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ROLES AND VALUES OF FISH IN RURAL WELFARE IN CAMBODIA

(WELFARE DATA ANALYSIS)

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(WELFARE DATA ANALYSIS)

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with inputs from

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July 2016

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Eric Mousset organized data, performed the data and statistical analyses, and wrote the report;
Victoria Rogers cross-checked data and amended the report;
Saray Samadee and Ouch Kithya contributed to illustrations and graphs;
Srey Sinath and Mith Samonn checked raw results and provided inputs;
Eric Baran initiated and supervised the study, commented results and provided inputs.

Key words

Rural livelihoods – economic valuation – wealth – nutrition – health - occupation – resilience – gender – Tonle Sap – Lowlands - Mekong

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EXECUTIVE SUMMARY

This report examines the contributions of fisheries to welfare in diversified farming systems in Cambodia based on indicators for wealth, nutrition, labor, resilience and health, with a focus on wealth in terms of income, assets and debt. The report identifies connections and convergences between the welfare indicators as well as gaps and issues for further research. It is based on Cambodian Agricultural Research and Development Institute surveys over three years. These large-scale surveys targeted households with very high, high, medium or low dependence on fishing. The 747 households in 37 villages were located in three main agro-ecological zones – the Tonle Sap, the Lowlands and the Upper Mekong. Survey results are representative of the situation of about 3.7 million of the country's inhabitants.

On average, the households caught 216 kg of fish worth USD 333 per year, earning annual net income of USD 170 by selling 57% of their catch. Tonle Sap households earned the highest income of USD 269 compared with USD 179 in Upper Mekong households and USD 75 in Lowland households. Asset-insufficient households performed best in terms of commercial value of fish yield, net income and profitability. On average, those with very high fishing dependency generated the highest annual fish yields of 500 kg and the highest net income from fish sales of USD 444. The performance of capture fishery value chains, fish yield and net income were generally higher in male-headed households and highest for male-headed and male-prevalent households. On average, 75% of fish processed was used for household consumption. Profitability of fish processing was highest in very high fish dependency areas of the Tonle Sap zone where average household net income from fish processing was USD 63 per year. This finding may prove particularly relevant to any further policy effort focusing on post-harvest activities. Fewer than 5% of households in the three zones engaged in aquaculture and average net income from fish farming was modest at USD 15 per year.

Household average net income from crop farming amounted to USD 471 per year. Rice, vegetables, fruit and cassava represented 96% of crop income with rice farming alone accounting for nearly 50%. On average, livestock value chains generated household net income of USD 130 and 70% profit margins — a weaker performance than capture fishery value chains in both respects. Average net income from floodplain natural resources was USD 11.70. Households incurred an average loss of USD 8.50 from terrestrial natural resources, possibly due to underreporting income from timber. Average net income from salaries, wages and business amounted to USD 1,970 per year, of which 99% was not related to fisheries.

On average, household assets were valued at USD 10 357 for land, USD 80 for fishing gear and USD 64.50 for aquaculture assets. Other asset valuations include USD 308 for farming equipment, USD 179 for crops in storage, USD 568 for livestock, USD 39 for livestock infrastructure, USD 12 for equipment used to collect terrestrial natural resources, USD 316 for business assets and USD 318 for cash deposits and loans to others. Household debt averaged USD 465 with an average *monthly* interest rate of 2.1%.

Fishing, processing and marketing value chain for capture fisheries featured a fair labor efficiency ratio of USD 139 in terms of full involvement equivalent (FIE) per year, requiring only a modest labor input from households. Aquaculture value chains featured the third highest labor efficiency ratio compared with other activities. While poultry farming seemed to mobilize higher labor input from households, rice farming featured a stronger labor efficiency ratio. Labor input for collecting terrestrial natural resources was primarily directed to household use at USD 0.95 FIE per year and marginally to sales at USD 0.10 FIE per year.

Fish was the most widely consumed source of animal protein, with an average household consumption of 3.6 kg per household each week, or 97 grams per person each day. Fish is twice more abundant in the diet of people surveyed than pork, chicken, and beef altogether (15.7 kg/person/yr. for these three items).

Forty-six percent of households reported having children who show malnutrition symptoms, and only 19% could access safe drinking water year round. Ninety-eight percent of households could afford to take a member to a health center or hospital but 46% could not afford medical expenses of more than USD 100. A vast majority of households reported having access to a health center or hospital and to medicines other than paracetamol or aspirin.

Households in the Lowlands had the highest annual incomes (USD 4 278) followed by those around the Tonle Sap (USD 3 694) and Upper Mekong households (USD 2 682). Businesses and jobs were the primary income sources, representing 50% to 63% of net income in all three zones. Significant incomes were derived from capture fisheries, livestock and rice farming with prevalence towards fisheries around the Tonle Sap, rice in the Lowlands and livestock in the Upper Mekong. In all three zones, households had comparable asset values. But debt in Upper Mekong households (USD 200) was significantly lower than in Tonle Sap households (USD 372) and households in the Lowlands (USD°636). The main reasons for incurring debt were agriculture and other business activities, excluding those related to fishing and agriculture. In the face of adversity, spending cash savings was the most popular option in all three zones.

Survey results suggested that households regarded consumption of meat as elastic but rice and fish as more inelastic. Poultry farming dominated labor allocation in each zone followed by a diverse range of activities. Household food intake was led by rice followed by fish. Rice was consumed on a daily basis in all three zones while fish and fish-derived products were the most frequent source of protein. Food insecurity remained a risk feared by most households in all zones, although repercussions and mitigation strategies varied. To mitigate risk, for example, 37% of Tonle Sap households and 36% of Lowland households chose fishing whereas this proportion was only 10% in Upper Mekong households. A vast majority of households, possibly all, never suffered from food deprivation for 24 consecutive hours. But a fair proportion did report food deprivation to some degree over the previous four weeks. Fifty-seven percent of Tonle Sap households, 55%, of Lowland households and 42% of Upper Mekong households reported severe dietary constraints. Between 9% and 37% of all households had children showing symptoms of malnutrition and 75% to 85% did not have year-round access to safe drinking water. In terms of malaria prevention, 92% to 99% of households in all three zones reported owning mosquito nets.

Twenty-two percent of adults (18 years and above) reported being involved in fishing activities, as did 17% of young people aged from 12 to 17 years. Thirty-six per cent of men are involved in fishing, compared to only 8.4% of women. Fish processing engaged 39% of adults and 20% of young people from ages 12 to 17 with women being more involved in these activities (56.2% of women involved vs. 20.1% of men). Fish marketing involved 11.3% of adults (in that age group, 16.5% of women market fish). Adults, teenagers and younger children had fair levels of involvement in floodplain resource activities with 17% of adults and 8% of teenagers engaged in processing such resources, the vast majority being female. But in marketing these resources, only 4.5 percent of adults were involved. Horticulture and orchards involved about a quarter of the adults and a fifth of the teenagers. On average, tending cattle engaged 36.0% of adults, 28.5% of teenagers and 7.8% of younger children. On average about 50% of adults, 40% of teenagers and 12% of younger children engaged in poultry farming. About 40% of adults and 28% of teenagers collected terrestrial natural resources for household use.

Across all economic activities, income tended to be more influenced by the gender of the household head rather than household gender prevalence, with male-headed households earning higher net incomes than female-headed households. The numbers and values of fishing gear owned, time spent fishing and quantity of fish caught were higher in the case of male-headed households in general, and especially so in male-prevalent households. Females were more involved than males in fish processing. The quantities of floodplain natural resources collected and sold were slightly higher in male-headed households. Those having children with malnutrition symptoms were found in comparable proportions across gender groups, the situation appearing to be slightly more favorable for female-headed or female-prevalent households. Education levels, defined as the average number of years of education per household member, showed little variation across gender. Absence was significantly higher in male-prevalent and female-headed households, with about 2.7 months of absence per year. Absence was about half as long in other households. Coping strategies to address unexpected shocks reflected mild variations, with gender-balanced and female-headed households appearing to adopt more discerning strategies than other gender-based groups.

Capture fisheries mostly engaged income-insufficient households followed by the asset insufficient, the financially vulnerable and the financially sound. Those with insufficient income were also more engaged in businesses and jobs than asset-insufficient and financially vulnerable households. Net income in male-headed and financially sound households was significantly higher than in female-headed and asset-insufficient households. Among the financially sound, households headed by males tended to possess assets of higher value compared with those headed by females. Debt was generally higher for the financially sound, and lower for those with insufficient income. The financially vulnerable seemed more likely to have children with malnutrition symptoms than other households. Income-insufficient households consumed more rice than other households and were also more frequent consumers of floodplain resources such as snails, shellfish, crabs and snakes compared with other meats such as wild mammals or birds.

1 INTRODUCTION

1.1 OBJECTIVES OF STUDY

With the support of the Australian Centre for International Agricultural Research (ACIAR), the WorldFish Center launched the project Assessing Economic and Welfare Values of Fish in the Lower Mekong Basin in 2012. The overall objective was to quantify the contribution of fishing-related resources and activities to household welfare, and to convey the results to national decision-makers and development agencies for policy formulation in the field of sustainable rural development. The results are summarized in this document.

The specific objectives were to (i) assess the economic value of capture fisheries in Cambodia, concentrating on the Tonle Sap, Lowland, and Upper Mekong agro-ecosystems (ii) assess the welfare value of fish for rural populations in Cambodia and identify strategies that maximize this value (iii) establish a coordinated monitoring of fish resources through a network of universities (iv) improve national statistics about fisheries resources and (v) inform a large range of stakeholders about the actual role of fisheries in the national economy and livelihoods. In support of the second objective, WorldFish carried out three rounds of a large-scale welfare survey in 2012, 2013 and 2014 with the technical assistance of the Cambodian Agricultural Research and Development Institute (CARDI).

1.2 SEGMENTATION AND SCOPE OF STUDY

The survey targeted 37 villages, potentially representing 3.7 million inhabitants. The population studied was segmented as follows.

Agro-ecosystems — The survey concentrated on three agro-ecological zones, namely the Tonle Sap, Lowlands and the Upper Mekong. These were defined as strata for the survey design.

Fish dependency groups — A fish-dependency indicator was compiled from a combination of indicators and variables from three separate datasets (the National Census of 2008, the Commune Database of 2010 and the Ministry of Planning Village Poverty Score of 2006) by integrating the following information: (i) total number of persons whose primary occupation is fishing (ii) total number of persons whose secondary occupation is fishing (iii) number of families with row boats used for fishing and (iv) number of families with motor boats used for fishing (see detailed description in Nasielski *et al.*, 2013)[1]. In turn, the fish-dependency indicator was used to segment the population into five strata labeled as very high, high, medium, low and no dependency on fishing activities. With the no dependency stratum suffering from under-sampling, further data analysis concentrated on a subsample of 655 households in areas with very high, high, medium and low dependency on fishing.

[1] Nasielski J., Tress J., Baran E. 2013. Fishing dependency in Cambodia - mapping and methodology report. Report for the project “Assessing economic and welfare values of fish in the Lower Mekong Basin”. WorldFish, Phnom Penh, Cambodia. 16 pp.

Gender prevalence groups — The survey sample was segmented into three gender-prevalence groups labeled and defined as follows:

- Male-prevalent households — where 60% or more household members are male;
- Female-prevalent households — where 60% or more household members are female; and
- Gender-balanced households otherwise.

Those three groups were further combined with household head gender, labeled as male-headed or female-headed households.

Wealth quadrants — The survey sample was also segmented into four quadrants reflecting household net income using USD 1 per day as a threshold and household net assets using a value of USD 5 000. The four quadrants are presented below.

Table 1. Wealth quadrants

	Net income per capita per day equals or exceeds USD°1:	**Net income per capita per day is less than USD°1:**
Net asset value equals or exceeds USD 5 000:	Financially sound	Income-insufficient
Net asset value is less than USD 5 000:	Asset-insufficient	Financially vulnerable

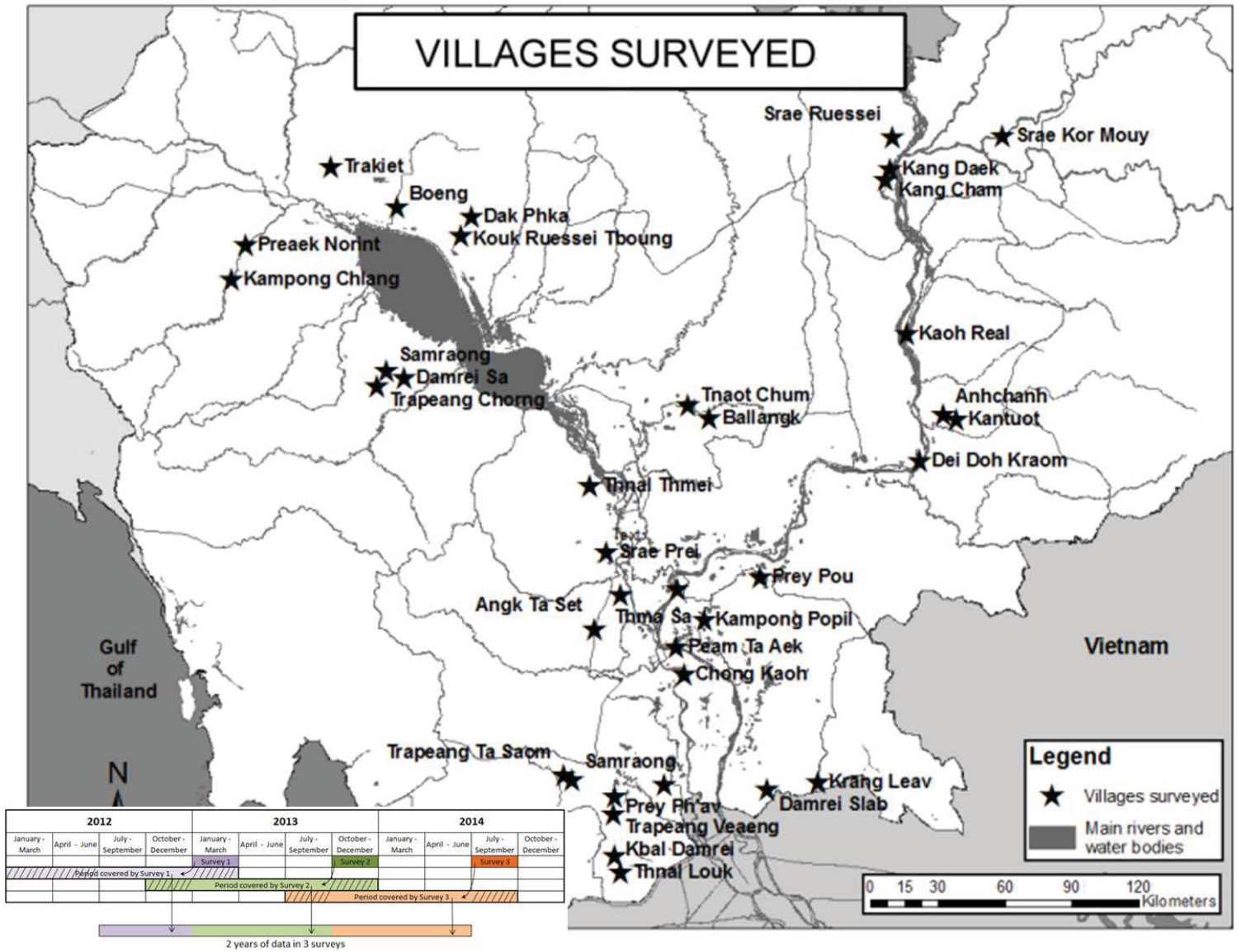
Survey period — Survey data have been collected over calendar 2012, 2013 and 2014. Original survey data have been further processed to perform a temporal integration and compile results on a yearly basis (or a monthly basis in the case of seasonal consumption of fish). In total, 747 households were repeatedly surveyed during three rounds of fieldwork countrywide:

Survey 1: January to March 2013, covering 2012 to improve quality of data based on recollection by interviewees (only July to September 2012 data were kept for analysis);

Survey 2: October to December 2013, covering 2013 (only January to September 2013 data were kept for analysis);

Survey 3: July to September 2014 (only October 2013 to June 2014 data were kept for analysis).

In total, 2 241 questionnaires were generated. The location of villages and the timing of surveys are detailed in the location map below.



Location map: Identification of the villages surveyed and timing of the surveys

1.3 HOUSEHOLD WELFARE PROFILE

From the original 265 questions of the survey, five summary indicators were built to represent a household welfare profile: wealth, nutrition, resilience, labor and health[2] as depicted below. The mean estimate for household size is 5.3 persons.

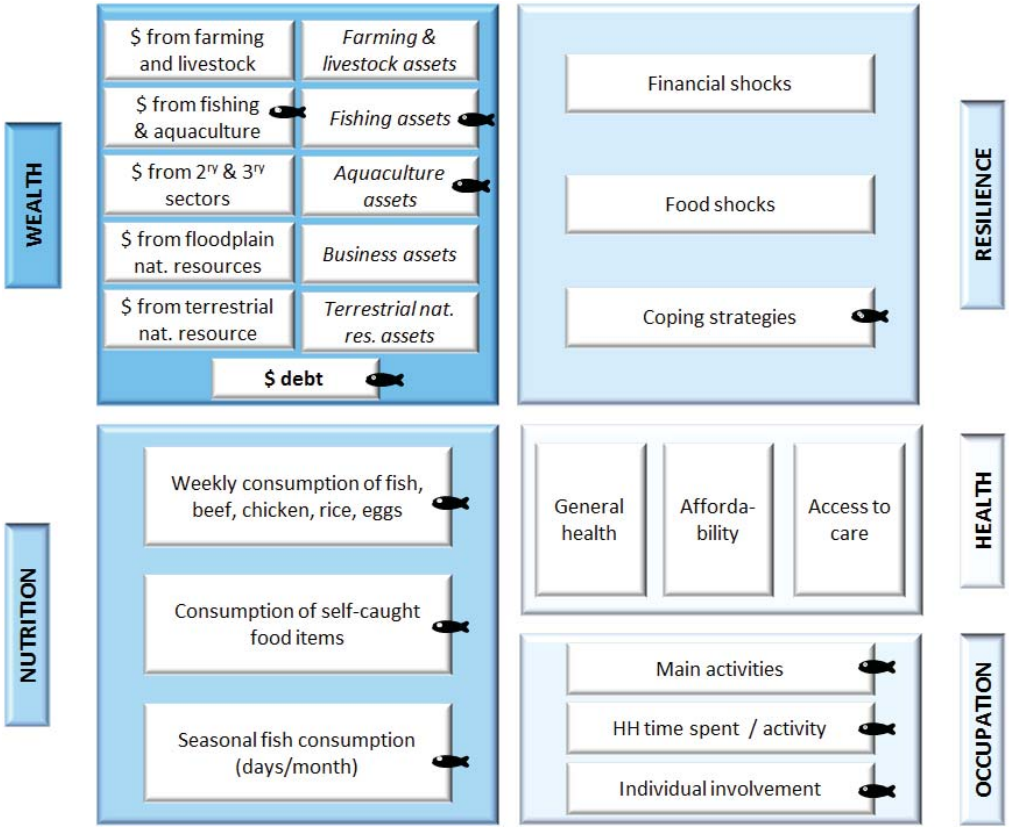


Figure 1. Welfare indicators

The main body of this report concentrates on a detailed presentation and analysis of these indicators[3] on a stand-alone basis and in relation to one another. The report details:

i) household wealth, encompassing (a) household net income from fish capture, fish processing, aquaculture, farming and livestock, floodplain natural resources, terrestrial natural resources, land rental and natural environment-independent activities (b) household assets and capital as fishing equipment, aquaculture systems, crops in storage, livestock inventory, farming equipment, farming infrastructure, equipment for collecting floodplain and terrestrial natural resources, house assets, and assets related to natural environment-independent activities and (c) household debt.

[2] A general outline of the structure of the household surveys is detailed in "Welfare Survey Database Survey Manual, I- Data Analysis Framework" (March 2013).

[3] See comprehensive book of questions: "Welfare Data Analysis II. Research Questions" (April 2014)

ii) household weekly food consumption and seasonal consumption of fish;

iii) household labor involvement in fishery activities, aquaculture activities, farming and livestock activities, floodplain natural resource collection, terrestrial natural resource collection and natural environment-independent activities;

iv) household resilience in welfare, including types of shocks incurred and coping strategies; and

v) household health, affordability and accessibility of health services.

1.4 STATISTICAL ANALYSIS AND SIGNIFICANCE OF RESULTS

The present study is the first of its kind to compile statistics on a range of welfare-related variables in Cambodia, with a focus on the specific segment of population living in fishing-dependent zones. The determination of an adequate sampling scheme during the initial survey design phase was performed on a blind basis (in the absence of knowledge of variance for most variables under study). As a result, most mean estimates suffer from broad confidence intervals while generalized to the target population of 3.7 million. While comparing mean estimates between independent groups, confidence intervals often overlap with one another.

Mean estimates and confidence intervals were derived from the SPSS software's Complex Sample module, where the computation of statistical parameter estimates is based on the Taylor series linearization. This consists of an algorithmic iterative process to better integrate the study's complex sampling design. This process explains why the reported overall averages may vary from any weighted average calculations of the three agro-ecological regions.

Throughout this report, whenever 95% confidence intervals of mean estimates between independent groups do not overlap, or whenever T-Tests with $\alpha = 0.05$ significance level reject the null hypothesis of equality between means under comparison, the following abbreviation is affixed: $\alpha = 0.05$ significance.

