNEX 2:
List of sample villages/communes

1. Cambodia

No.	Sample village	Commune	District	Province	SIMVA Zone
1	Pong Tuek	Sdach Kong Khang Cheung	Banteay Meas	Kampot	
2	Phum Thom	Phum Thom	Kien Svay	Kandal	
3	Chey Otdam	Samraong Thom			
4	Anlong Slat	Leuk Daek	Koh Thom		
5	Kompong Thkol	Sampov Pun			
6	Trapeang Tuem	Pring Chrum	Cheung Prey	Kompong Cham	
7	Chrey Sokhom	Damrel	Ou Reang Ov		
8	Tnaot Kraom	Ruessey Srok	Srei Santhor		
9	Khtuoy Bei	Ou Mlu	Stung Trang		**Zone 4**
10	Chries Ti Pir	Thma Pechr	Tboung Khmum		
11	Kaeng Prasat	Sambour	Sambour	Kratie	
12	Bos Tnaot	Kork Kong Kaeut	Kanhchriech	Prey Veng	
13	Chamnat Trach	Thna Thnong	Rumduol	Svay Rieng	
14	Chambak	Pot Sar	Bati	Takeo	
15	Svay Chal	Char	Prey Kabbas		
16	Totueng Thngai	Cheang Tong	Tram Kak		
17	Poun	Tralach	Treang		
18	Khu Svay	Bos Sbov	Preah Netr Preah	Banteay Meanchey	
19	Phnom Lieb Kaeut	Phnom Lieb			
20	Nikom Krau	Chroy Sdau	Thma Koul	Battambang	
21	Ta Meakh	Kork Khmum			
22	Tuek Hout	Tuek Hout	Rolea B'ier	Kompong Chhnang	
23	Ku	Chong Doung	Baray	Kompong Thom	
24	Chieb	Chrolong			
25	Ngan	Ngan	Sandan		
26	Chambak Panhnha	Banteay Stoung	Stoung		**Zone 5**
27	Chamnak	Chamnar Kraom			
28	Ka	Chong Kal	Chong Kal	Oddar Meanchey	
29	Khnach Romeas	Boeng Khnar	Bakan	Pursat	
30	Ou Bat	Ou Ta Paong			
31	Thnuoh Ta Chab	Snam Preah			
32	Ta Trav	Svay Chek	Angkor Thom	Siem Reap	
33	Bos Kor	Kork Thlok Kraom	Chi Kraeng		
34	Ou Ta Prak	Puok	Puok		

2. Lao PDR

No	Sample village	District	Province	SIMVA Zone
1	Houailum	Nga	Oudomxay	
2	Houaio			
3	Tong	Pakpeng		
4	Houayka			
5	Nangam	Hoyaxai	Bokeo	
6	Nangam	Meung		
7	Houaibong	Phaoudom		
8	Pangsa	Paktha		
9	Nongkhouay	Xienggnern	Luang Prabang	**Zone 2**
10	Fayyouak	Nan		
11	Kiad	Pakou		
12	Houaykhanh	Chomphet		
13	Nasam	Xayyabouly	Xayaboury	
14	Ponnvane	Paklaiy		
15	Tountan	Bortaen		
16	Donephoung	Sanakham	Vientiane	
17	Naoudomtai	Maed		
18	Nahouaphou	Paksan	Bolikhamxay	
19	Phonxay			
20	Houaihay	Pakkading		
21	Tanh	Thakhaek	Khammouan	
22	Phonphang	Nongbok		
23	Donekhiawtai			
24	Beungvanuea	Kaiyson phomvihan	Savannakhet	
25	Nonesomboun	Songkhon		
26	Miyiem			
27	Mueangfong	Xonbouly		
28	Beungkham	Saravan	Saravanh	
29	Kaengtavang	Khongsedon		
30	Phalai	Bajieng jalernsouk	Champasack	
31	Sisiengmay			
32	Sichantho	Pathoumphone		
33	Houaykang	Champasak		
34	Houaythed	Moonlapamork		