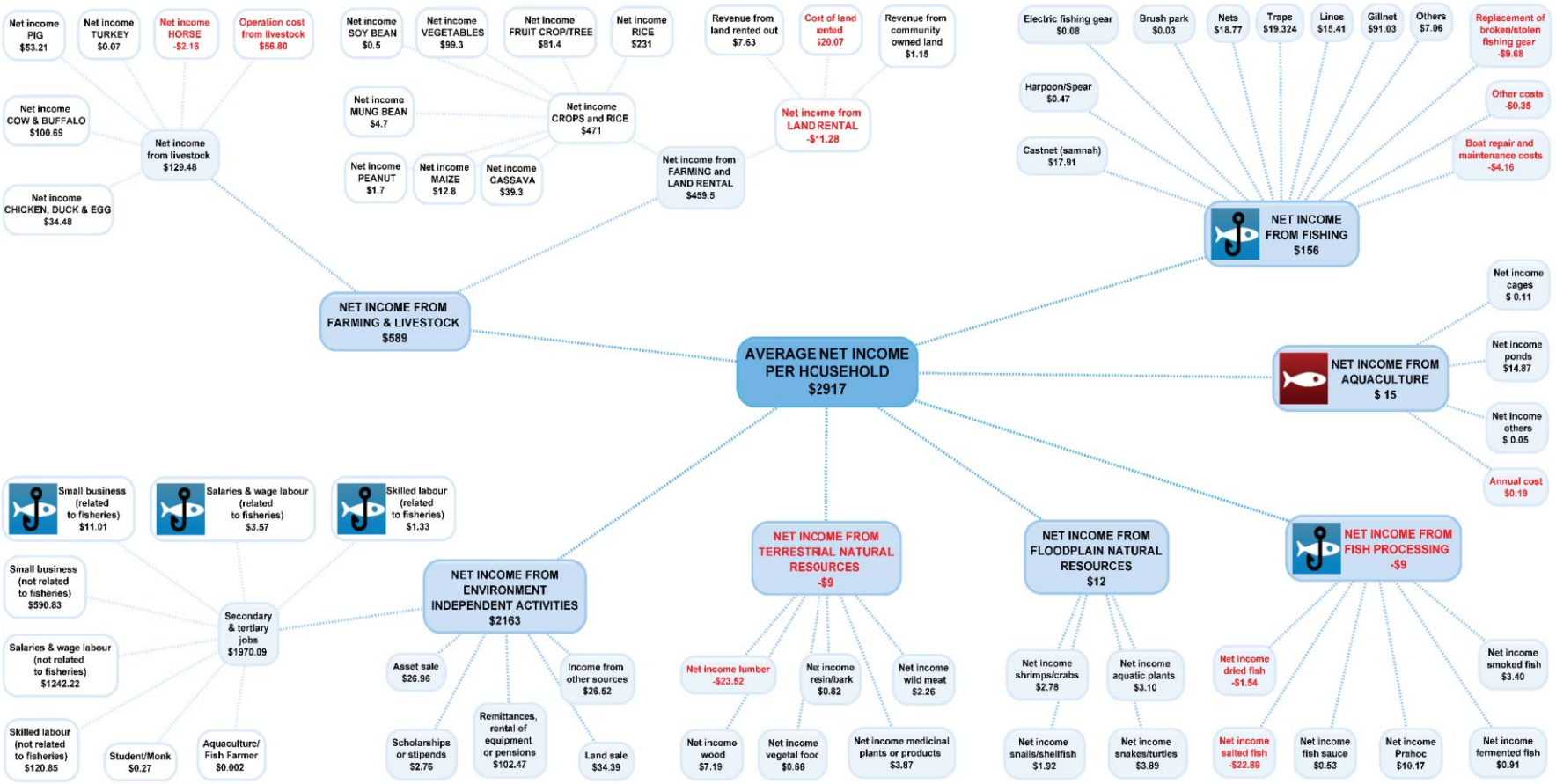


Figure 2. Overview of annual net income sources in an average household of the study area

2 WEALTH IN WELFARE — *NET INCOME*

2.1 NET VALUE AND NET INCOME REALIZED BY CAPTURE FISHERIES

The average annual household income amounts to USD 2 917/year. On average, households catch 216 kg of fish worth USD 333[4] per year, and earn annual net income of USD 155.90[5] by selling 124 kg or 57% of fish caught. Fifty kilograms (23%) is consumed unprocessed, 36 kg (17%) is processed and 7 kg (3%) is bartered or given away. The average annual value of USD 333 is based on respondents' own evaluations.[6] In terms of fishing gear, small gillnets (*morng*) of one finger (less than 2.5 cm), two fingers (3-4 cm) and three fingers (5-7 cm) mesh size along with castnets (*samnah*) and seine/drag nets (*uorn/neam/anhchourn*) represent 67% of annual fish catch and 60% of annual net income per household. Details about the contribution of fishing gear in the capture fishery value chain may be found in Appendix 1.

The performance of capture fishery value chains varies across zones, with Tonle Sap households showing the highest net income and profitability compared with Upper Mekong and Lowland households. Upper Mekong households catch the highest quantity of fish at 342 kg/yr with a potential commercial value of USD°571. But only 125 kg (37%) are destined for sale and 123 kg (36%) are retained for household consumption. Although Tonle Sap households catch a lower quantity of fish at 263 kg/yr representing a potential commercial value of USD 400, they destine 189 kg of the catch to commercialization (72% which is twice as much as Upper Mekong households) and retain only 41 kg (16%) for their own consumption. Lowland households capture a more modest 132 kg/yr representing a potential commercial value of USD 195 and use 62 kg for commercial use — see Figure 3 below. As a result, average annual net income derived from sales of unprocessed fish is highest in Tonle Sap households at USD 269 followed by Upper Mekong households at USD 179 and Lowland households at USD 75 — see Table 2 below. Noticeable differences are also observed in value chain profitability where Tonle Sap households have a 92% gross margin ratio[7], outperforming Lowland households with 84% and Upper Mekong households with 80% — the difference between Tonle Sap and Lowland gross margin ratios being statistically significant [α = 0.05 significance].

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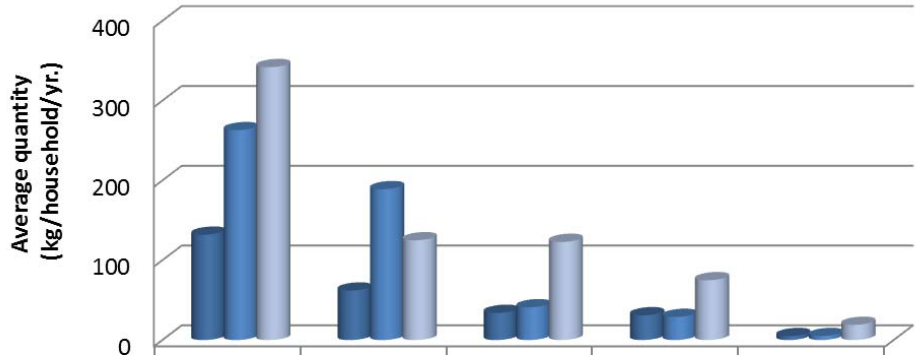
[4] USD 1 = KHR 3,964 is the currency exchange rate used throughout this study and final report.

[5] Together, net income from fisheries-related business and skilled/salaried labor, contributes an additional USD 14.40 to a household's overall net income. For the purpose of this report, net income from fisheries is specified as either the net income generated by fishing or that of fish processing activities.

[6] The following abbreviation is used throughout this report: "/household/yr." for "per household per year".

[7] Throughout this report, the *gross margin ratio* is defined as the ratio of net income to gross sales.



	Qty fish caught	Qty fish sold	Qty fish consumed	Qty fish processed	Qty fish bartered
Lowland	132	62	34	31	5
Tonle Sap	263	189	41	29	5
Upper Mekong	342	125	123	75	19

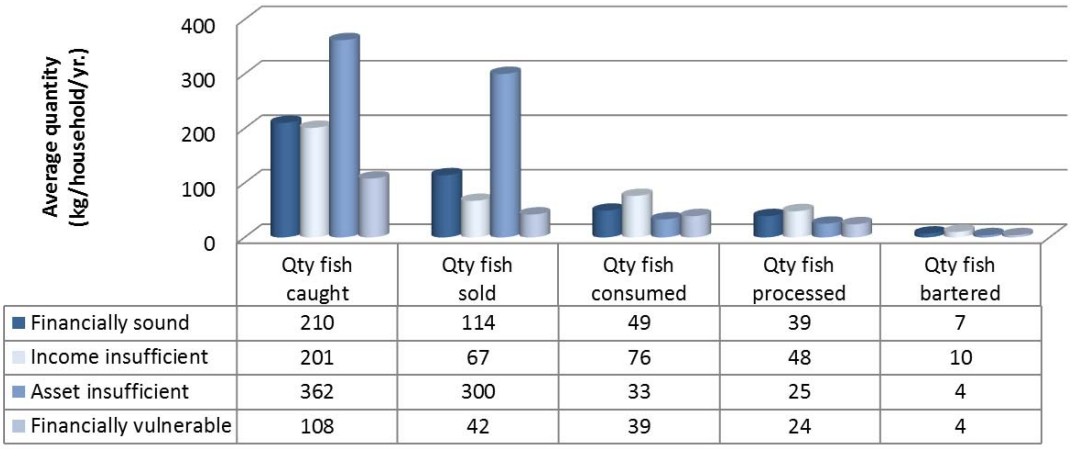
Figure 3. Purpose of fish in capture fishery value chain, by agro-ecological zone

Table 2. Performance of capture fishery value chains across agro-ecological zones

	Average value of fish captured USD/household/yr.	Gross sales from capture fishery USD/household/yr.	Net income from fish sold (unprocessed) USD/household/yr.	Gross margin ratio of capture fishery (household average)
Lowland	195	89	75	84%
Tonle Sap	400	291	269	92%
Upper Mekong	571	225	179	80%

Significant differences in value chain performance are observed in household comparisons based on wealth with asset-insufficient households achieving the highest in terms of commercial value of fish yield, net income and profitability ratio. On average, asset-insufficient households[8] catch 362 kg per year with the highest commercial potential of USD 562 and the highest quantity of sales of 300 kg. Most interestingly, asset-insufficient households have the highest profitability ratio of 96% — significantly higher than financially vulnerable households with 85%, financially sound households with 85% and income-insufficient households with 81% [α = 0.05 significance]. Financially vulnerable households have the weakest annual fish yield of 108 kg, representing the lowest commercial value of USD 170 and selling the lowest quantity of fish of 42 kg from which they derive the lowest net income of USD 56 per year.

[8] An explanation on the segmentation of the household population into wealth quadrants may be found in Section 1.2 "Segmentation and scope of study"



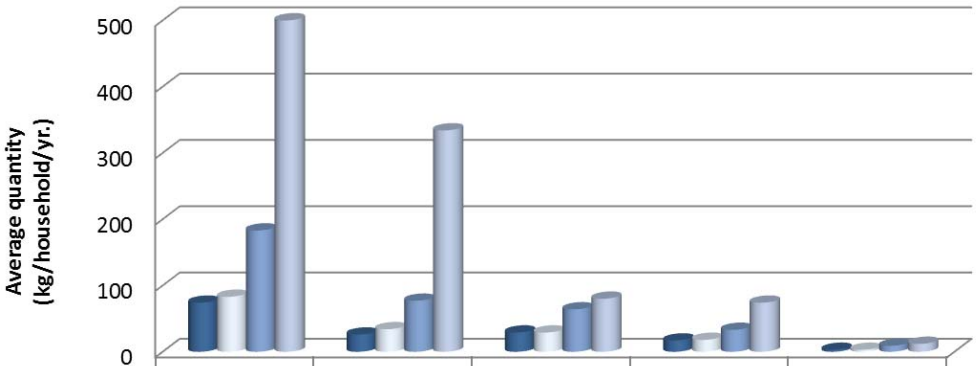
	Qty fish caught	Qty fish sold	Qty fish consumed	Qty fish processed	Qty fish bartered
Financially sound	210	114	49	39	7
Income insufficient	201	67	76	48	10
Asset insufficient	362	300	33	25	4
Financially vulnerable	108	42	39	24	4

Figure 4. Purpose of fish in capture fishery value chain, across wealth quadrants

Table 3. Performance of capture fishery value chains across wealth quadrants

	Average value of fish captured USD/household/yr.	Gross sales from capture fishery USD/household/yr.	Net income from fish sold (unprocessed) USD/household/yr.	Gross margin ratio ofcapture fishery (household average)
Financially sound	316	171	145	85%
Income insufficient	329	119	97	81%
Asset insufficient	562	470	450	96%
Financially vulnerable	170	66	56	85%

Among the four fishing-dependency groups, households of very high dependency have the highest annual fish yield of 500 kg with the highest commercial value of USD 744 per year. They also have the highest share of fish yield to sales of 334 kg per year — significantly higher than households in both low and medium fish-dependency areas [α = 0.05 significance]. Households with very high dependency also derive the highest net income from selling fish with USD 444 per year on average. In all aforementioned respects, households with high dependency come second followed by those with medium and low dependency. The profitability ratio is highest in low-dependency households at 95% followed by very high dependency at 89%, high dependency at 87% and medium dependency at 76% — the difference between both extremes being statistically significant [α = 0.05 significance].



	Qty fish caught	Qty fish sold	Qty fish consumed	Qty fish processed	Qty fish bartered
Low dependency	74	26	29	17	3
Medium dependency	83	34	29	18	3
High dependency	183	77	64	33	9
Very high dependency	500	334	80	74	12

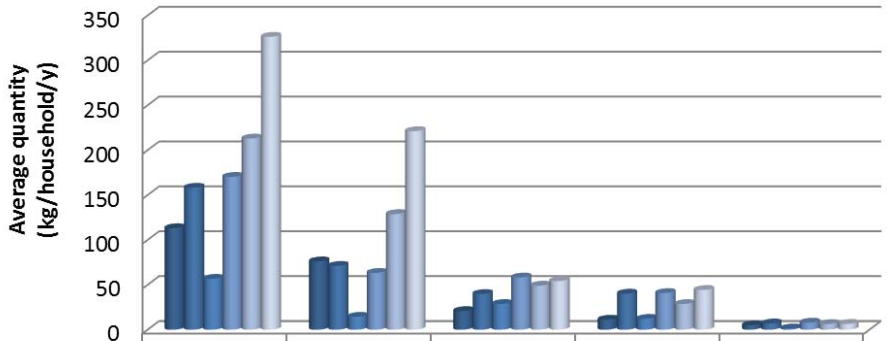
Figure 5. Purpose of fish in capture fishery value chain, across fishing-dependency groups

Table 4. Performance of capture fishery value chains across fishing-dependency groups

	Average value of fish captured USD/household/yr.	Gross sales from capture fishery USD/household/yr.	Net income from fish sold (unprocessed) USD/household/yr.	Gross margin ratio of capture fishery (household average)
Low dependency	127	50	47	95%
Medium dependency	142	63	48	76%
High dependency	284	121	105	87%
Very high dependency	744	498	444	89%

Household gender influences the performance of value chains, with annual fish yield and net income being generally higher in male-headed households and highest in male-headed & male-prevalent households. Male-headed & male-prevalent[9] households catch the highest quantity of fish at 326 kg per year with the highest commercial value of USD 540. They also sell the highest quantity of 221 kg and have the highest net income of USD 345 on average — see Figure 6 and Table 5. They also have the highest profit margin ratio of 92% on average. In contrast, female-headed & male-prevalent households catch the smallest amount of fish at 57 kg per year corresponding to a commercial value of USD 90. They also destine the smallest share of fish yield to sales with only 14 kg per year from which they derive the lowest net income of USD 14 on average. Further insights on the influence of gender on household welfare may be gained from Section 10.

[9] Details on gender-based segmentation and labels may be found in Section 1.2. “Segmentation and scope of study”.



	Qty fish caught	Qty fish sold	Qty fish consumed	Qty fish processed	Qty fish bartered
Female-headed & gender-balanced	113	76	21	11	5
Female-headed & female-prevalent	158	71	40	40	7
Female-headed & male-prevalent	57	14	29	12	1
Male-headed & gender-balanced	170	63	58	41	8
Male-headed & female-prevalent	213	129	49	29	6
Male-headed & male-prevalent	326	221	54	44	6

Figure 6. Purpose of fish in capture fishery value chain, by gender group

Table 5. Performance of capture fishery value chains across gender groups

	Average value of fish captured USD/household/yr.	Gross sales from capture fishery USD/household/yr.	Net income from fish sold (unprocessed) USD/household/yr.	Gross margin ratio of capture fishery (household average)
Female-Headed & Gender-Balanced	179	119	90	75%
Female-Headed & Female-Prevalent	235	105	96	92%
Female-Headed & Male-Prevalent	90	26	20	78%
Male-Headed & Gender-Balanced	248	86	73	85%
Male-Headed & Female-Prevalent	306	180	150	84%
Male-Headed & Male-Prevalent	540	375	345	92%

2.2 NET INCOME FROM FISH PROCESSING

On average, three quarters of fish processed are for household consumption. Profitability of fish processing appears to vary significantly across fishing-dependency levels. Highest profits are made in very high dependency areas of the Tonle Sap zone (with average net income from fish processing of USD 63 per year) whereas households incur a loss of USD 9.40 across the entire survey. Of the average production of 9.9 kg per year, 76% of the fish processed is for household consumption, 17% is sold and 7% bartered. Prahoc (regular and semi-final) represents 51% of total production. On average, households derive annual net incomes of USD 10.20 from commercializing prahoc (regular and semi-final), USD 3.40 from smoked fish, USD 0.90 from fermented fish and USD 0.50 from fish sauce. They incur annual losses of USD 1.50 on dried fish and USD 22.90 on salted fish. See detailed results below.

Table 6. Fish processing — average production and net income per household

	Quantity processed (kg/ household /yr.)	Quantity consumed (kg/ household / yr.)	Quantity bartered (kg/ household / yr.)	Quantity sold (kg/ household / yr.)	Income (USD/ household / yr.)	Cost (USD/ household / yr.)	Net income (USD/ household / yr.)
Prahoc (regular and semi-final)	18.9	11.9	1.6	5.1	15.8	5.7	10.2
Smoked fish	2.7	1.5	0.2	0.9	4.2	0.8	3.4
Fermented fish	5.6	3.7	0.7	1.1	3.6	2.6	0.9
Fish sauce	3.5	2.6	0.4	0.5	1.0	0.5	0.5
Dried fish	4.3	3.1	0.4	0.7	3.7	5.3	-1.5
Salted fish	24.1	21.8	0.6	1.6	6.3	29.2	-22.9

After processing costs are integrated, surveyed households report an average net loss of USD 9.40 per year from processing and commercializing fish catches (see Figure 7 for details on the fish value chain). Households with a very high fish dependency earn an average net income of USD 34, the highest of all four dependency groups and significantly higher compared with households of medium and low dependency [α = 0.05 significance][10]. **The latter finding may prove particularly relevant to any policy effort focusing on post-harvest activities.** See comparisons in Figure 8 below.

An interpretation of such results may be found in the tradition characterizing fish processing, whose primary purpose is to preserve fish for consumption by the household catching it. In the Tonle Sap area, commercialization may be supported by adequate marketing networks and therefore be more profitable.

[10] 95% confidence intervals were computed for mean estimates of each fish dependency group using the Complex Samples analysis module of the SPSS statistical software. The 95% confidence interval for the mean estimate for the very high fish dependency group showed no overlap with the 95% confidence intervals for medium fish dependency and low fish dependency groups.

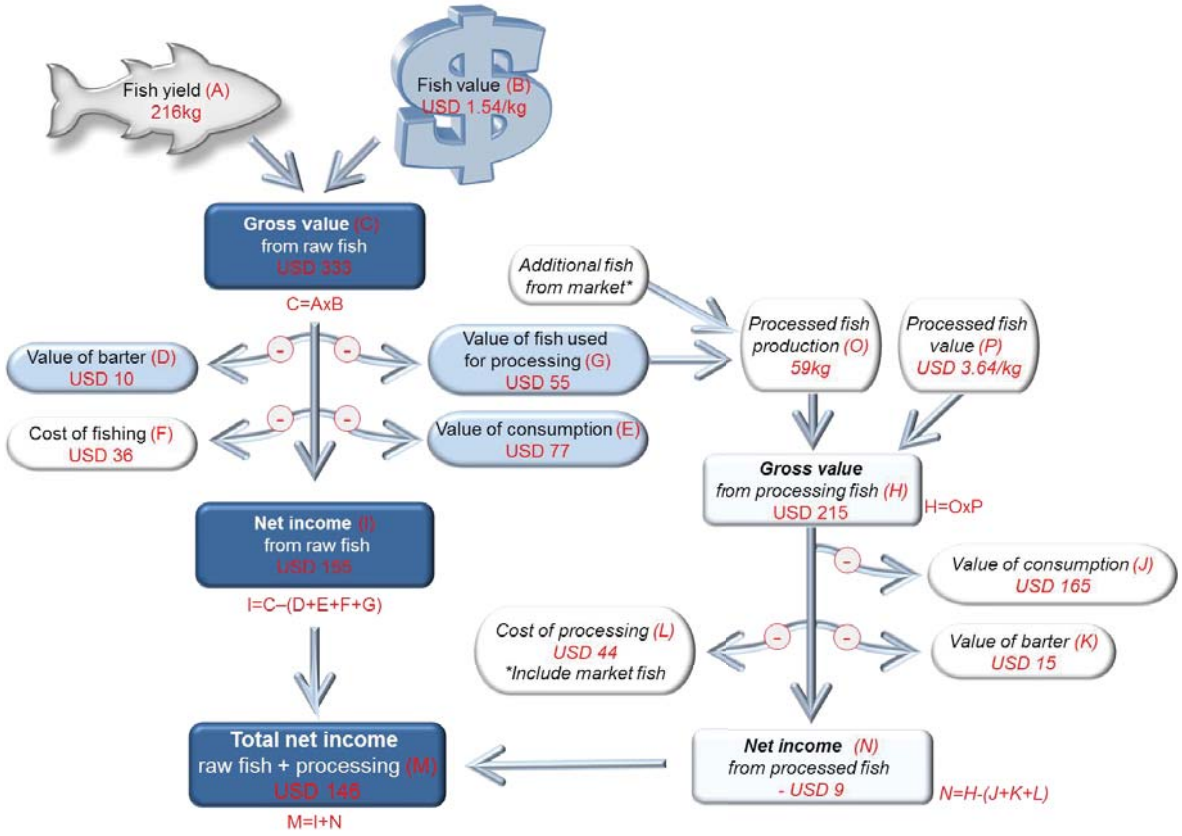


Figure 7. Fish value chain

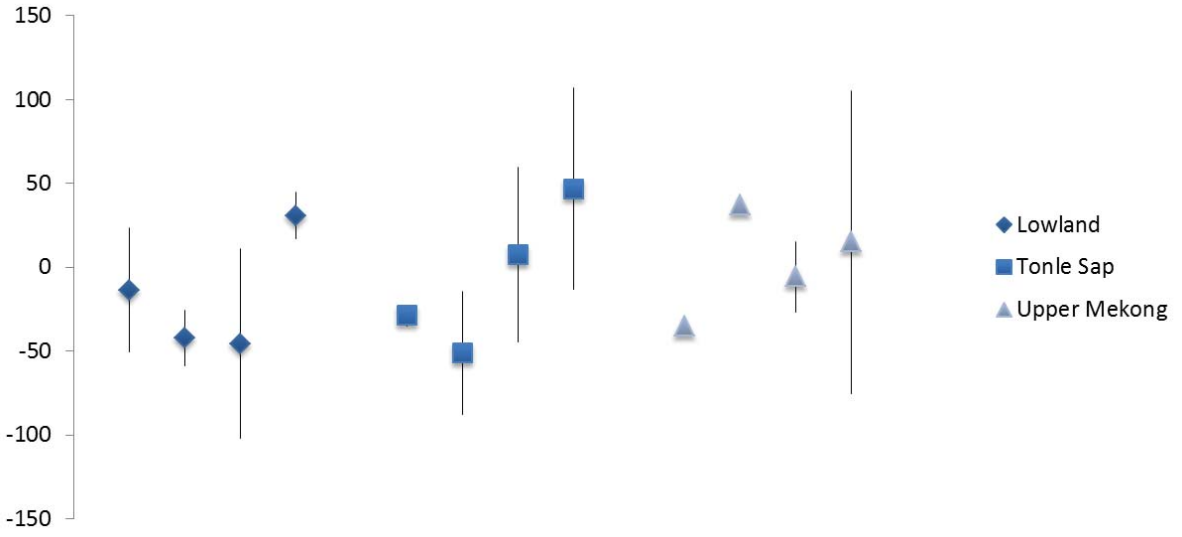


Figure 8. Net income from fish processing — mean estimates by fish dependency group and agro-ecological zone (USD/household/yr.) From left to right in each series, low/medium/high/very high fish dependency groups. Vertical bars indicate 95% confidence intervals.

2.3 NET INCOME FROM AQUACULTURE

On average, households generate annual net income of USD 15 from aquaculture. Fewer than 5% of the 655 surveyed households report engaging in aquaculture activities. On average, production from aquaculture amounts to 17.7 kg per year, most of which is from ponds (98%) for commercial use of 13.5 kg per year, the rest being used for personal consumption. Households generate average gross income of USD 18 and incur USD 3 in production costs. Further insight may be gained in Sections 6.2 and 9.4 below.

2.4 NET INCOME FROM RICE FARMING AND CROP FARMING

On average, net household income from crop farming amounts to USD 471 per year of which 96% is derived from rice, vegetables, fruit and cassava – and nearly 50% from rice alone. Average household rice production is 3 351 kg per year of which 2 180 kg is sold, generating net income of USD 231. The dominant farming method is dry-season rice, representing 43% of production, 54% of sales and 42% of net income from farming. The average sales price of KHR 861 per kg, significantly lower than market prices, was estimated on the basis of survey data (interviewee information).

Net income from vegetables is also significant at USD 99 per year followed by USD 81 from fruit and USD 39 from cassava[11]. Worth noting are discrepancies in terms of profit margin ratios, where fruit and cassava value chains appear to perform at an 83% ratio in both cases compared with ratios of 76% for vegetables and 49% for rice.

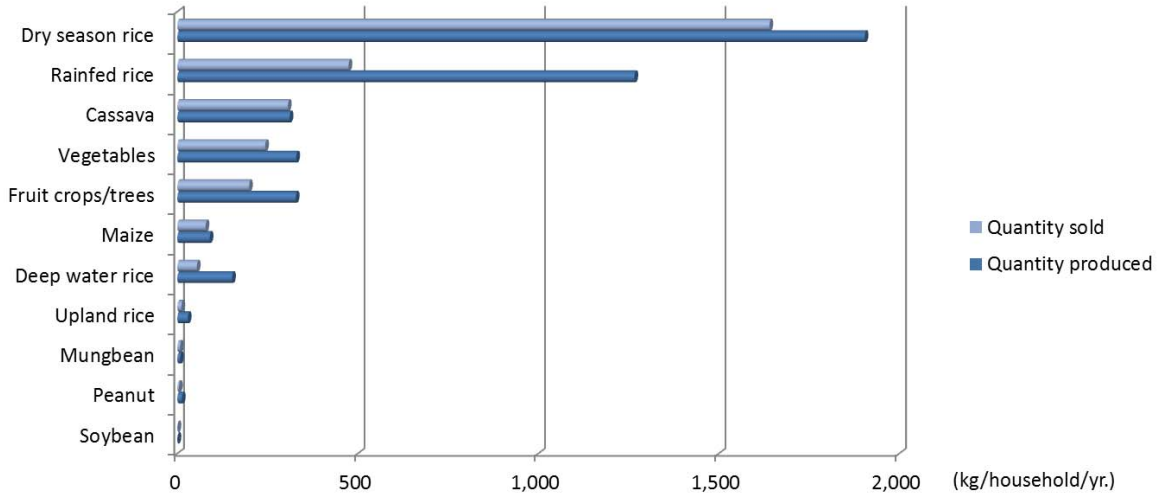


Figure 9. Crop farming —household average production by crop (kg/household/yr.)

[11] An artifact was introduced due to questionnaire design and data collection, which might cause quantitative data for vegetable farming as well as fruit crops/trees farming to be underestimated.

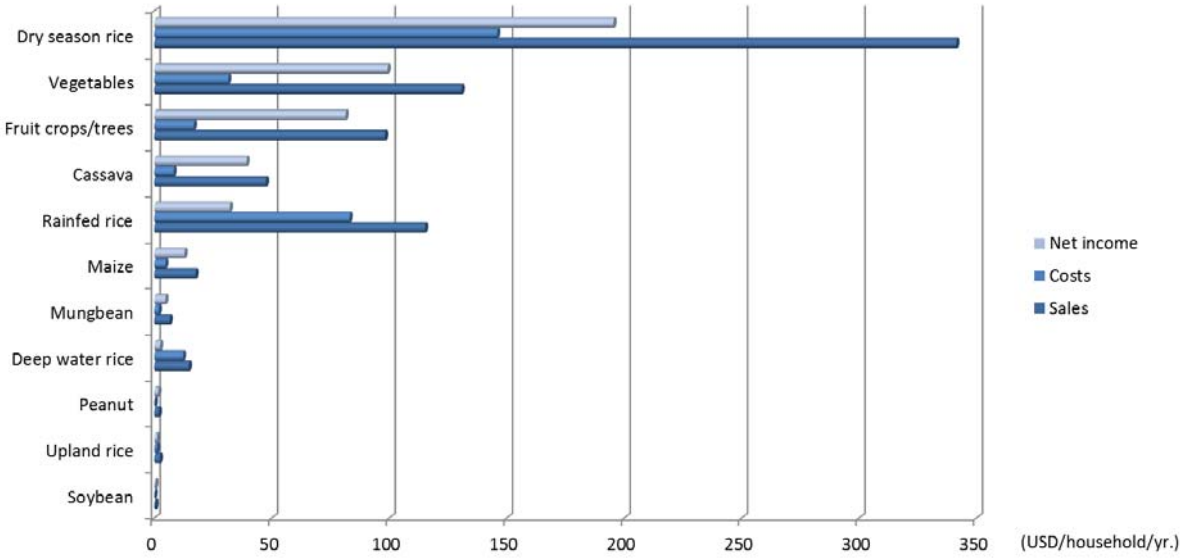


Figure 10. Crop farming —household average net income by crop (USD/household/yr.)

Table 7. Crop farming — household average production by crop

	Quantity produced (kg/ household/ yr.)	Quantity produced (% total)	Quantity sold (kg/ household/ yr.)	Quantity sold (% total)
Dry-season rice	1,904	43.0%	1 640	54.3%
Rain-fed rice	1,266	28.6%	474	15.7%
Vegetables	329	7.4%	243	8.1%
Fruit crops/trees	328	7.4%	199	6.6%
Cassava	311	7.0%	306	10.1%
Deep water rice	152	3.4%	54.1	1.8%
Maize	89.6	2.0%	78.2	2.6%
Upland rice	29.0	0.7%	11.3	0.4%
Peanut	12.5	0.3%	4.6	0.2%
Mungbean	7.8	0.2%	7.6	0.3%
Soybean	0.4	0.0%	0.4	0.0%
TOTAL RICE	3,351	75.6%	2 180	72.2%
TOTAL	4,430		3 019	

Table 8. Crop farming — household average net income by crop

	Sales (USD/ household/ yr.)	Sales (% Total)	Costs (USD/ household/ yr.)	Price (KHR)	Net income (USD/ household/ yr.)	Net income (% Total)	Profit margin Ratio
Dry-Season Rice	341	44.0%	146	825	195	41.5%	57%
Vegetables	131	16.8%	31	2 130	99	21.1%	76%
Fruit crops/trees	98	12.6%	17	1 958	81	17.3%	83%
Cassava	47	6.1%	8	614	39	8.3%	83%
Rain-fed rice	115	14.8%	83	963	32	6.8%	28%
Maize	18	2.3%	5	888	13	2.7%	73%
Mung bean	7	0.8%	2	3 409	5	1.0%	72%
Deep-water rice	15	1.9%	12	1 073	2	0.5%	17%
Peanut	2	0.2%	0	1 633	2	0.4%	90%
Upland rice	2	0.3%	1	814	1	0.3%	53%
Soybean	1	0.1%	0	5 251	0	0.1%	88%
TOTAL RICE	473	61.0%	242	861	231	49.1%	49%
TOTAL	776		305	1 019	471		

2.5 NET INCOME FROM LIVESTOCK

On average, households earn net income of USD 130 per year from livestock at a profit margin of 70%, weaker than capture fishery value chains in both respects. Annual net sales (the difference between gross sales and purchase expenditure of livestock over 12 months) amount to USD 186 per year, breaking down to USD 81 from cows, USD 53 from pigs, USD 26 from chickens, USD 20 from buffaloes and USD 9 from eggs. Net sales of turkeys, ducks and horses are insignificant or even negative. Average sale prices (the ratio between reported sales value and reported heads sold) were USD 665 per buffalo, USD 512 per cow, USD 322 per horse, USD 64 per pig, USD 11 per turkey, USD 7 per duck, USD 3.80 per chicken and USD 0.40 per kilogram of eggs — see Table 9 below. Operating costs for livestock farming represent USD 57 per year, breaking down to USD 50.50 in animal feed, USD 4.70 in veterinary services, USD 0.80 in labor and USD 0.80 in technical services. The high level of operating costs leads to a rather weak gross margin ratio of 70%.

Table 9. Gross sales and purchase expenditure from livestock

	Heads: quantity purchased	Purchase expenditure (USD/ household/ yr.)	Buying price (USD)	Heads: quantity Sold	Gross sales (USD/ household/ yr.)	Selling price (USD)	Net sales (USD/ household/ yr.)
Cow	0.1	50.5	489.1	0.3	131.6	511.5	81.1
Pig	0.6	22.5	39.0	1.2	75.7	64.1	53.2
Chicken	6.9	25.1	3.6	13.5	51.3	3.8	26.3
Buffalo	0.0	9.7	453.4	0.0	29.2	665.1	19.5
Eggs (kg)	15.9	1.9	0.1	27.5	10.9	0.4	9.0
Turkey	0.0	0.0	10.1	0.0	0.1	10.8	0.1
Goat/Sheep	0.0	0.0	-	0.0	0.0	-	0.0
Rabbit	0.0	0.0	-	0.0	0.0	-	0.0
Duck	3.3	8.4	2.5	1.1	7.6	7.2	-0.7
Horse	0.0	5.1	790.3	0.0	2.9	322.3	-2.2

2.6 NET INCOME FROM FLOODPLAIN NATURAL RESOURCES

Household average net income from floodplain natural resources is USD 11.70 per year. This breaks down as USD 3.90 from snakes and turtles, USD 3.10 from aquatic plants, USD 2.80 from shrimps and crabs, and USD 1.90 from snails and other shellfish. Average sales prices are USD 1.40 for snakes and turtles, USD 0.50 for aquatic plants, USD 0.40 for shrimps and crabs, and USD 0.50 for snails and other shellfish. Operating or gathering costs are USD 0.50 for snakes and turtles, USD 0.30 for aquatic plants, USD 0.90 for shrimps and crabs, and 0.20 for snails and other shellfish.

2.7 NET INCOME FROM TERRESTRIAL NATURAL RESOURCES

The average household loss from terrestrial natural resources is USD 8.50, probably due to respondents underreporting income from illegal felling of timber, which generates high collection costs. See Table 10 below for details. Another possible explanation is that terrestrial natural resources are mainly for self-consumption and therefore generate weak income from sales (as is the case for fish processing). Nonetheless, the USD 23.52 loss incurred from cutting timber is not credible and influences the whole terrestrial natural resource "sub-sector".

Table 10. Net income from terrestrial natural resources

	Income (USD/household/yr.)	Cost (USD/household/yr.)	Net Income (USD/household/yr.)
Firewood	8.7	1.5	7.2
Medicinal plants	4.1	0.3	3.9
Vegetable foods	0.7	0.1	0.7
Wild meat	2.4	0.1	2.3
Resin/bark	0.89	0.07	0.82
Timber	23.51	47.04	– 23.52 (loss)

2.8 NET INCOME FROM LABOR AND BUSINESS

Household average net income from salaries, wages and business amounts to USD 1 970 per year of which 99% is not related to fisheries. Average annual involvement is 22.1 months per household or 4.2 months per person[12]. Breakdowns are reported in Table 11 below.

Table 11. Net income from jobs and involvement

	Income (USD/ hh/ yr.)	Labor input (months/ hh)	Monthly income (USD/ hh)
Salaried (not related to fisheries)	785	6.2	127.3
Small business (not related to fisheries)	591	6.6	89.3
Wage labor (not related to fisheries)	457	10.8	42.2
Skilled labor (not related to fisheries)	121	1.5	79.0
Small business (related to fisheries)	11	0.1	76.8
Salaried (related to fisheries)	2.0	0.0	77.5
Wage labor (related to fisheries)	1.6	0.0	76.8
Skilled labor (related to fisheries)	1.3	0.0	35.7
Student/Monk	0.3	0.0	21.5

Labor inputs related to fisheries such as cost of fishing gear, boat maintenance, fuel and processing costs are not reflected in these results. It is unclear whether these inputs were not covered by the questionnaire or if respondents did not give weight to such inputs.

On average, annual household net income amounts to USD 34.40 per year from selling land[13], USD 27 from selling household or livelihood assets, USD 2.80 from scholarships or stipends from third parties, USD 102 from remittances, USD 26.50 from renting equipment or pensions and USD 14.60 from lotteries or gambling[14].

[12] All household members are considered in this result, regardless of age.

[13] This USD 34 value was compiled under the assumption that land sale revenues reported by respondents are reallocated as both cash flow (50%) and cash assets (50%). Based on a different scheme whereby 100% of land sale revenues would be allocated to cash flow, household average net income from selling land would then amount to USD 68.80 per year.

[14] It was considered that lotteries and gambling do not fulfill the fundamental assumption of rationale behavior in economics. Therefore net income from lottery and gambling was not integrated into the calculation of household total net income.

3 WEALTH IN WELFARE — *CAPITAL, ASSETS AND DEBT*

3.1 ASSETS AND CAPITAL RELATED TO FISHING

On average, household assets related to fishing are valued at USD 80. Sixty-five percent of these assets comprise boats (USD 33.40 per household) or outboard motors (USD 18.60 per household). A detailed breakdown of fishing assets by type is presented in the below table.

Table 12. Fishing asset types and values

	Asset count	Asset value (USD)
Boat	0.3	33.4
Outboard motor for boat	0.1	18.6
Jar for fish	1.2	13.3
Castnet *(samnah)*	0.4	5.5
Gillnet *(morng)* 5-7 cm (3 fingers)	0.3	1.0
Small trap	0.5	1.0
Other	0.8	0.9
Hooked line *(santouch)*	5.8	0.9
Seine/drag net *(uorn/neam/anhchourn)*	0.0	0.8
Gillnet *(morng)* 3-4 cm (2 fingers)	0.3	0.8
Cooler box	0.0	0.7
Trap	0.2	0.7
Gillnet *(morng)* <2.5 cm (1 finger)	0.2	0.4
Long hook line	0.2	0.4
Barrel *(thung tram)*	0.1	0.4
Gillnet *(morng)* >12 cm	0.0	0.3
Plunge basket	0.1	0.3
Gillnet *(morng)* 8-11 cm (4 fingers)	0.1	0.2
Scoop	0.0	0.1
Harpoon/spear	0.1	0.1
Bamboo/rattan trap	0.0	0.1
Push net	0.0	0.1
Smoke griller	0.0	0.1
Electric fishing gear	0.0	0.0
Shrimp trap	0.0	0.0
Brush park	0.0	0.0
Fyke net made of mosquito nets	0.0	0.0
Lift net	0.0	0.0
Funnel trap	0.0	0.0

3.2 ASSETS AND CAPITAL RELATED TO AQUACULTURE

On average, household assets related to aquaculture were valued at USD 64.50. Ponds represent almost the sole type of asset reported by respondents. The average area of ponds is 27 m^3.

3.3 ASSETS AND CAPITAL RELATED TO FARMING AND LIVESTOCK

On average, household land capital amounts to USD 10 357, farming equipment to USD 308, crops in storage to USD 179, livestock to USD 568 and livestock management infrastructure to USD 39.

A breakdown of average household land amounting to USD 10 357 is presented below:

Table 13. Household land capital

	Value (USD)
*Chamka** land	1,800
Fallow land	279
Garden/orchard land	773
Homestead land	4,015
Paddy field	3,433
Permanent pasture land	57

* a piece of land with a combination of mixed standing plants such as banana trees, mung or soya beans, vines and gourds, or maize and spice shrubs.

A breakdown of average farming equipment amounting to USD 308 is presented below:

Table 14. Household farming equipment value

	Value (USD)
Hand tractor (e.g. power tiller)	193.5
Motorized pump (electric or engine)	30.0
Ox cart	25.1
Small rice mill for household consumption	23.2
Motorized thresher	12.8
Insecticide sprayer	6.1
Plough	4.3
Spades, shovels, hoe, etc.	4.1
Rickshaw/cart	3.8
Evaporative cooler / Cooler box for vegetables	3.2
Harvesting machine	0.6
Hand thresher	0.4
Drum seeder	0.3
Bed	0.1
Big jar	0.0

A breakdown of average household crops in storage amounting to USD 179 is presented below:

Table 15. Value of crops in storage

	Quantity (kg)	Value (USD)
Rain-fed rice	392.1	138.3
Deep-water rice	49.2	19.5
Dry-season rice	52.1	16.8
Cassava	4.6	2.9
Upland rice	4.3	0.9
Vegetables	0.5	0.4
Fruit crop/trees	0.5	0.3
Mung bean	0.2	0.1
Peanut	0.1	0.0
Maize	0.0	0.0
Soybean	0.0	0.0

A breakdown of average livestock amounting to USD 568 is presented below:

Table 16. Value of livestock

	Head count: purchased	Head count: born	Head count: sold	Head count: lost	Head count: total	Head count: value
Cow	0.1	0.2	0.3	0.1	1.3	355.8
Buffalo	0.0	0.1	0.1	0.1	0.4	141.6
Chicken	8.7	36.7	12.9	20.2	11.5	38.8
Pig	0.5	1.3	1.2	0.4	0.6	20.8
Horse	0.0	0.0	0.0	0.0	0.0	7.4
Duck	2.2	1.4	1.0	2.0	1.1	2.5
Goat/Sheep	0.0	0.0	0.0	0.0		
Rabbit	0.0	0.0	0.0	0.0		
Turkey	0.0	0.0	0.0	0.0		

A breakdown of average livestock infrastructure amounting to USD 39 is presented below:

Table 17. Value of livestock-related infrastructure

	Value (USD)
Chicken fencing	7.7
Duck fencing	0.6
Cow fencing	20.4
Pig pen	9.8

3.4 ASSETS AND CAPITAL RELATED TO THE COLLECTION OF TERRESTRIAL NATURAL RESOURCES

On average, the value of household assets related to collection of terrestrial natural resources amounts to USD 12. A breakdown by asset is presented below.

Table 18. Value of assets related to the collection of terrestrial resources

	Count	Value (USD)
Axe	1.2	2.4
Chainsaw	0.2	7.3
Knife	1.0	1.9
Saw	0.1	0.2
Others	0.2	0.2

3.5 ASSETS AND CAPITAL LINKED TO BUSINESS-RELATED ACTIVITIES

On average, the value of household business assets amounts to USD 316. A breakdown by asset value is presented below.

Table 19. Value of assets related to business activities

	Value (USD)
Larger business not related to fisheries without shop/workshop	156
Larger business not related to fisheries - shop/workshop/factory/machines	134
Larger business related to fisheries without shop/workshop	12
Larger business related to fisheries - shop/workshop/factory/machines	7
Small business related to fisheries *without* shop/workshop/factory/machines	5
Small business not related to fisheries - shop/workshop/factory/machines	2

3.6 CASH DEPOSITS AND LOANS TO OTHERS

On average, household cash deposits and loans to others represent USD 318. Household loans to third parties amount to USD 233, higher than cash deposits in a bank or microfinance institution which amount to USD 56. Cash assets and assets not elsewhere classified represent a combined value of USD 29.

3.7 DEBT

On average, household debt amounts to USD 465 with an average *monthly* interest rate of 2.1%. Seventy-two percent of household debt is productive with non-agricultural and non-fishing related activities accounting for 37%, agricultural activities for 26%, purchases or improvements of dwellings for 9% and fishing activities for 1%. A detailed breakdown is presented below.

Table 20. Household debt by purpose

PURPOSE	PRINCIPAL USD	REMAINING MONTHS	DEBT VALUE USD
Non-agricultural and non-fishing related activities	252.0	1.6	169.8
Agricultural activities	158.4	1.4	119.2
Purchase/improvement of dwelling	46.5	0.9	41.9
Illness, injury, accident	54.4	0.7	37.3
Household consumption needs	42.8	0.4	33.2
Purchase of consumer durables	33.5	0.3	25.0
Servicing and existing debts	30.4	0.5	22.6
Rituals (marriage/funeral/etc.)	12.6	0.1	10.1
Fishing activities	7.4	0.1	4.9
Other	9.2	0.1	0.5
Other emergencies (fire/flood/theft)	-	-	-

4 NUTRITION IN WELFARE

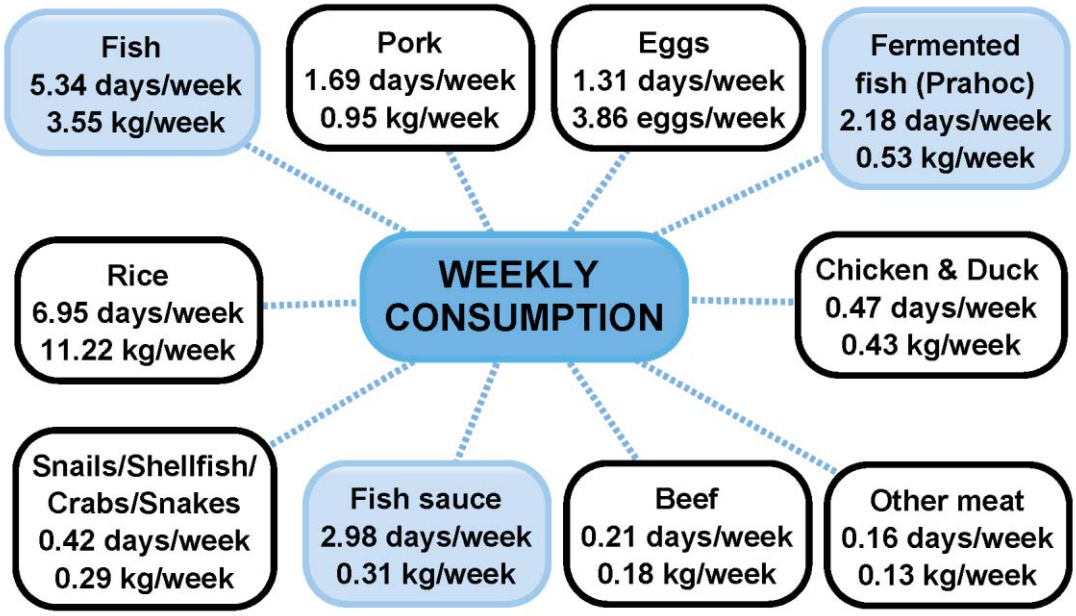


Figure 11. Weekly household consumption of food items by frequency and quantity
Note: consumption of vegetables and fruits has not been surveyed**.**

4.1 HOUSEHOLD WEEKLY CONSUMPTION OF FOOD

Fish is the most widely consumed source of animal protein, with average household consumption of 3.6 kg per week, or 97 grams per person each day[15]. Rice is the most consumed item surveyed in terms of both frequency and quantity – 6.9 days and 11.2 kg per household per week on average. Fish consumption has the second highest weekly frequency (5.3 d/w[16]) followed by fish sauce (3.0 d/w), fish paste (2.2 d/w) and pork (1.7 d/w). In terms of household animal protein, fish comes first with 3.6 kg then pork with 1.0 kg. Combining fish and fish products, average household consumption is 4.4 kg per week. Personal consumption is 120 grams per day, 830 grams per week and 43.2 kg per year.