3. Thailand

No.	Sample village	Commune	District	Province	SIMVA Zone
1	Ban Sri Donchai	Si Donchai	Chiang Khong	Chiang Rai	Zone 2
2	Ban Tha Khanthong	Ban Saew	Chiang Saen		
3	Ban Pong Khongneua	Mae Ngern			
4	Ban Thung Sai	Laai Ngao	Vieng Kaen		
5	Ban Praokud (Sri Lanna)	Si Donchai	Chiang Khong		
6	Ban Chiangkhan	Chiangkhan	Chiangkhan	Loei	
7	Ban Chiangkhan				
8	Ban Tha Dee-Mee	Pak Tom			
9	Ban Pha-Mum	Had Sai Khao			
10	Ban Non Somboon	Pakchom	Pakchom		
11	Ban Chol-Prathan	Tha-Li	Tha-Li		
12	Ban Vieng Kaew	Vieng Khok	Muang-Nongkhai	Nongkhai	
13	Ban Hua Haad Tai	Ban Duea			
14	Ban Duea	Jumpol	Phone Pisai		
15	Ban Dan Muang	Wat Luang			
16	Ban Kudbongmai	Kud Bong			
17	Ban Wern Don	Pak Kaad	Pak Kaad		
18	Ban Ta Mui	Huai Phai	Khong Jiem	Ubon Ratchathani	Zone 3
19	Ban Na Muang	Na Waeng	Khem-raj		
20	Ban Pak Ka-Lang	Song Khon	Phosai		
21	Ban Hin Khan	Khok San	Chanuman	Amnat Charoen	
22	Ban Tha Klai	Beung-gan	Beung-gan	Nongkhai	
23	Ban Sok Phok	Beung Khong Long	Beung Khong Long		
24	Ban Bung Kla Thung	Bung Kla	Bung Kla		
25	Ban Charoenchai	Ratanavapi	Ging-Amphoe Ratanavapi		
26	Ban Naad	Ban Klang	Muang-Nakhon Phanom	Nakhon Phanom	
27	Ban Taan	Chaiburi	Tha U-then		
28	Ban Pak Thuay	Wern Prabat			
29	Ban Na Thon Tha	Na Thon	That-panom		
30	Ban Nam Gam Tai	Nam Gam			
31	Ban Tha Klai	Na Si-Nuan	Muang-Mukdahan	Mukdahan	
32	Ban Nonglom	Pho Sai	Don Tan		
33	Ban Na Wan Yai	Wan Yai	Wan Yai		
34	Ban Cha Nod Tai	Cha Nod			

4. Viet Nam

No.	Commune Name	District name	Province Name	SIMVA Zone
1	X. Long Hung B	Lap Vo	Dong Thap	6 Fresh Water
2	X. Thuong Thoi Tien	Hong Ngu		
3	X. Phong Hoa	Lai Vung		
4	X. Tan Ninh	Tan Thanh	Long An	
5	X. Chau Phong	Tan Chau	An Giang	
6	X. Vinh Phu	Thoai Son		
7	X. Dinh Thanh			
8	X. Vinh Trung	Tinh Bien		
9	X. Phu Thanh	Phu Tan		
10	X. Thien Tri	Cai Be	Tien Giang	
11	X. Hoa Khanh			
12	X. Binh Nghi	Go Cong Dong		
13	X. My Phuoc	Mang Thit	Vinh Long	
14	X. Trung Nghia	Vung Liem		
15	X. Dong Thanh	Chau Thanh	Hau Giang	
16	X. Thoi Thuan	Thot Not	Can Tho City	
17	X. Vinh Hoa Hung	Go Quao	Kien Giang	
18	X. Long Vinh	Duyen Hai	Tra Vinh	6 Saline Water
19	X. Long Toan			
20	X. Don Xuan	Tra Cu		
21	X. Bao Thanh	Ba Tri	Ben Tre	
22	X. Binh Hoa	Giong Trom		
23	X. Luong Hoa			
24	X. Tan Loi Thanh			
25	X. Huong My	Mo Cay		
26	X. Vinh Binh	Hoa Binh	Bac Lieu	
27	X. Phong Thanh A	Gia Rai		
28	X. Vinh Hung A	Vinh Loi		
29	X. Song Phung	Long Phu	Soc Trang	
30	X. Nam Thai	An Bien	Kien Giang	
31	X. Phu My	Kien Luong		
32	X. Vinh Thanh	Giong Rieng		
33	X. Son Kien	Hon Dat		
34	X. Hoa Chanh	U Minh Thuong		