[15] Mean estimate for household size is 5.3 persons.

[16] "d/w" = day per week

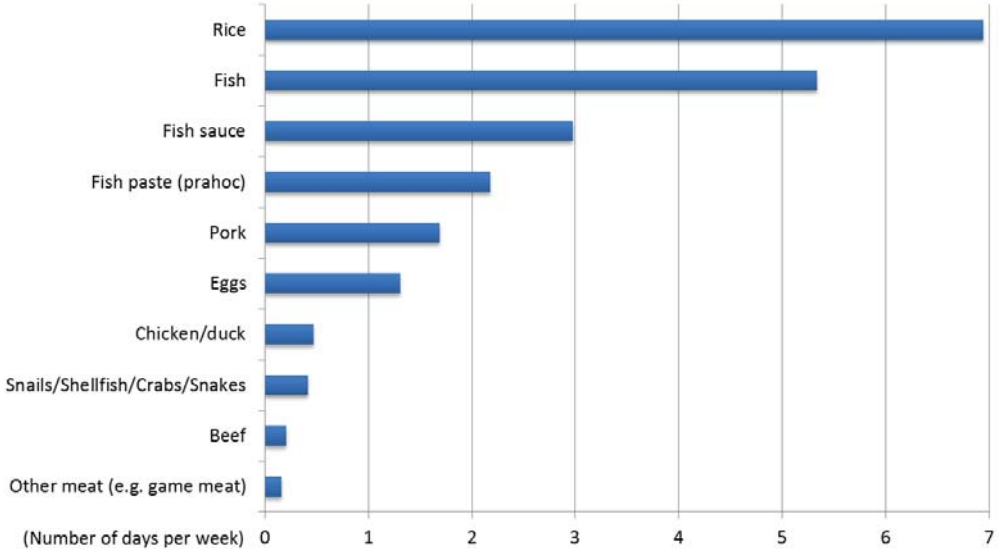


Figure 12. Household weekly consumption of food (number of days per week)

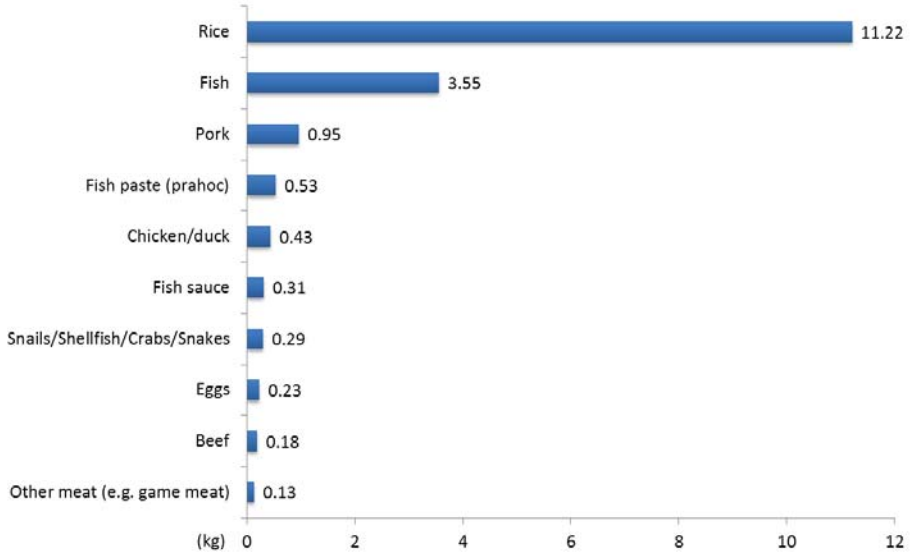


Figure 13. Average household weekly food consumption (kg)

A breakdown by source of food is presented in Table 21 below, distinguishing between fishing/hunting/gathering, own production and purchases. That information may be cross-checked with information derived from separate sets of questions related to annual fish processing as reported in Section 0 — see especially Table 6. Results from the latter converted to weekly quantities are generally consistent with Table 21 below. In terms of own production, Section 0 indicates average household consumption of 0.86 kg of processed fish per week: 0.42 kg of salted fish, 0.23 kg of prahoc (regular and semi-final), 0.07 kg of fermented fish, 0.06 kg of dried fish, 0.05 kg of fish sauce and 0.05 kg of smoked fish.

Table 21. Household average food consumption (weekly)

Kind of Food	Source	Days per week #	Quantity per week (kg/w)
Rice	Own production	3.3	6.1
	Purchased	3.5	5.1
	Other	0.1	0.1
Eggs[17]	Own production	0.1	0.0
	Purchased	1.2	0.2
	Other	0.0	0.0
Fish	Own production (fish farming)	0.2	0.2
	Fishing	1.3	1.1
	Purchased	3.6	2.2
	Other	0.2	0.1
Pork	Own production	0.0	0.0
	Purchased	1.7	0.9
	Other	0.0	0.0
Fish paste (prahoc)	Own production	1.2	0.3
	Purchased	1.0	0.2
	Other	0.0	0.0
Chicken/duck	Own production	0.1	0.2
	Purchased	0.3	0.3
	Other	0.0	0.0
Fish sauce	Own production	0.6	0.1
	Purchased	2.4	0.2
	Other	0.0	0.0
Snails/other shellfish/crabs/snakes	Own production	0.0	0.0
	Hunting/gathering	0.2	0.2
	Purchased	0.2	0.1
	Other	0.0	0.0
Beef	Purchased	0.2	0.2
	Other	0.0	0.0
Other meat (e.g. game**)**	Own production	0.0	0.0
	Hunting/gathering	0.0	0.0
	Purchased	0.1	0.1
	Other	0.0	0.0

[17] The information related to eggs as collected through the survey questionnaire was a number of units, which has been further converted into a weight on the basis of a unit weight of 60 grams.

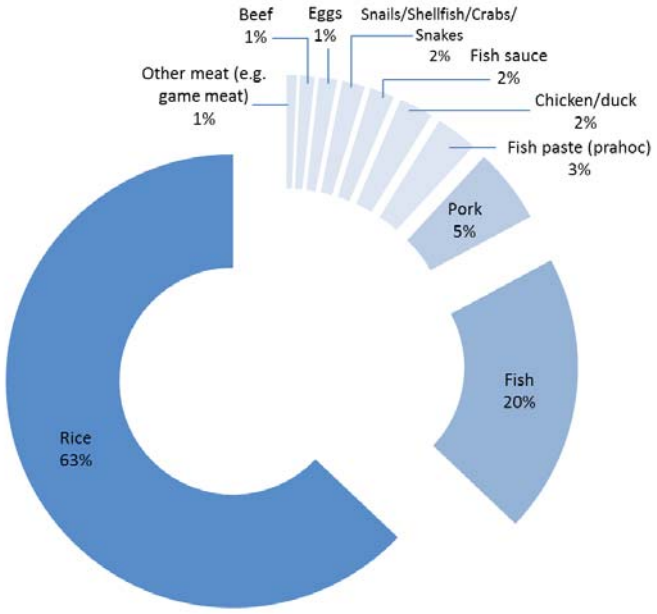


Figure 14. Annual household food consumption and food source

4.2 HOUSEHOLD SEASONAL CONSUMPTION OF FISH

In November, fish consumption tends to become frequent. Household consumption of fish (excluding fish products) shows mild seasonal variations, which tend to reflect fish reproduction and market supply cycles. All households report consuming fish every month of the year, whether seldom or more frequently. The vast majority of households report consuming fish often (more than 10 times per month). In November, consumption patterns tend to shift from "sometimes" to "often" or from "often" to "daily" — see Figure 15 below.

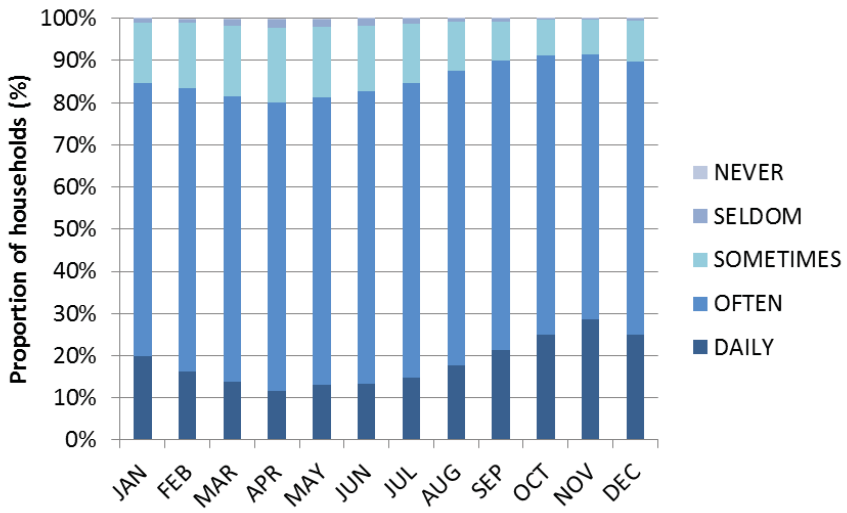


Figure 15. Seasonal patterns of fish consumption

5 RESILIENCE IN WELFARE

On average, households face unexpected expenditure due to shocks amounting to USD 96 per year. The most frequent shocks are illness (or health emergency), crop loss and costly family events, which represent the strongest financial burden of USD 77 or 75% of annual expenditure on shocks.

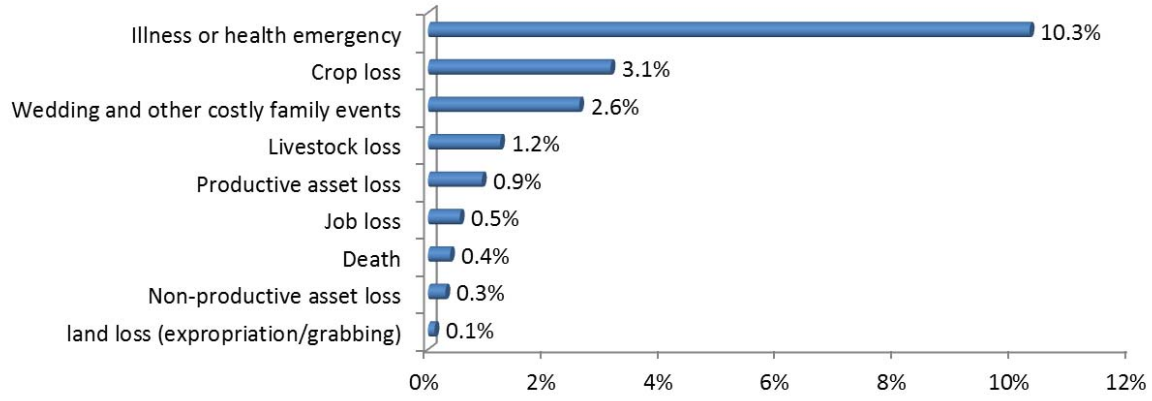


Figure 16. Causes of shocks and impact on population

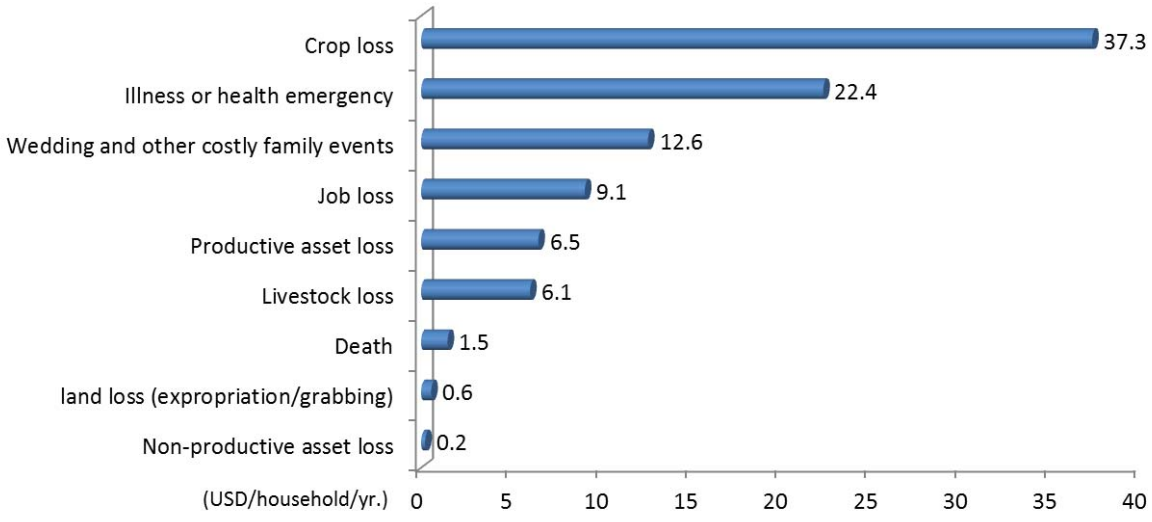


Figure 17. Causes of shocks and financial impact (USD/household/yr.)

Among strategies reported by households that incurred shocks, 40% are financial, another 40% are based on reducing food consumption and another 20% are ad-hoc strategies. Relying on cash savings is the most common financial measure and accounts for 24% of all coping responses. Among coping measures based on reducing household consumption, both rice and fish appear as the most inelastic.

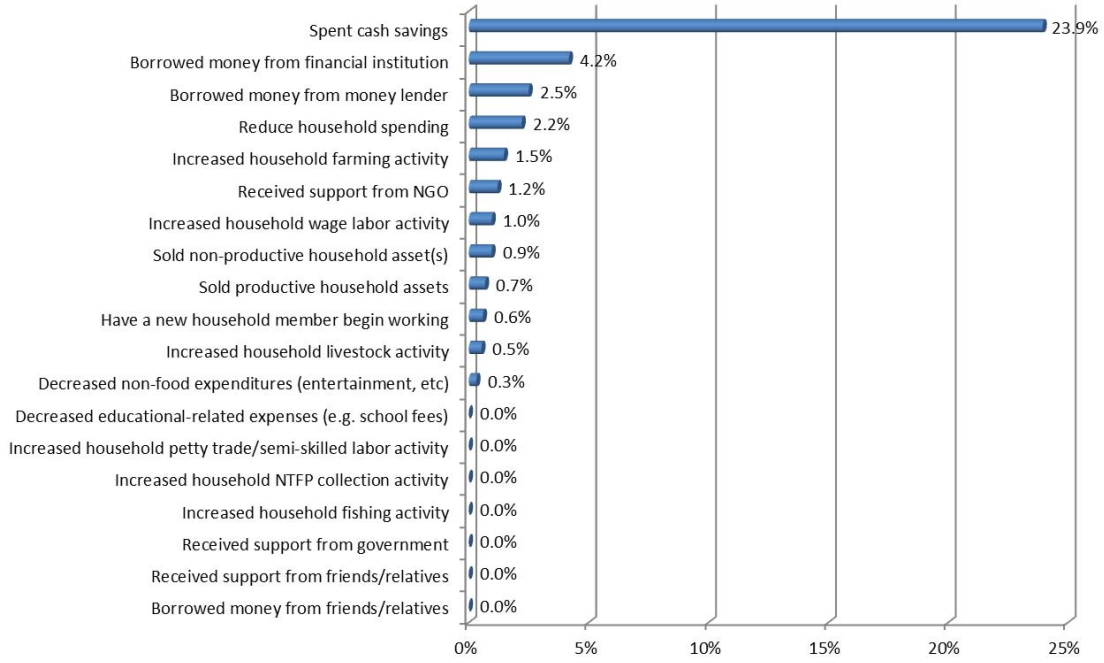


Figure 18. Coping strategies based on financial measures — % of household responses

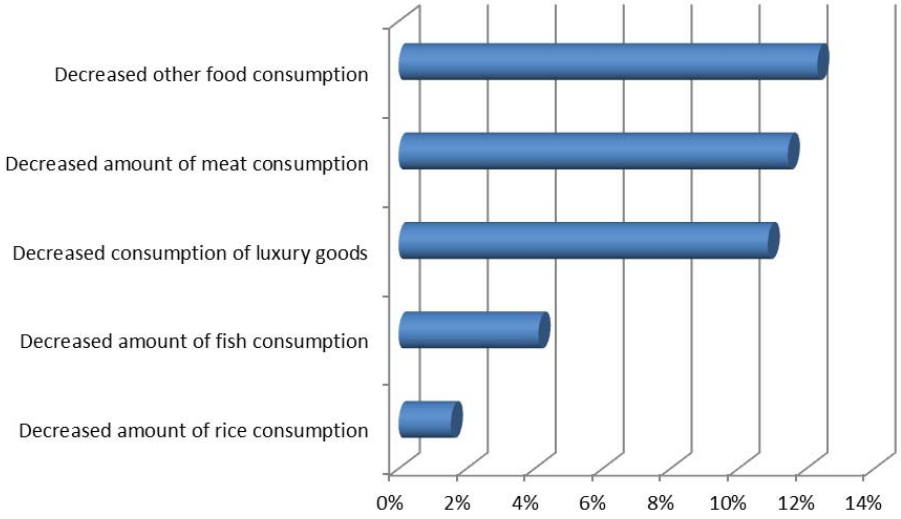


Figure 19. Coping strategies based on consumption measures — % of household responses

Households are more likely to spend savings, reduce spending or borrow money than increase labor as a financial coping strategy; probably because shocks require an immediate response in cash. These results call for further research about the important role of fish in relation to shocks. Assuming that rice is the most inelastic food item, then fish can be regarded as the second most important food item and therefore more important to households than meat or other food items. This result confirms the importance of fish in nutrition as already highlighted in nutrition studies.

6 LABOR IN WELFARE

Average labor input per household was derived from survey data by computing a "full-involvement equivalent" (FIE) indicator and assuming a full/partial-involvement ratio equal to 1/3 (meaning that the quantity of labor produced by three household members partially involved is equivalent to the quantity of labor produced by a single household member fully involved). This section presents summary results on labor input based on the FIE indicator.

STUDY LIMITATION FOR LABOR ANALYSIS

Labor in this study refers to the level of involvement people have in different livelihood activities. In the surveys, respondents indicated whether they were "fully", "partially" or "not" involved so involvement does not indicate the time a person spends on a certain activity.

It is recognized that being "fully involved" in an activity implies a notion of time while being "partially involved" does not. A drawback of using the latter is that the extent of involvement is ambiguous. For example, a person can spend only 15 minutes feeding chickens once a day and be considered "partially involved" in poultry farming.

Due to data limitations, labor cannot be fully detailed here in terms of labor efficiency (income generated for time worked). To gain a more representative indication of labor in future studies, the time people spend working on a certain activity must be calculated. Although this report's assessment is insufficient for time, it demonstrates the most common activities in which people participate so insights into the labor demands and profitability of each activity can still be made.

This section also compares activities in terms of labor efficiency, based on a labor efficiency ratio calculated as the ratio of a household's average net income to its average FIE for a given activity — see results in Table 22 below. Orchard & homestead gardening activities feature a high labor efficiency ratio of USD 235 FIE per year. So does rice farming at USD 220 FIE followed by aquaculture[18] (production/processing/marketing) at USD 161 FIE and capture fisheries (fishing/processing/marketing) at USD 139 FIE. Cattle and other livestock activities (apart from poultry) have comparable labor efficiency ratios.

[18] Because of the marginal number of households engaging in aquaculture activities across the survey, results suffer from high standard errors, possibly compromising the accuracy of related estimates.

Table 22. Average household labor input and labor efficiency, by activity.

	Net income (USD/ household/yr.)	Labor input (FIE/ household)	Labor efficiency ratio (USD/FIE/ yr.)
Orchard/homestead gardening	180.7	0.77	235
Rice farming	236.8	1.08	220
Fish farming activities	14.9	0.09	161
Capture fishery activities	155.9	1.12	139
Cattle farming (cow and buffalo)	130.2	0.96	136
Other livestock activities	63.1	0.49	129
Poultry farming	59.4	1.44	41
***Chamka* crops**	6.8	0.56	12
Floodplain resource activities	11.7	1.21	10

Further accounts on labor in welfare are provided in Sections 8, 9.4, 10.4, and 11.1.

6.1 LABOR IN FISHING

Capture fishery value chains (fishing/processing/marketing) have a fair labor efficiency ratio requiring only a modest labor input from households. On average, households allocate 1.12 FIE per year to these activities with involvement in marketing about half the level of involvement for fishing.

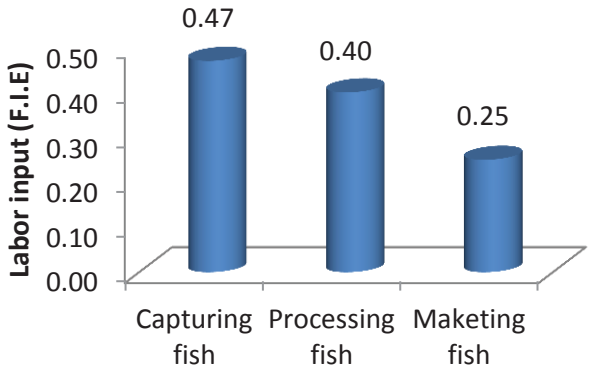


Figure 20. Average labor input per household — capture fishery

6.2 LABOR IN AQUACULTURE

Aquaculture value chains have the third highest labor efficiency ratio. Household allocation of labor to fish farming is marginal at 0.09 FIE per year reflecting the low engagement in aquaculture in the zones under study. Similar to capture fisheries, however, aquaculture features a high labor efficiency ratio at USD 161 FIE per year, the third highest across value chains in focus.

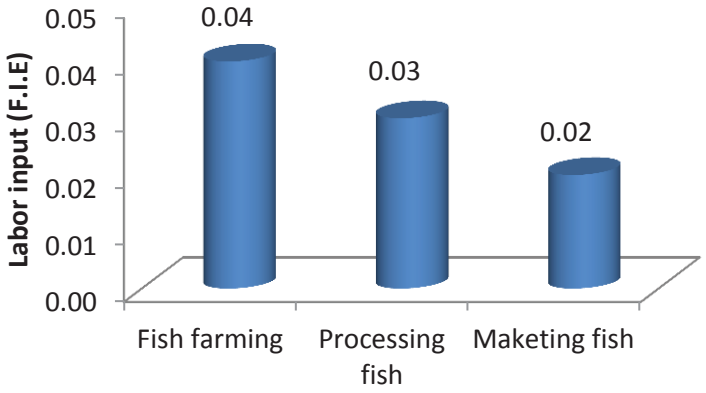


Figure 21. Average labor input per household — aquaculture

6.3 LABOR IN FARMING AND LIVESTOCK

While poultry farming seems to mobilize a higher level of labor input from households, rice farming features stronger labor efficiency. Poultry farming is where households report the highest involvement with 1.44 FIE per year followed by rice farming with 1.08 FIE, cattle farming with 0.96 FIE, orchard and homestead gardening with 0.77 FIE, *chamka* crops with 0.56 FIE and other livestock activities with 0.49 FIE. However, orchard and homestead gardening have the highest labor efficiency ratio of USD 235 FIE per year followed by rice farming with USD 180 FIE. At the other end of the labor efficiency spectrum are poultry farming at USD 41 FIE, *chamka* farming at USD 12 FIE and floodplain resource collection at USD 10 FIE.

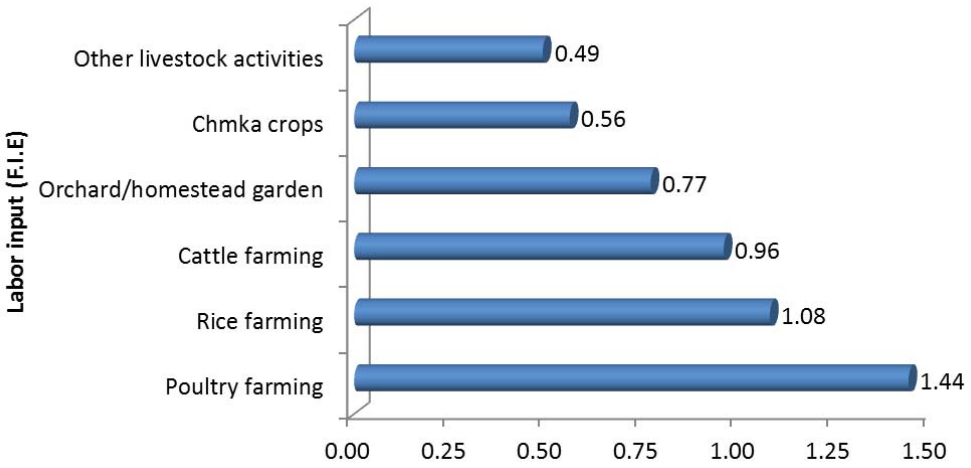


Figure 22. Average labor input per household — crop and livestock farming

6.4 LABOR IN TERRESTRIAL NATURAL RESOURCES

On average, labor input for collecting terrestrial natural resources is primarily 0.95 FIE per year for household use and marginally 0.10 FIE for sales.

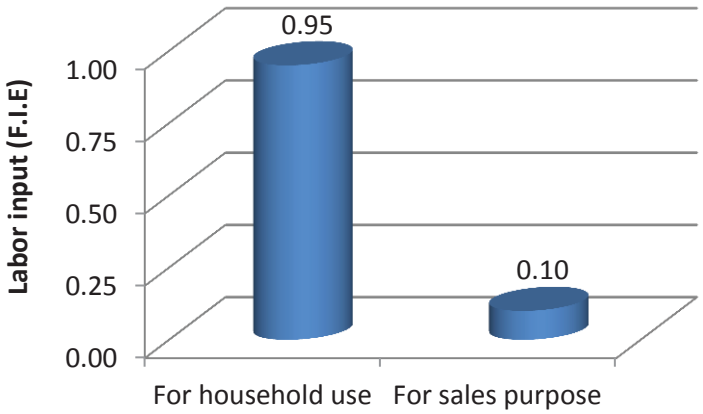


Figure 23. Average labor input per household — terrestrial resource collection

7 HEALTH IN WELFARE

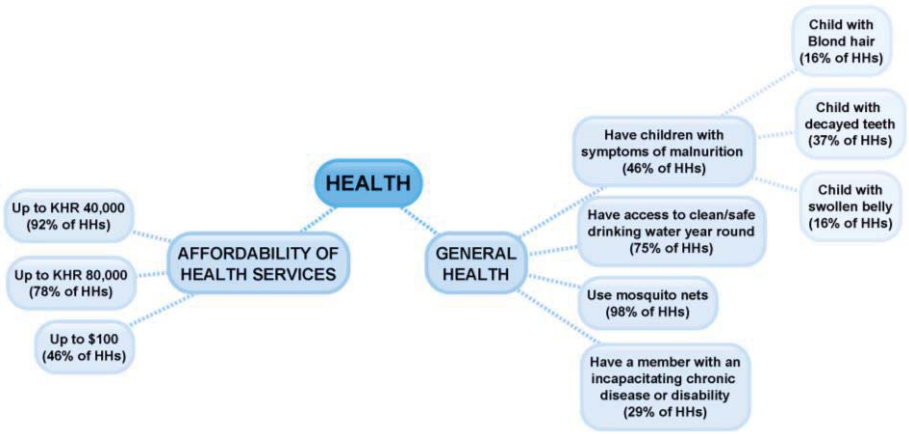


Figure 24. Overview of health in the population surveyed

7.1 GENERAL HEALTH OF HOUSEHOLDS

Forty-six percent of households report having children who show malnutrition symptoms and less than one-fifth can access safe drinking water all year round. Sixteen percent of households report having children who have developed blond hair, 37% report children with decayed teeth and 16% report children with permanently swollen bellies. Seventy-five percent report treating water through boiling, chlorinating or other methods while 19% report being able to access safe drinking water all year round. In terms of malaria prevention, 92% to 99% report owning mosquito nets.

7.2 AFFORDABILITY OF HEALTH SERVICES

Ninety-eight percent of households report that they can afford to bring a member to a health center or hospital, however only 46% can afford treatment up to USD 100. Fifty-six percent of households report that they can afford bringing a member to a traditional healer in case of an accident or illness, while 98% of households report that they can afford bringing a member to a health center or hospital. These results, which at first might appear as counter intuitive, may find an explanation in public health policy supporting health centers at the level of every commune (hence 100% coverage) whereas the activities of traditional healers may be declining or may not be present in every commune (hence less than 100% coverage). Ninety-two percent of households can afford prescriptions up to KHR 40,000, while only 78% can afford prescriptions up to KHR 80,000 and 46% can afford treatment up to USD 100.

7.3 ACCESSIBILITY OF HEALTH SERVICES

Ninety-eight percent of households report having access to a health center or hospital and 96% reporting being able to access medicines other than paracetamol or aspirin. Sixty-one percent of households report having access to traditional healers.

8 COMPARISONS ACROSS AGE GROUPS

8.1 AGE GROUPS IN FISHING ACTIVITIES

Twenty-two percent of adults and 17% of 12 to 17-year-olds report being involved in fishing. On average, 16.7% of adults report partial involvement and 5% (p/household[19]) full involvement in fishing — the latter corresponding to professional fishermen. A significant share of labor is also contributed by the 12-17 y.o.[20] group with an average of 16.6% reporting some level of involvement: 8.3% (p/household) partially involved and another 8.3% (p/household) fully involved. Some degree of involvement is also noted in younger children – 3.8% (p/household) for the 6-11 y.o. group and 1.7% (p/household) for the 0-5 y.o. group. Males dominate fishing in adults (35.9% of male p/household vs. 8.4% of female p/household) and the three younger age groups[21].

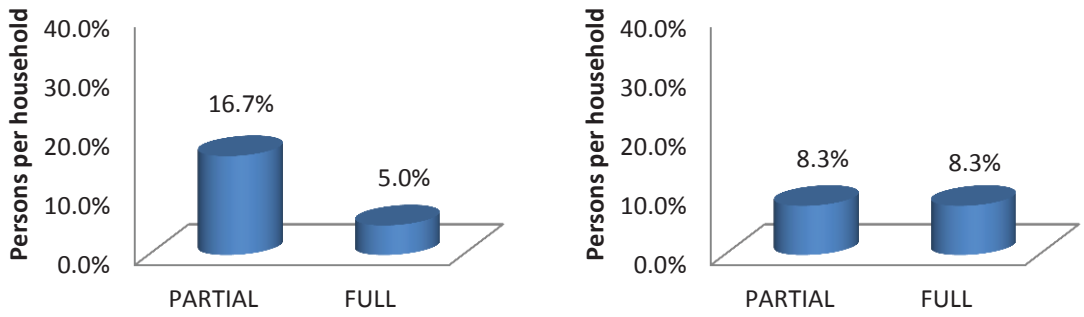


Figure 25. Involvement in fishing – adults (left) and 12 to 17-year-olds (right)

On average, the proportion of household members engaging in fish processing is stronger than fishing activities at 39% (p/household) for adults and 20% (p/household) for the 12-17 y.o. age group with greater involvement of females than males. Full involvement in fish processing is 16.8% (p/household) for the 12-17 y.o. group and 13.6% (p/household) for adults. Partial involvement is 25% (p/household) for adults and 3.1% (p/household) for the 12-17 y.o. group. Some degree of involvement is also noted in younger age groups – 4.6% (p/household) for the 6-11 y.o. group and 0.9% (p/household) for the 0-5 y.o. group. Females dominate processing in adults (56.2% female p/household vs. 20.1% male p/household) and the two younger age groups.

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[19] The following abbreviation is used throughout this report: "p/household" for "person per household".

[20] The following abbreviation is used throughout this report: "y.o." for "year-old"

[21] As opposed to previous calculations, percentages by gender are based on the number of individuals in each gender group (1 198 female and 1 137 male respondents) and not in the whole population (2 335 people)

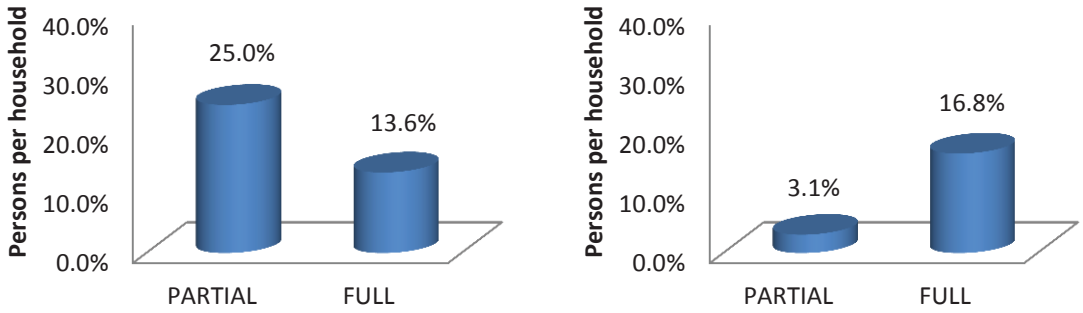


Figure 26. Involvement in processing fish – adults (left) and 12 to 17-year-olds (right)

Marketing fish is dominated by female adults with 11.3% of adults reporting some involvement of whom 8.4% are female. Involvement is marginal at 4.9% (p/household) in the 12-17 y.o. group and 1.2% (p/household) in the 5-11 y.o. group. Gender-wise, 16.5% of female p/household and 6.1% of male p/household are involved in marketing

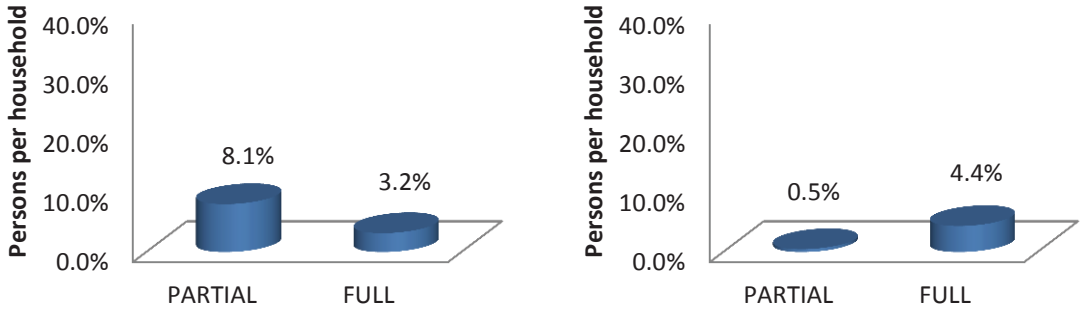


Figure 27. Involvement in marketing fish – adults (left) and 12 to 17-year-olds (right)

8.2 AGE GROUPS IN AQUACULTURE ACTIVITIES

Aquaculture is a marginal activity within the population sample under study.

- Farming involves 2.3% (p/household) of adults and 1.4% (p/household) of the 12-17 y.o. age group on average.
- Processing involves 1.4% (p/household) of adults and 0.5% (p/household) of the 12-17 y.o. age group on average
- Marketing involves 0.7% (p/household) of adults and 0.5% (p/household) of the 12-17 y.o. age group on average.

8.3 AGE GROUPS IN FLOODPLAIN NATURAL RESOURCE ACTIVITIES

Adults, 12 to 17 year-olds and younger children are engaged in floodplain resource activities. A fair proportion of 30.9% p/household of adults are fully engaged of whom 9.5% are full involved and 21.4% partially involved. In the 12-17 y.o. age group, a significant proportion of 27% p/household are engaged, split almost evenly between being fully involved and partially involved. Also noteworthy and significant is the contribution of the 6-11 y.o. group with 9.0% p/household involved. Among adults, 33.3% of male p/household and 28.6% of female p/household are involved.

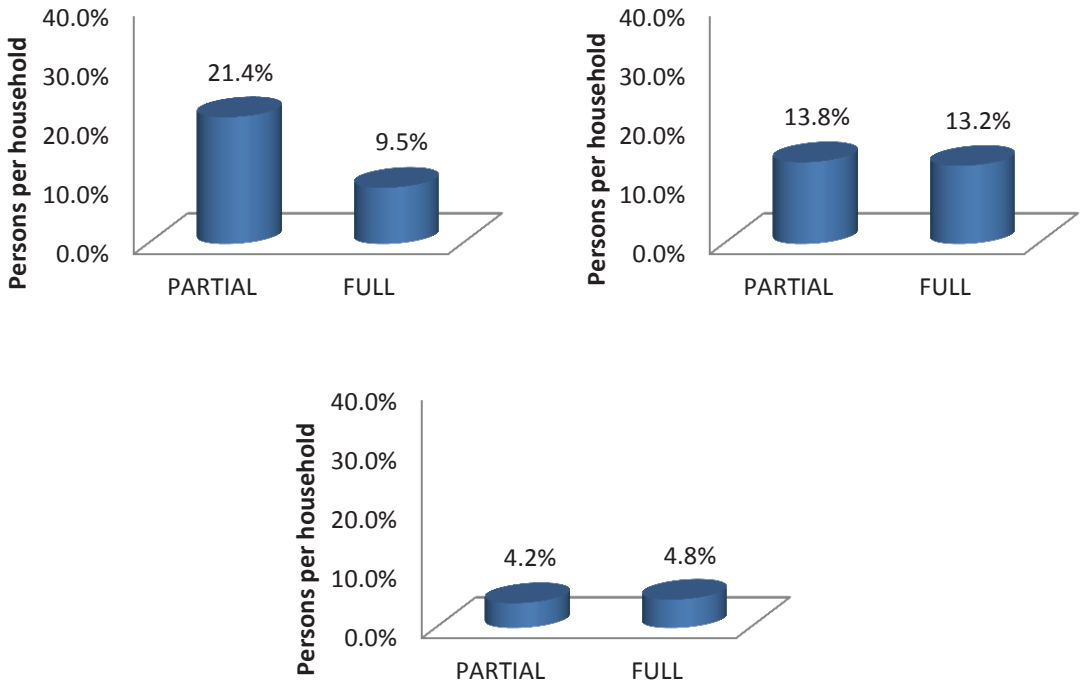


Figure 28 . Involvement in floodplain natural resource collection – adults (upper left), 12 to 17-year-olds (upper right) and 6 to 11-year-olds (bottom)

On average, 17% of adults and 8% of 12 to 17-year-olds are engaged in processing floodplain natural resources, a vast majority of whom are female. Marginal involvement (4.5% p/household) is reported for marketing-related activities among adults. Among the 16.5% p/household of adults engaged, 11.4% p/household are partially involved and 5.0% p/household are fully involved. A symmetric pattern of involvement is observed for the 12-17 y.o. group, where 6.5% p/household are fully involved and 1.6% p/household are partially involved. Among adults, 25.4% of female p/household and 7.0% of male p/household are involved.

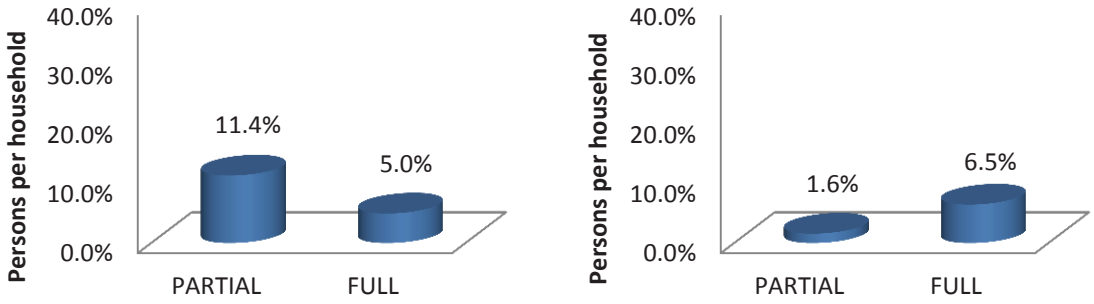


Figure 29. Involvement in floodplain natural resource processing – adults (left) 12 to 17-year-olds (right)

8.4 AGE GROUPS IN FARMING AND LIVESTOCK ACTIVITIES

About half of the adults and a third of the 12 to 17-year-olds engage in rice farming. Among the adults of 50.9% p/household, 39.0% p/household are partially involved and 11.9% p/household are fully involved. A symmetric pattern of involvement is observed for the 12-17 y.o. group, where 22.6% p/household are fully involved and 9.2% p/household are partially involved. Some level of involvement is also reported in younger age groups – 3.5% p/household of the 6-11 y.o. group and 0.9% p/household of the 0-5 y.o. group. Among adults, 53.8% of male p/household and 49.5% of female p/household are involved.

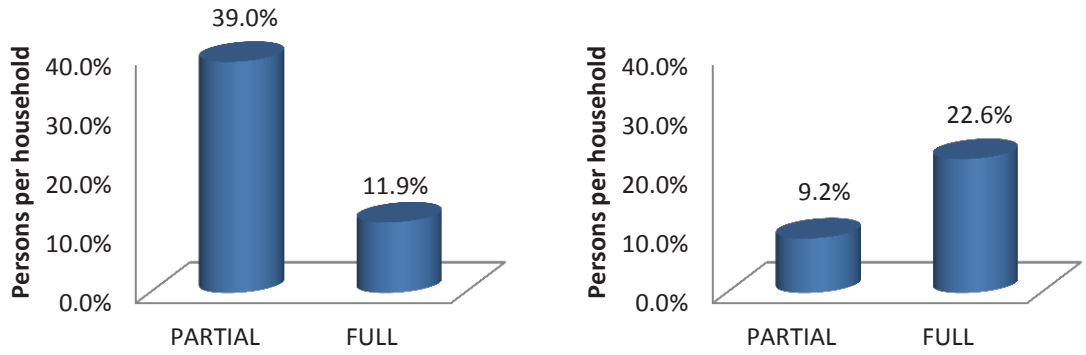


Figure 30. Involvement in rice farming – adults (left) and to 12 to 17-year-olds (right)

On average, 25% of adults and 20% of 12 to 17-year-olds are engaged in *chamka* crops. Among adults, 19.8% p/household are partially involved and 5.6% are fully involved. Again, a symmetric pattern of involvement is observed for the 12-17 y.o. group where 13.7% p/household are fully involved and 4.8% p/household are partially involved. Some level of involvement is also reported in younger age groups – 4.8% p/household in the 6-11 y.o. group and 0.6% p/household in the 0-5 y.o. group. Among adults, 26% of male p/household and 24.7% of female p/household are involved.

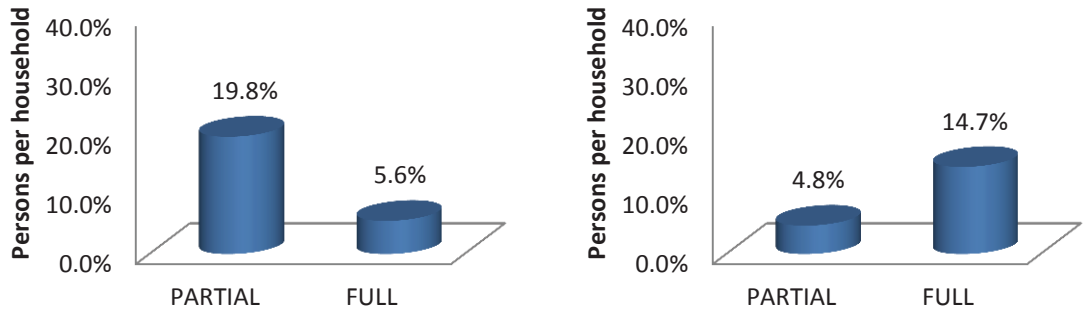


Figure 31. Involvement in *chamka* crops – adults (left) and 12 to 17-year-olds (right)

Thirty percent of adults engage in orchard and homestead gardening. On average, 17.6% p/household are partially involved and 12.4% p/household are fully involved. Again, a symmetric pattern of involvement is observed for the 12-17 y.o. group where 14.5% p/household are fully involved and 3.1% p/household are partially involved. Some involvement is also reported in younger age groups – 3.1% p/household in the 6-11 y.o. group and 0.4% p/household in the 0-5 y.o. group. Among adults, 31.6% of female p/household and 29.3% of male p/household are involved.

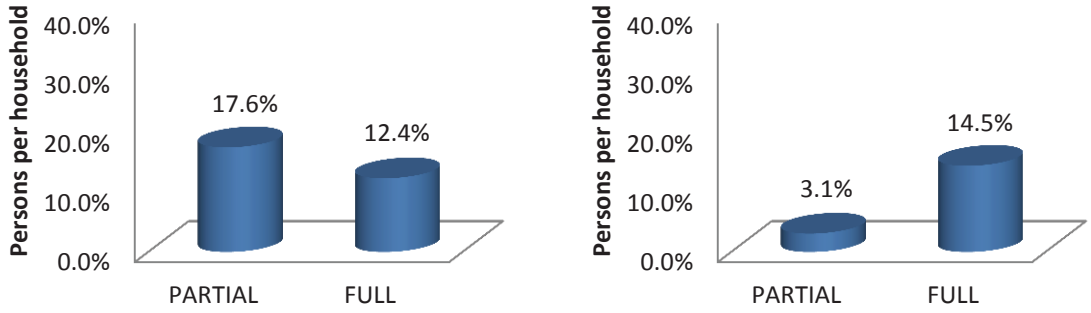


Figure 32. Involvement in homestead gardening – adults (left) and 12 to 17-year-olds (right)

Thirty-six percent of adults, 28.5% of 12 to 17-year-olds and 7.8% of 6-11-year-olds are engaged in tending cattle. Of the adults, 14.6% p/household are fully involved and 21.4% p/household partially involved. In the 12-17 y.o. group, 19.9% p/household are fully involved and 8.6% p/household partially involved. Among adults, 38.9% of male p/household and 33.1% of female p/household are involved.

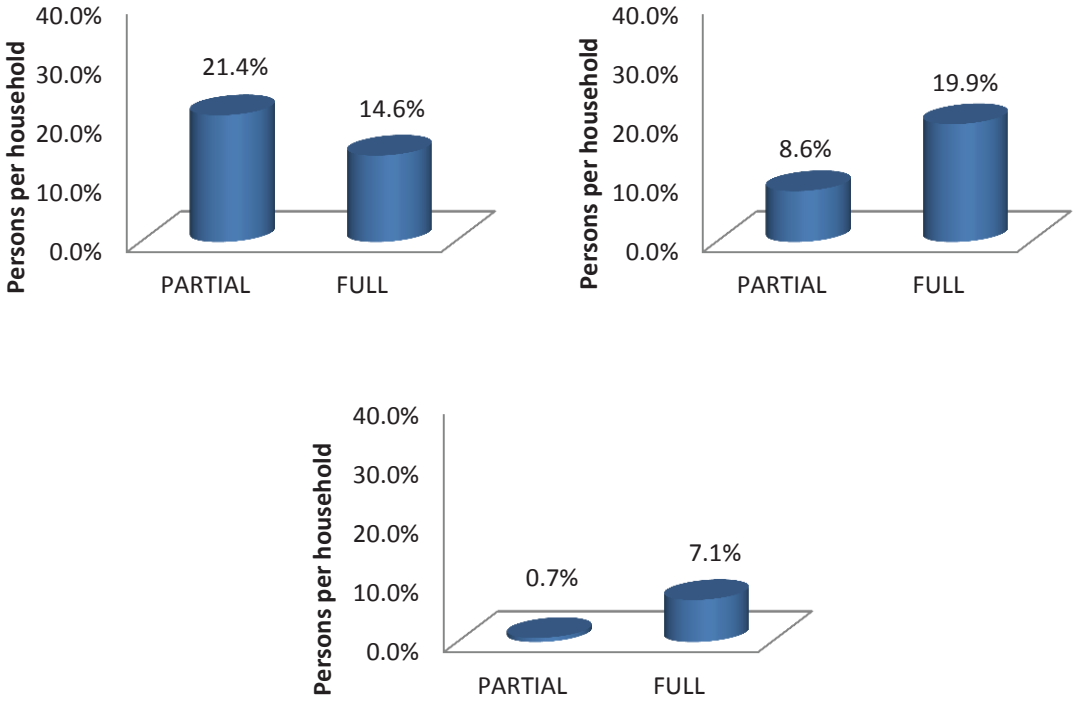


Figure 33. Involvement in tending cattle – adults (upper left), 12 to 17-year-olds and 6-11-year-olds (bottom)

Among average households, 49.5% of adults, 40% of 12 to 17-year-olds and 12.5% of 6 to 11-year-olds are engaged in poultry farming. Of the adults, 26.4% p/household are involved partially and 23.1% p/household fully. Of the 12-17 y.o. group, 33.9% p/household are fully involved and 6.4% p/household partially involved. Among adults, 51.5% of female p/household and 47.5% of male p/household are involved.

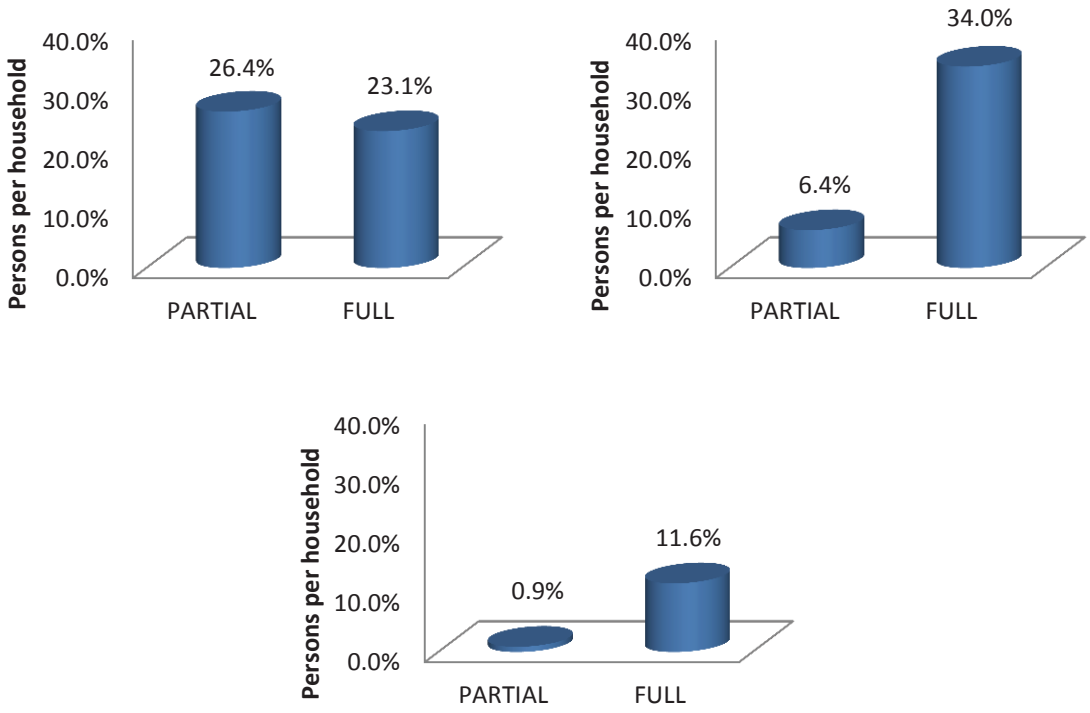


Figure 34. Involvement in poultry farming – adults (upper left), 12 to 17-year-olds (upper right) and 6 to 11-year-old (bottom)

On average, 16.8% of adults and 14% of 12 to 17-year-olds are engaged in other kinds of livestock farming. Among the adults, 8.9% p/household are involved partially and 7.9% p/household fully. Within the 12-17 y.o. age group, an average of 11.9% p/household are fully involved and 1.6% p/household partially involved. For the 6-11 y.o. age group, 3.2% are involved. Among adults, 15.8% of male p/household and 17.8% of female p/household are involved.

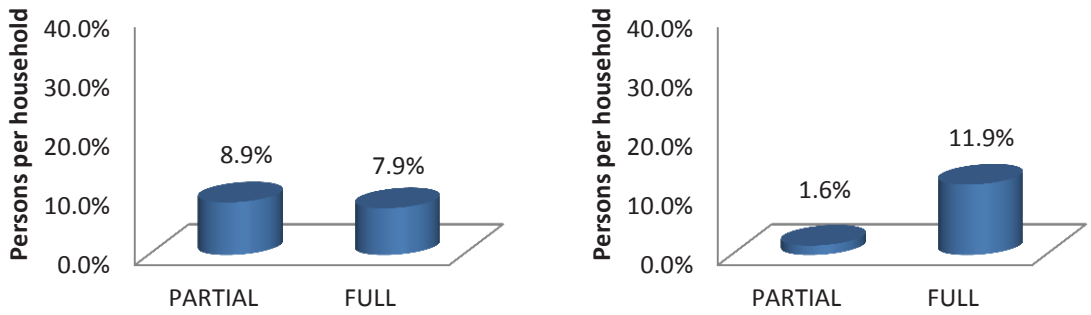


Figure 35. Involvement in other livestock farming – adults (left) and 12 to 17-year-olds (right)

8.5 AGE GROUPS IN TERRESTRIAL NATURAL RESOURCES ACTIVITIES

A significant proportion of 39.8% of adults and 28% of 12 to 17-year-olds collect terrestrial natural resources for home use. Among the adults, 26.0% p/household are partially involved and 13.8% p/household fully involved. In the 12-17 y.o. group, 14.7% p/household are involved fully and 13.4% p/household partially. In the 6-11 y.o. group, 5.8% p/household are involved. Among adults, 47.1% of male p/household and 32.9% of female p/household are involved.

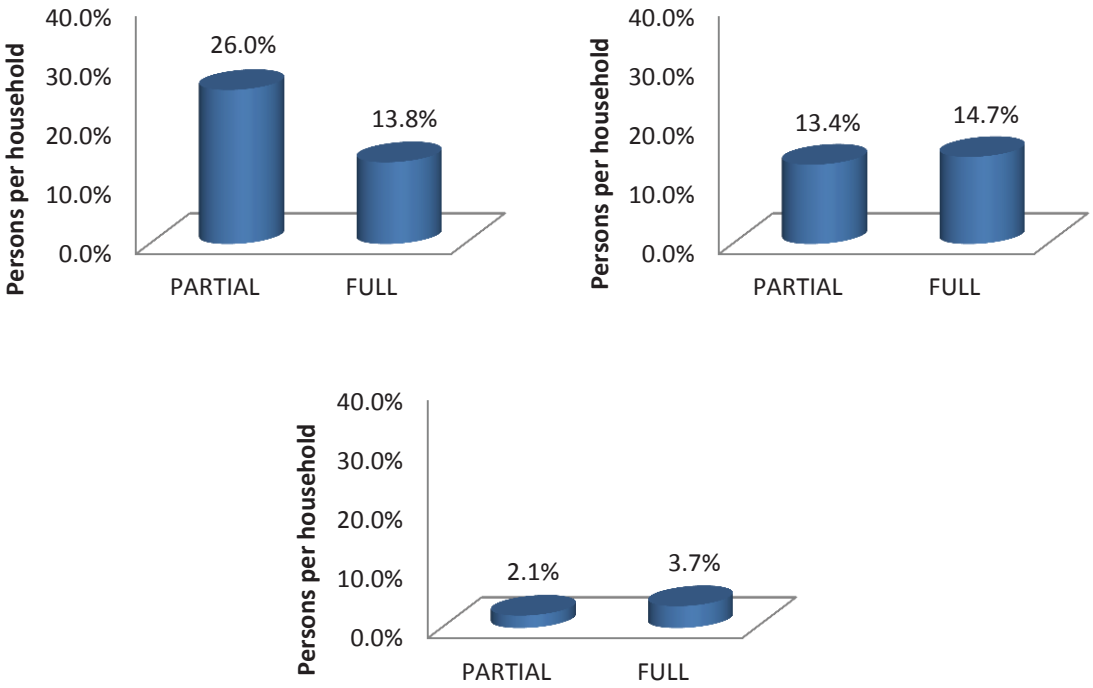


Figure 36. Involvement in terrestrial resource collection for home use – adults (upper left), 12 to 17-year-olds (upper right) and 6 to 11-year-olds (bottom)

8.6 DISCUSSION ON INVOLVEMENT IN LABOR BY AGE GROUPS

This section compares the three older age groups: adults (18 years and older), largely autonomous 12 to 17-year-olds who contribute to work or food gathering and younger children aged 6 to 11 years who are partly autonomous but not contributing significantly to work or food gathering.[22]

Across the three zones and four dependency groups, adults and 12 to 17-year-olds appear to engage in a diversified range of activities. Highest levels of involvement are noted in poultry farming with 1.4

[22] Expectedly, the involvement of the 0-5 y.o. group (babies, toddlers and young children who are non-autonomous and constrain their mother's actions) in labor is null or marginally small, and therefore not considered in the present analysis.

full-involvement equivalent[23] per household and rice farming with 1.1 FIE[24] per household on average, with the former also attracting the highest involvement of younger children. In decreasing order of FIE, adults and 12 to 17-year-olds contribute a significant share of labor to tending cattle (cows and buffalos), firewood and natural product collection for household use, orchard/homestead gardening, floodplain resource collection, *chamka* crops, other livestock activities, fishing and collecting timber and other natural products collection to sell — see table below.

Table 23. Involvement in primary activities by age group

Involvement	% Of household members involved in 18+ Group	% Of household members involved in 12-17 Group	% Of household members involved in 6-11 Group
Poultry farming	50%	40%	12%
Rice farming	51%	32%	4%
Cattle farming (cow and buffalo)	36%	28%	8%
Firewood and natural product collection for household use	40%	28%	6%
Orchard/homestead gardening	30%	18%	3%
Floodplain resource collection	31%	27%	9%
Chamka crops	25%	19%	5%
Other livestock activities	17%	13%	3%
Capturing fish	22%	17%	4%
Timber and natural products collection for selling purpose	5%	2%	0.10%
Aquaculture	2%	1%	0.04%

Another noteworthy finding is the pattern of labor allocation within adults and 12 to 17-year-olds, where surveys reflect partial involvement as the dominant scheme for adults and full-involvement for the 12 to 17-year-olds — as illustrated by most charts from Sections 8.1 to 0. This may be explained by the predominance of natural environment-independent activities i.e. jobs on average household annual net income — jobs mobilizing most of the time among the adult age group. On the other hand, households may find it more productive to train 12 to 17-year-olds to specialize in a given area rather than diversify across a variety of areas, deliberately allocating them to be fully involved in their area of specialization.

[23] Full-involvement equivalent was calculated by considering a full-involvement/partial involvement labor ratio of 1/3 (meaning that the quantity of labor produced by three household members partially involved is equivalent to the quantity of labor produced by a single household member fully involved).

[24] The FIE abbreviation is used throughout this report for “full-involvement equivalent”

9 COMPARISONS ACROSS AGRO-ECOSYSTEMS

9.1 AVERAGE HOUSEHOLD PRODUCTION AND INCOME IN EACH AGRO-ECOSYSTEM

Natural environment-independent activities are the primary sources of household income in all three zones. Average annual household net incomes of USD 4 278 in the Lowland zone and USD°3°694 in the Tonle Sap are both greater than in the Upper Mekong zone where the average is USD°2 682. Businesses and jobs are the primary sources of household income in all zones, representing 50% to 63% of net income. Among environment-dependent activities, significant net incomes are derived from capture fisheries, livestock and rice farming but relative levels vary. The highest average net incomes for households are from capture fisheries in the Tonle Sap zone (USD 255 per year), livestock in the Upper Mekong (USD 261 per year) and rice farming in the Lowlands (USD 443 per year).

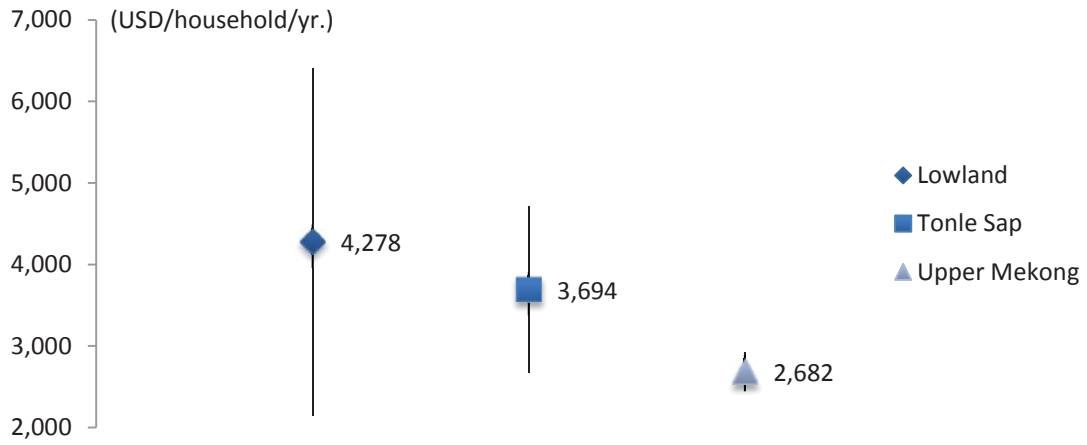


Figure 37. Household net income across agro-ecological zones (USD/household/yr.) Vertical bars represent 95% confidence intervals of mean estimates

Tonle Sap households derive USD 2 367 per year from natural environment-independent activities (predominantly jobs) while Lowland households generate USD 2 181 and Upper Mekong households USD 1 436 net income on average. Capture fisheries, livestock and rice farming appear as the topmost sources of net income from natural environment-dependent activities but relative levels vary:

- On average Tonle Sap households, capture fisheries are predominant with USD 255 in net annual income followed by livestock with USD 114 and rice farming with USD 93.

- On average Upper Mekong households, livestock is predominant with USD 261 in net annual income which is significantly higher compared with mean estimates of net income from livestock in Tonle Sap and Lowland households [α = 0.05 significance] and followed by capture fisheries with USD 160 and rice farming with USD 11.90.
- On average Lowland households, rice farming is predominant with USD 443 in annual net income followed by livestock with USD 98.40 and capture fisheries with USD 61.70.

Less prevalent but generating positive and comparable net incomes are aquaculture and floodplain resource collection activities — with a small dominance of the former over the latter in both the Tonle Sap and Upper Mekong zones. Surveys reflect losses from fish processing and terrestrial resource collection across all three zones except terrestrial resource collection in Lowland households, which barely exceeds zero.

To compare contributions of economic activities to net income across all three zones, contribution ratios were determined for all households in a zone. Results expressed as percentages in Figure 39, Figure 41 and Figure 43 below reinforce the economic role of capture fisheries in the Tonle Sap zone where it is the primary source of income from natural environment-dependent activities and represents almost 7% of net income. Capture fisheries contribute 6% of net income in Upper Mekong households but only 1.4% in Lowland households.

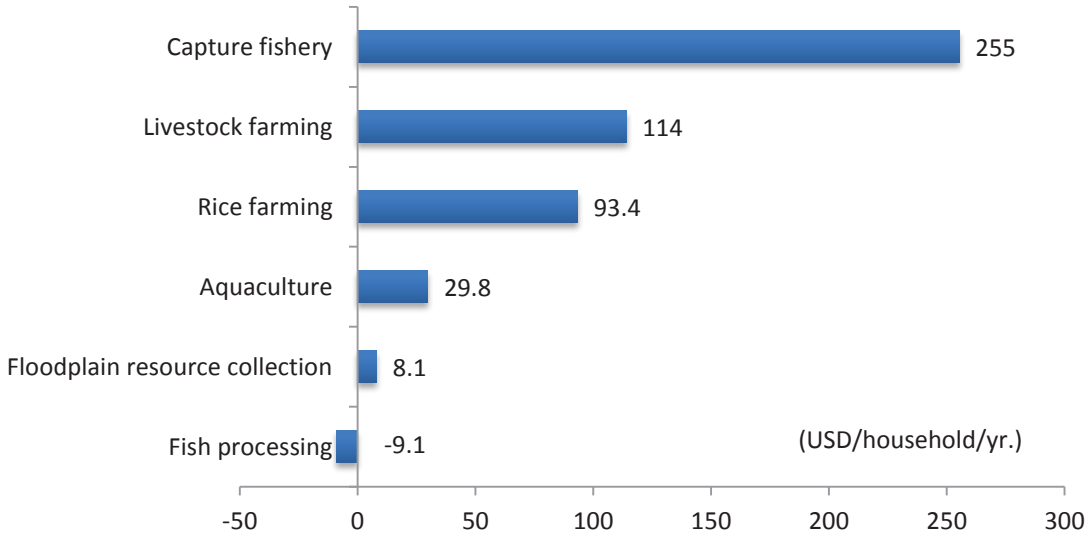


Figure 38. Tonle Sap agro-ecosystem — net income from environment-dependent activities (USD/household/yr.)

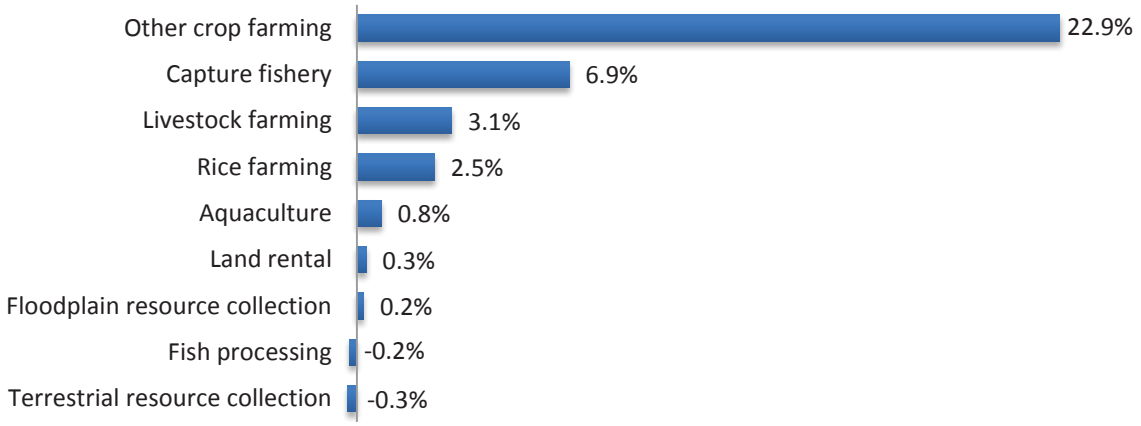


Figure 39. Contribution of activities to total net income — Tonle Sap

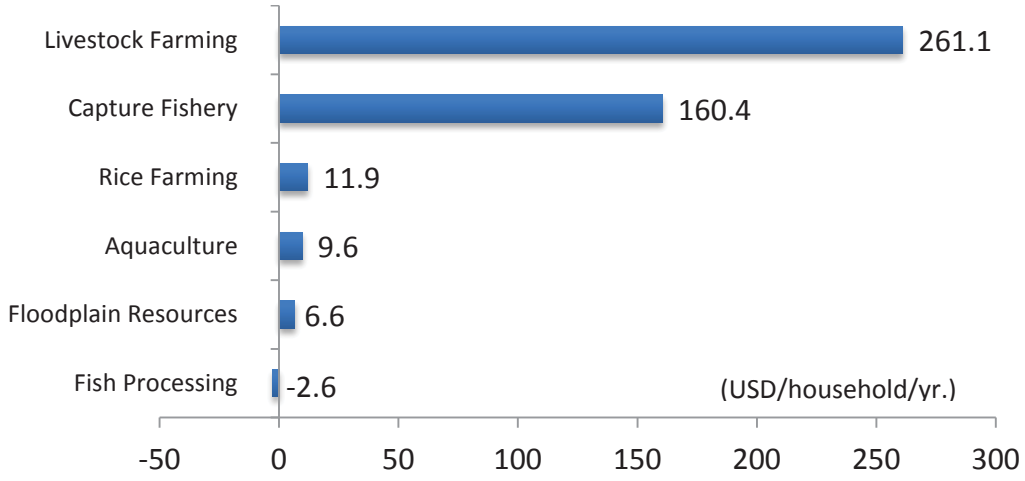


Figure 40. Upper Mekong agro-ecosystem — net income from environment-dependent activities (USD/household/yr.)

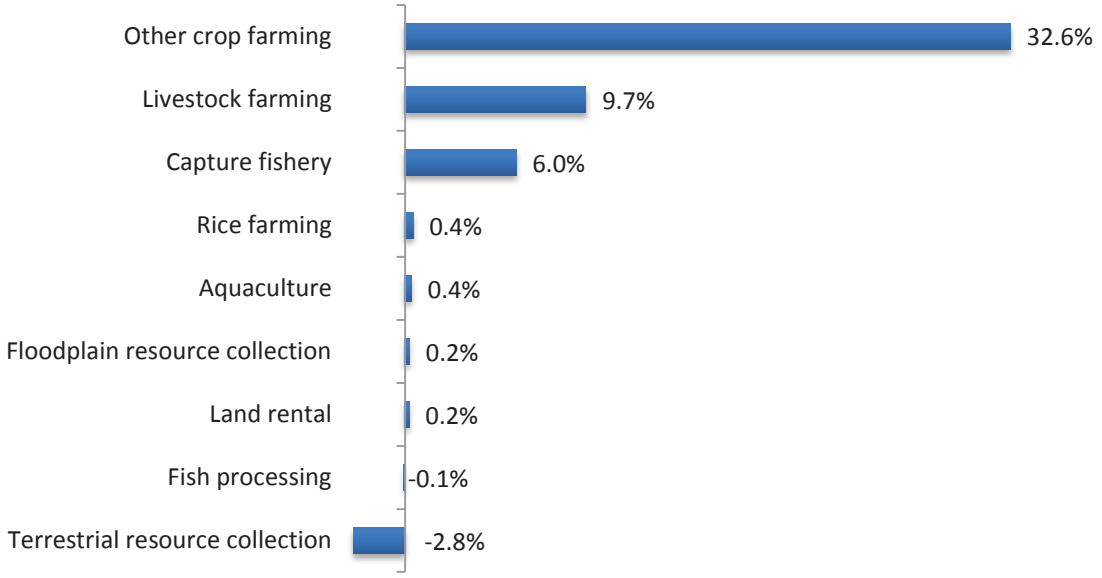


Figure 41. Contribution of activities to total net income — Upper Mekong

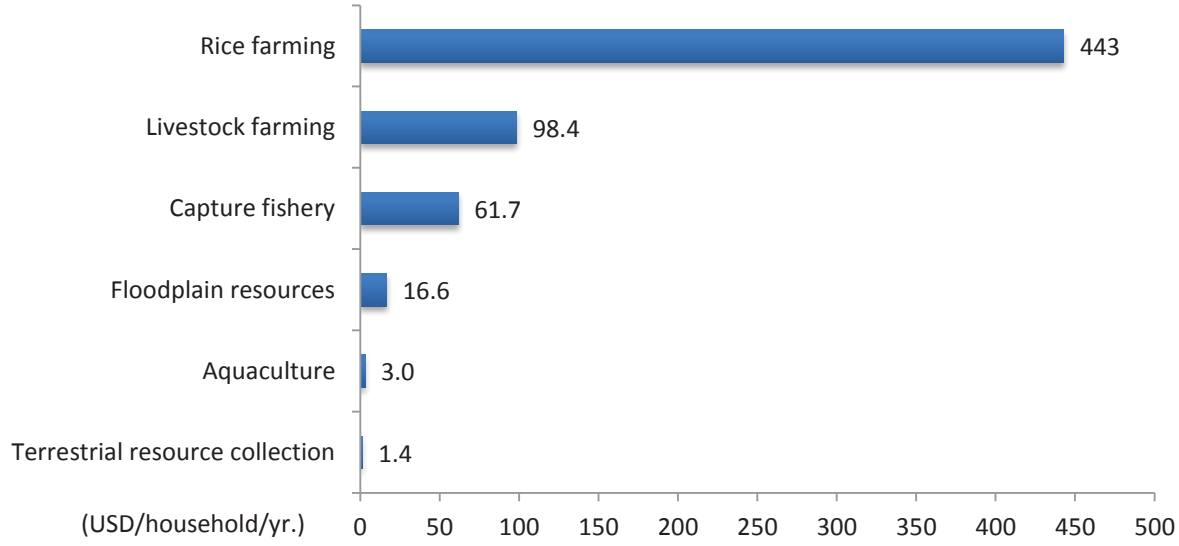


Figure 42. Lowland agro-ecosystem —net income from environment-dependent activities

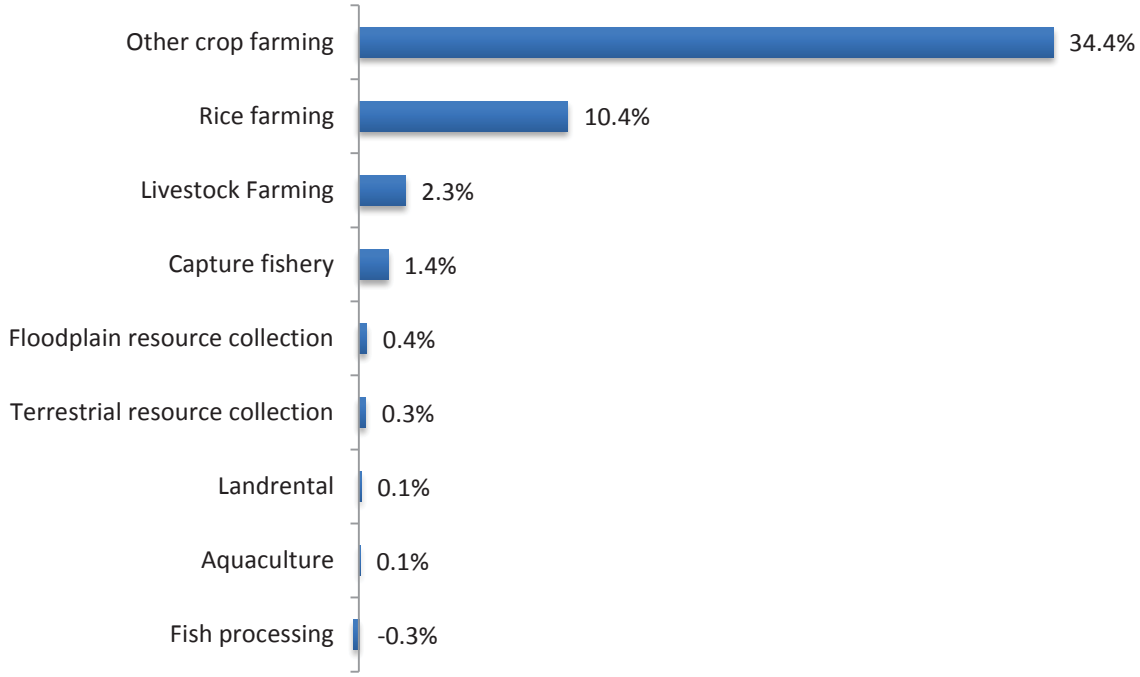
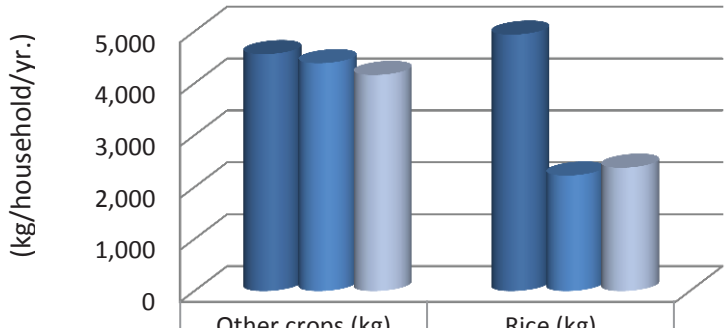


Figure 43. Contribution of activities to total net income — Lowlands

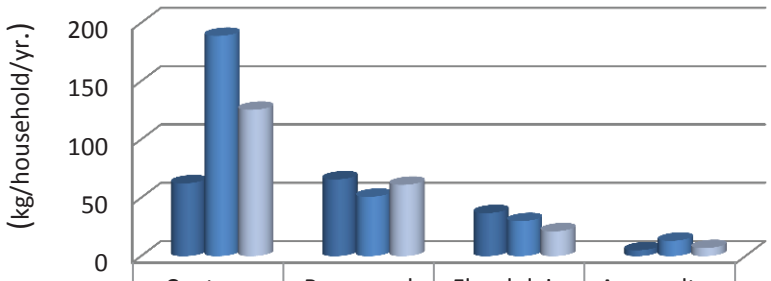
Tonle Sap households market the highest quantity of fish per year with 189 kg of capture fish and 27 kg of aquaculture fish, followed by Upper Mekong households with 125 kg of capture fish and 11 kg of aquaculture fish and Lowland households with 62 kg of capture fish and 2 kg aquaculture fish.

Rice prevails in the Lowland zone with 4 941 kg per year which compares with 2 377 kg/yr for Upper Mekong households and 2 227 kg/yr for Tonle Sap households. Variability of production is high and confidence intervals broad within each zone (thereby precluding establishing statistical significance of differences between means across the three zones).



	Other crops (kg)	Rice (kg)
Lowland	4,565	4,941
Tonle Sap	4,390	2,227
Upper Mekong	4,164	2,377

Figure 44. Production of rice and other crops (kg/household/yr.)



	Capture fish (kg)	Processed fish (kg)	Floodplain resources (kg)	Aquaculture fish (kg)
Lowland	62	66	37	5
Tonle Sap	189	51	30	13
Upper Mekong	125	61	21	7

Figure 45. Production of capture fish, processed fish, floodplain resources and aquaculture fish (kg/household/yr.)

9.2 HOUSEHOLD ASSETS AND DEBT IN EACH AGRO-ECOSYSTEM

Although households possess comparable asset values across zones, Upper Mekong household debt is significantly lower than the debt of Tonle Sap and Lowland households. Average household asset values are USD 13 467 in the Tonle Sap zone, USD 12 988 in the Lowland zone and USD 12 650 in the Upper Mekong zone. Lowland households incur the highest debt of USD 636 on average followed by Tonle Sap households at USD 372 and Upper Mekong households at USD 200, which is significantly lower than the other two zones [α = 0.05 significance].

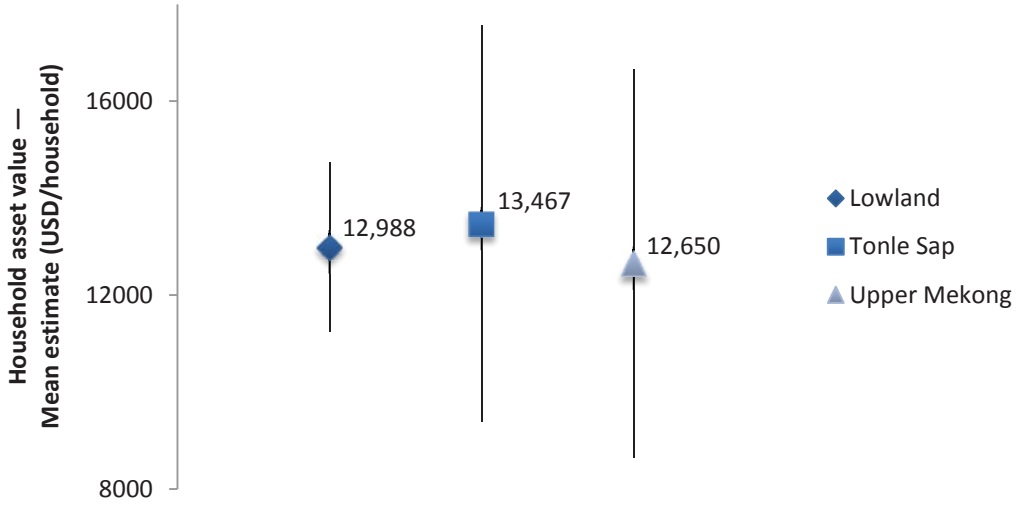


Figure 46. Household total land/capital/asset value by agro-ecological zone (USD/household)
Vertical bars represent 95% confidence intervals of mean estimates.

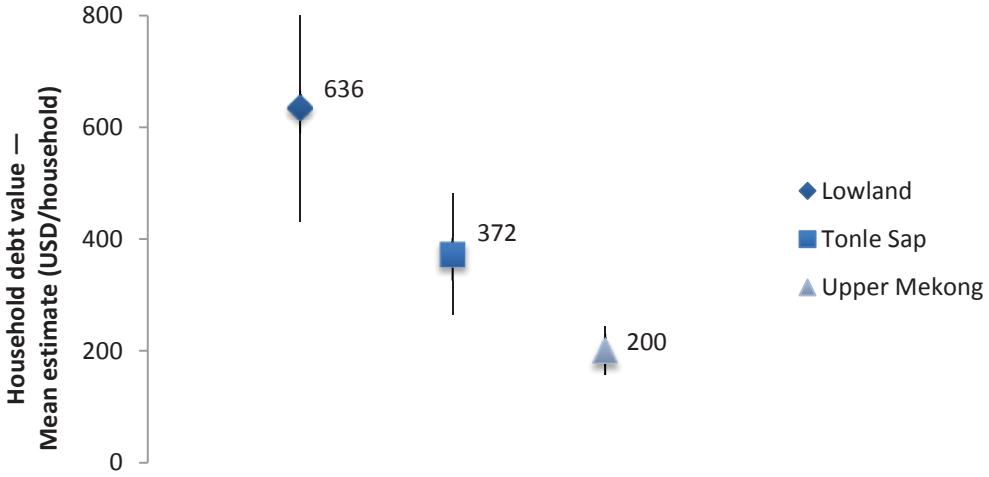
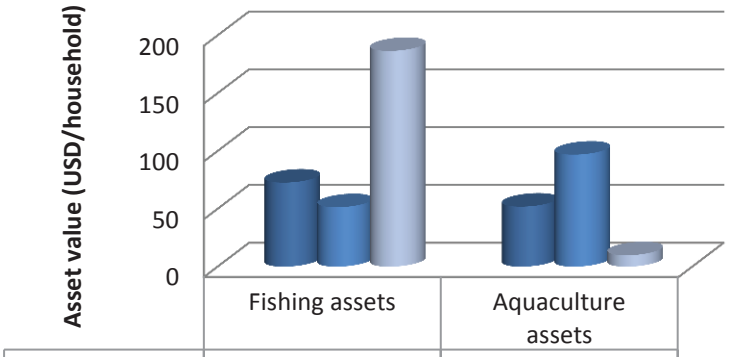


Figure 47. Household debt value by agro-ecological zone (USD/household) Vertical bars represent 95% confidence intervals of mean estimates.

Upper Mekong household fishing assets are the most valuable at USD 187 followed by those in the Lowland zone at USD 73 and the Tonle Sap zone at USD 51. Conversely, the most valuable aquaculture assets are in Tonle Sap households (USD 97) and Lowland households (USD 52). The average value of Upper Mekong household aquaculture assets of USD 10 is significantly lower than in the other two zones [α = 0.05 significance].



	Fishing assets	Aquaculture assets
Lowland	72.7	51.9
Tonle Sap	51.4	96.9
Upper Mekong	186.6	9.9

Figure 48. Average value of household fishing/aquaculture assets by agro-ecosystem (USD/household)

Agriculture and other business activities except fishing are the top two reasons for incurring debt regardless of geographic location — up to USD 206 in debt value[25] for business activities other than fishing or agriculture in the Lowland zone. Households do not seem to consider fishing worthy of debt-financed investment. Even in the Tonle Sap zone, where households derive the highest net income from fishing activities, the value of debt to support fishing is only USD 8.50 on average.

Among secondary debt purposes, noticeable variations are observed across zones. Average Lowland household debt ranks first or almost first for purchasing or improving dwellings (USD 54), consumer durables (USD 47), servicing other debt (USD 44), consumer perishables (USD 36) and family rituals (USD 17). Upper Mekong households tend to adopt the most frugal behavior, resorting to debt because of accidents/injuries/illnesses (USD 19), consumer perishables (USD 8) and servicing other debt (USD 8) which suggests a higher level of economic vulnerability.

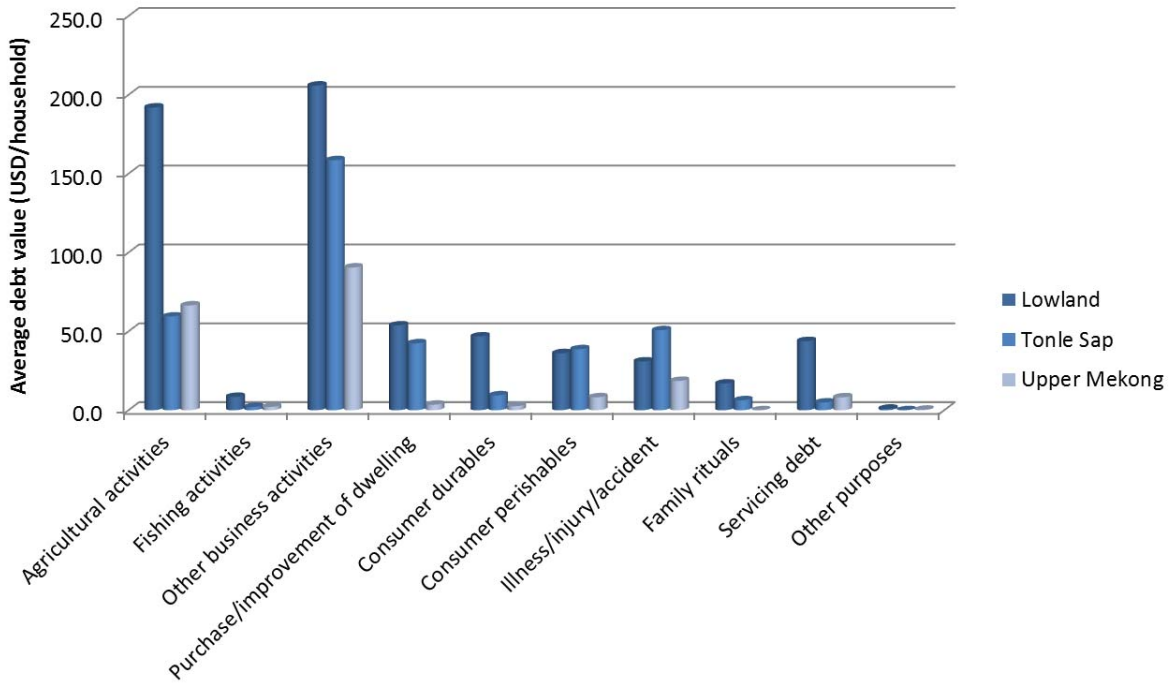


Figure 49. Household debt purpose and value by agro-ecological zone

[25] "Debt value" is to be understood here as the amount due at the time of respondent interviews. The same meaning applies throughout this report.

9.3 RESILIENCE OF HOUSEHOLDS IN EACH AGRO-ECOSYSTEM

In the face of adversity, reducing consumption of food is the most popular strategic option for households across all three zones followed by spending cash savings. Interestingly, the third most frequently quoted option is "unspecific" (no specific strategy). Of the households that incur shocks, these three options are elicited by 20% to 31% of households on average (see Table 24, Table 25 and Table 26 below[26]). Then come two strategic options at varied orders of priority but with comparable levels across zones, namely decreased consumption of non-essential goods (3% of households) and money borrowed from financial institutions (13% of households). Secondary priorities adopted by less than 5% of households on average include a mix of strategic options, namely:

- increasing income (increasing farming, livestock or wage labor activity; engaging a new household member in work)
- increasing debt (borrowing money from financial institution or money lender)
- reducing household spending.

Table 24. Household coping strategies — Lowland

Lowland households — Strategic options	Of the Lowland households that incurred a shock, % of HH that employed strategic option
Spent cash savings	25%
No specific strategy	20%
Decreased amount of meat consumption	12%
Decreased food consumption (other than rice, meat and fish)	12%
Decreased consumption of non-essential goods	10%
Borrowed money from financial institution	6%
Decreased amount of fish consumption	6%
Borrowed money from money lender	2%
Increased household wage labor activity	2%
Reduce household spending	2%
Engaged a new household member in the world of work	2%
Decreased amount of rice consumption	2%
Sub-Total of Decreased food items	**31%**
Total	100%

[26] The column of percentages represents only those households from the previous column that incurred a shock.

Table 25. Household coping strategies — Tonle Sap

Tonle Sap households — Strategic options	Of the Tonle Sap households that incurred a shock, % of HH that employed strategic option
Spent cash savings	25%
No specific strategy	21%
Decreased food consumption (other than rice, meat and fish)	15%
Decreased consumption of non-essential goods	13%
Decreased amount of meat consumption	10%
Borrowed money from financial institution	4%
Sold productive household assets	2%
Borrowed money from money lender	2%
Received support from NGO	2%
Increased household farming activity	2%
Reduce household spending	2%
Decreased amount of fish consumption	2%
Sub-Total of Decreased food items	**27%**
Total	100%

Table 26. Household coping strategies — Upper Mekong

Upper Mekong households — Strategic options	Of the Upper Mekong households that incurred a shock, % of HH that employed strategic option
Spent cash savings	23%
No specific strategy	22%
Decreased amount of meat consumption	13%
Decreased food consumption (other than rice, meat and fish)	12%
Decreased consumption of non-essential goods	10%
Decreased amount of fish consumption	5%
Borrowed money from financial institution	3%
Received support from NGO	3%
Increased household farming activity	3%
Increased household livestock activity	3%
Borrowed money from money lender	1%
Increased household wage labor activity	1%
Reduce household spending	1%
Decreased amount of rice consumption	1%
Sub-Total of Decreased food items	**31%**
Total	100%

9.4 INVOLVEMENT IN ACTIVITIES BY HOUSEHOLDS IN EACH AGRO-ECOSYSTEM

With regard to labor allocation, poultry farming predominates in each zone followed by a diverse range of activities. Poultry farming mobilizes an average full involvement equivalent (FIE)[27] of 1.8 in Upper Mekong households which is significantly higher [α = 0.05 significance] compared with Tonle Sap households with 1.4 FIE and Lowland households with 1.3 FIE. Other activities for which average Upper Mekong household FIE effort is significantly higher are collecting terrestrial resources for household use, cattle, rice farming, catching fish, processing floodplain resources and collecting terrestrial resources to sell. See Table 27, 28 and 29.

Table 27. Household level of involvement in economic activities — Lowland

Lowland	FIE mean estimate	95% Confidence interval	
		Lower	Upper
Poultry farming	1.3	1.08	1.54
Rice farming	1.1	0.79	1.42
Processing fish capture	1.0	0.81	1.13
Collecting terrestrial resources for household use	0.8	0.64	0.96
Cattle farming	0.7	0.46	1.02
Orchard/homestead garden farming	0.7	0.45	0.93
Collecting floodplain resources	0.6	0.49	0.75
Chamka farming (horticulture and orchard)	0.5	0.07	0.97
Other livestock activities	0.5	0.23	0.71
Capturing fish	0.4	0.32	0.48
Processing floodplain resources	0.3	0.22	0.39
Marketing fish capture	0.2	0.10	0.31
Marketing floodplain resources	0.1	0.03	0.14
Collecting terrestrial resources for sales purpose	0.1	0.01	0.09
Aquaculture production	0.0	0.01	0.05
Processing aquaculture production	0.0	0.00	0.05
Marketing aquaculture production	0.0	0.00	0.02

[27] A full-involvement equivalent (FIE) indicator was formed by aggregating household members reporting full involvement with those reporting partial involvement indicator, and by considering a full-involvement/partial involvement labor ratio of 1/3 (meaning that the quantity of labor produced by three household members partially involved is equivalent to the quantity of labor produced by a single household member fully involved).

Table 28. Household level of involvement in economic activities — Tonle Sap

Tonle Sap	FIE mean estimate	95% Confidence interval	
		Lower	Upper
Poultry farming	1.4	1.24	1.66
Cattle farming	1.0	0.73	1.35
Rice farming	1.0	0.77	1.14
Collecting terrestrial resources for household use	0.9	0.66	1.11
Processing fish capture	0.8	0.66	0.93
Orchard/homestead garden farming	0.7	0.57	0.91
Collecting floodplain resources	0.7	0.49	0.89
Chamka crop farming	0.5	0.00	0.94
Capturing fish	0.4	0.32	0.57
Other livestock activities	0.4	0.17	0.56
Processing floodplain resources	0.3	0.19	0.46
Marketing fish capture	0.2	0.12	0.34
Marketing floodplain resources	0.1	0.05	0.16
Collecting terrestrial resources for sales purpose	0.1	0.00	0.18
Aquaculture production	0.1	0.02	0.09
Processing aquaculture production	0.0	0.00	0.06
Marketing aquaculture production	0.0	0.00	0.04

Table 29. Household level of involvement in economic activities — Upper Mekong

Upper Mekong	FIE mean estimate	95% Confidence interval	
		Lower	Upper
Poultry farming	1.8	1.57	2.08
Collecting terrestrial resources for household use	1.6	1.32	1.89
Cattle farming	1.4	1.22	1.61
Rice farming	1.3	1.16	1.52
Collecting floodplain resources	1.3	1.17	1.37
Processing fish capture	1.2	0.80	1.53
Orchard/homestead garden farming	1.1	0.90	1.28
Chamka crop farming	1.0	0.61	1.37
Other livestock activities	0.9	0.50	1.31
Capturing fish	0.8	0.62	0.94
Processing floodplain resources	0.7	0.54	0.86
Marketing fish capture	0.4	0.16	0.72
Collecting terrestrial resources for sales purpose	0.3	0.17	0.37
Marketing floodplain resources	0.1	0.05	0.20
Aquaculture production	0.1	0.00	0.16
Processing aquaculture production	0.0	0.00	0.12
Marketing aquaculture production	0.0	0.00	0.11

9.5 NUTRITION OF HOUSEHOLDS IN EACH AGRO-ECOSYSTEM

In terms of quantity, rice appears as the main household food followed by fish. Rice is consumed daily in all three zones. In the Upper Mekong, household seasonal consumption of fish follows a fairly regular pattern all year as opposed to Tonle Sap and Lowland households whose consumption fluctuates between a peak in November and a trough in April. The proportion of households reporting daily consumption of fish fluctuates between 25% and 30% in the Upper Mekong, dropping to 10% in the Tonle Sap zone and 8% in the Lowland zone (peaking at 29% in the Tonle Sap and 28% in Lowland zones). Between March and July, the proportion of Tonle Sap and Lowland households consuming fish daily is significantly lower compared with Upper Mekong households [α = 0.05 significance].

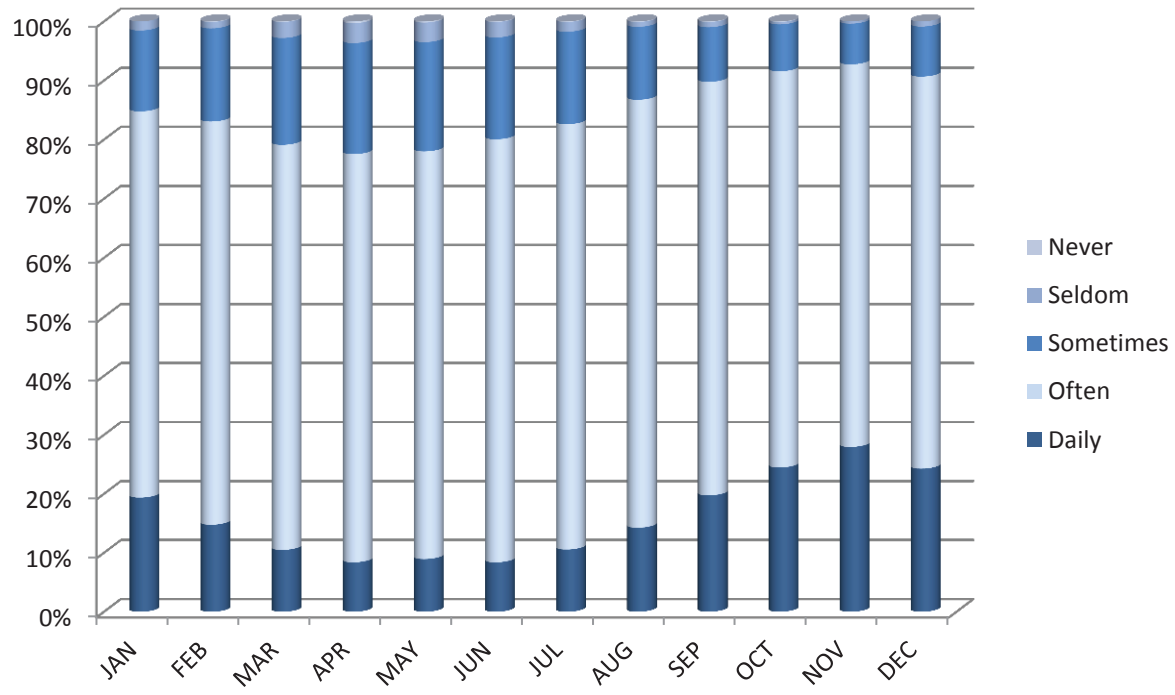


Figure 50. Household monthly consumption of fish — Lowland

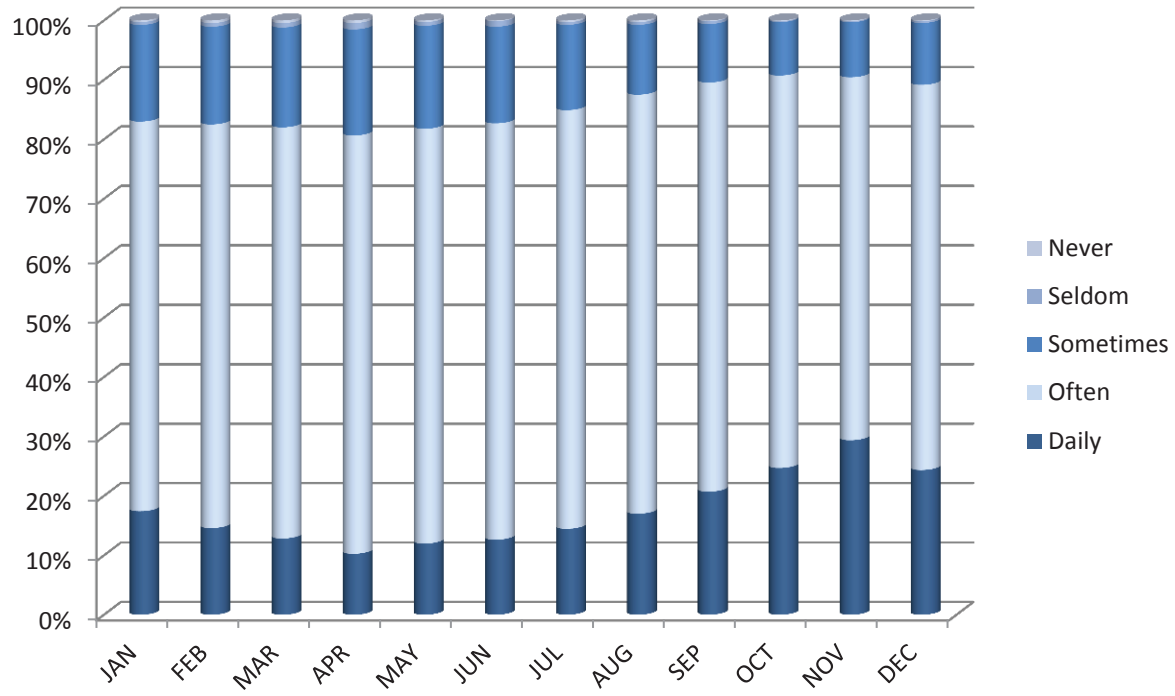


Figure 51. Household monthly consumption of fish — Tonle Sap

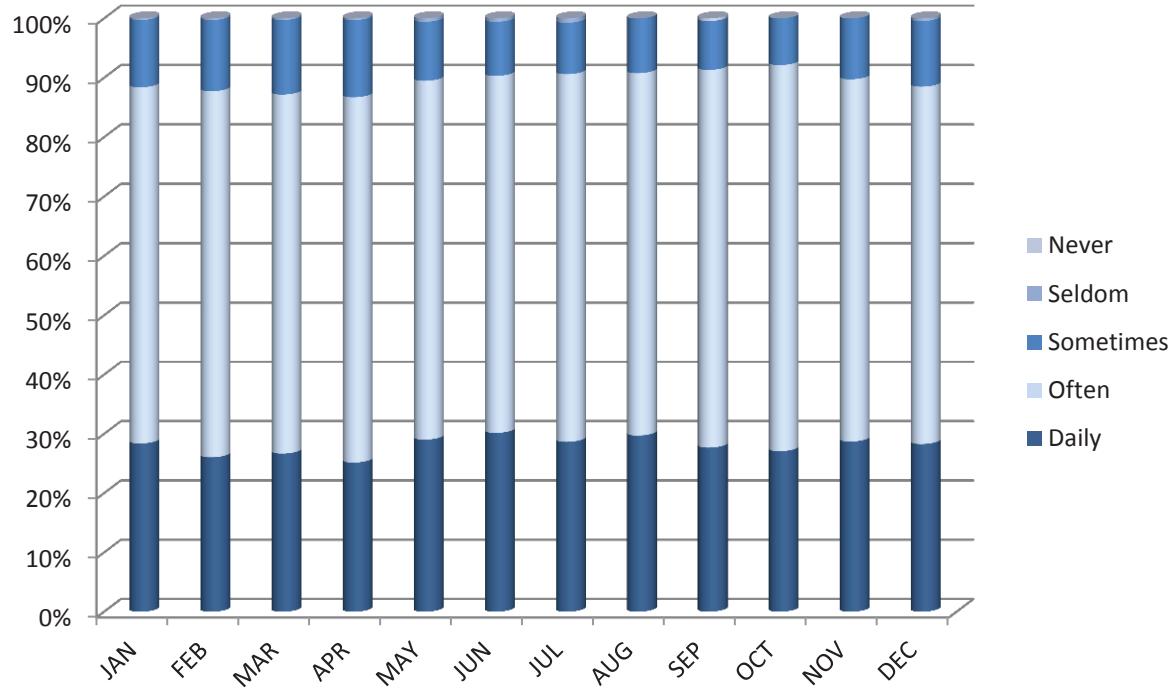


Figure 52. Household monthly consumption of fish — Upper Mekong

Average weekly rice consumption by Upper Mekong households is estimated at 13.8 kg, which is significantly higher compared with Tonle Sap households (11.5 kg) and Lowland households (10.2 kg). Fish stands as the first source of protein. Quantities of snails/other shellfish/crabs/snakes consumed are slightly higher than beef in all three zones.

Rice is consumed daily in all three zones. Fish sauce, prahoc and fish are the most frequent sources of protein. Mean estimates of frequency of fish consumption are 5.5 times per week in Tonle Sap and Lowland households, significantly higher compared with Upper Mekong household fish consumption of 4.4 times per week [α = 0.05 significance].

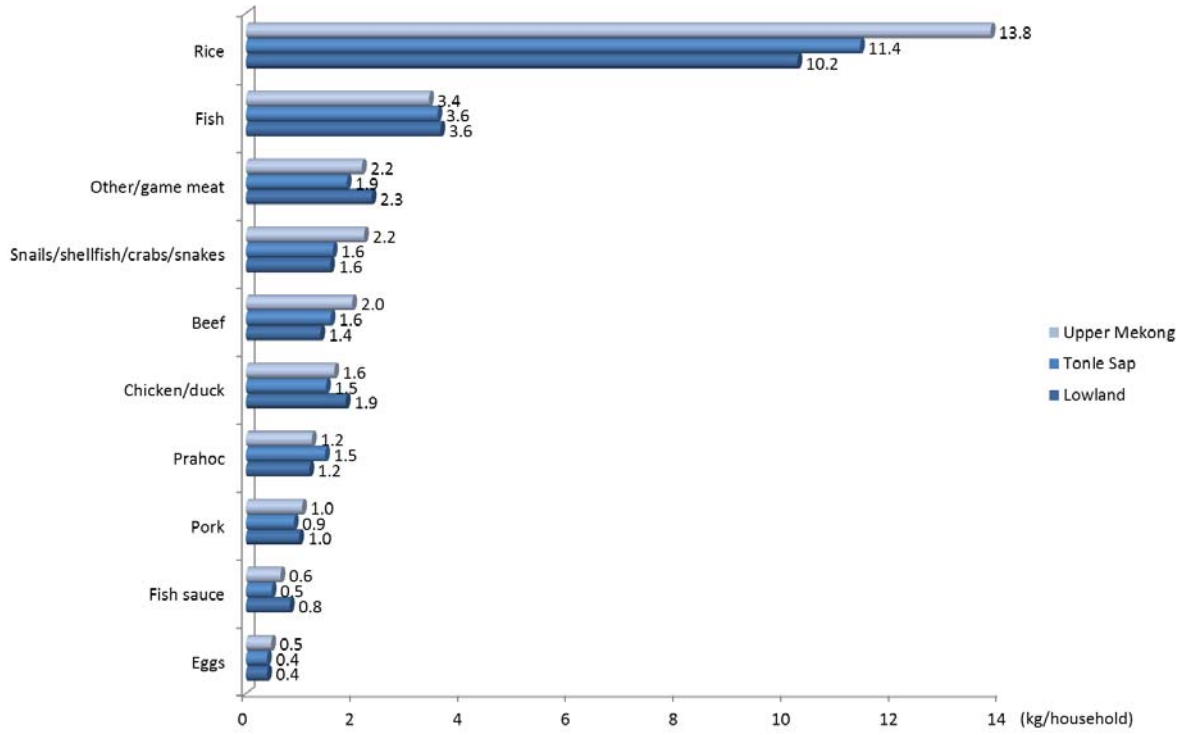


Figure 53. Household weekly food consumption by agro-ecological zone — quantity

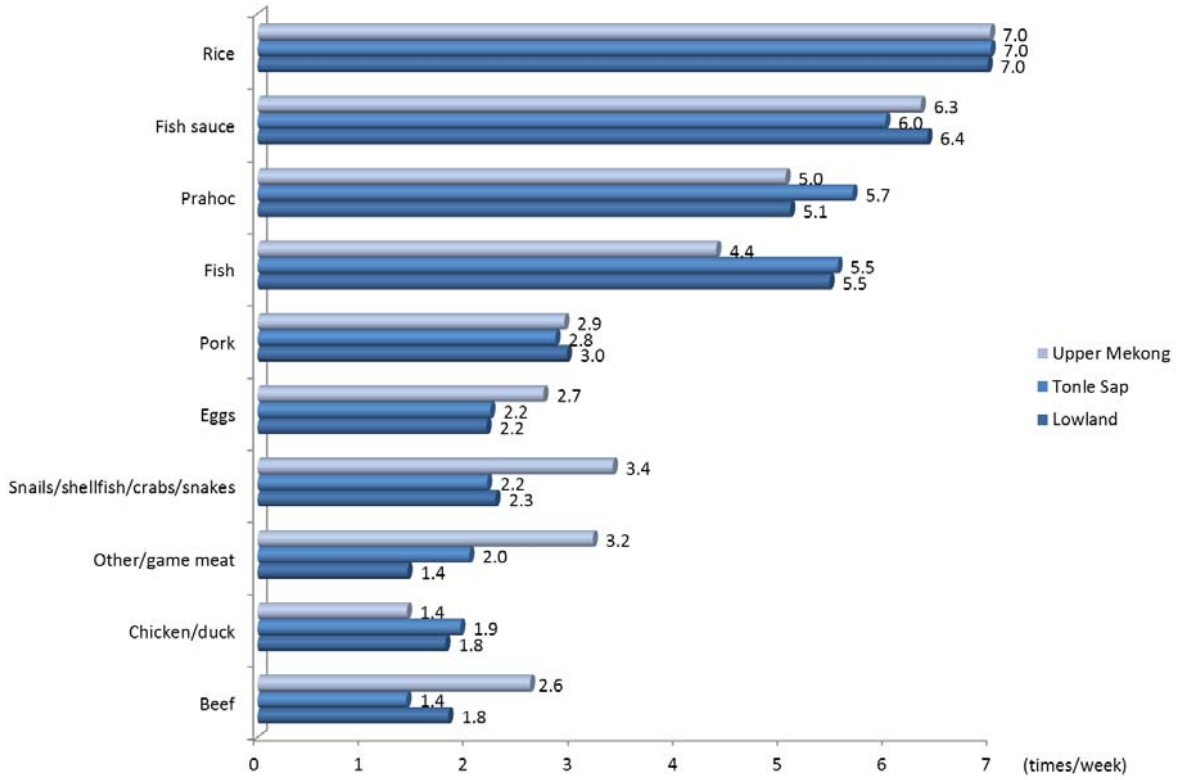


Figure 54. Household weekly food consumption by agro-ecological zone — frequency

9.6 FOOD SECURITY OF HOUSEHOLDS IN EACH AGRO-ECOSYSTEM

Most households in all zones fear food insecurity. Repercussions and mitigation strategies, however, vary across zones. For instance, 37% of Tonle Sap households, 36% of Lowland households and only 10% of Upper Mekong households report engaging in fishing activities to mitigate risks. Barely over 30% of households in each zone report feeling shielded from the risk of food insecurity or seldom facing such a risk[28]. Among those who feel concerned more frequently, 46% of Lowland households, 34% of Upper Mekong households and 23% of Tonle Sap households do so often or daily. As a risk mitigation measure, 37% of Tonle Sap households, 36% of Lowland households and 10% of Upper Mekong households engage in fishing activities; and 33% of Lowland households, 22% of Tonle Sap households and 8% of Upper Mekong households collect floodplain natural resources such as snails, crabs, other shellfish, morning glory, water lilies and wild lotuses. The difference between Lowland and Upper Mekong zones is statistically significant for both activities [α = 0.05 significance].

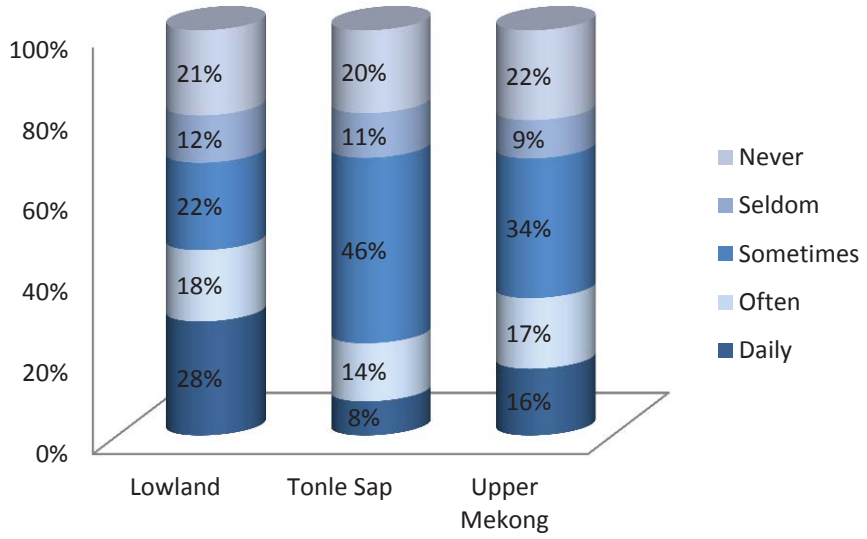


Figure 55. Percentage of households incurring threat of food insecurity

[28] This section presents results for an area of the questionnaire where all questions follow the same formulation, where respondents were asked to rate the frequency of occurrence of a given situation in the past four weeks preceding the interview — "seldom" meaning once or twice; "sometimes" meaning 3 to 10 times; and "often" meaning more than 10 times but less frequent than daily.

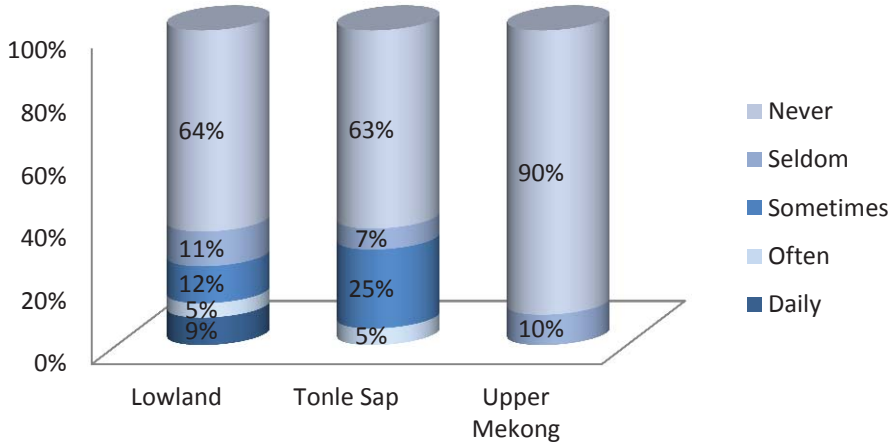


Figure 56. Percentage of households who engaged in fishing as a mitigation measure

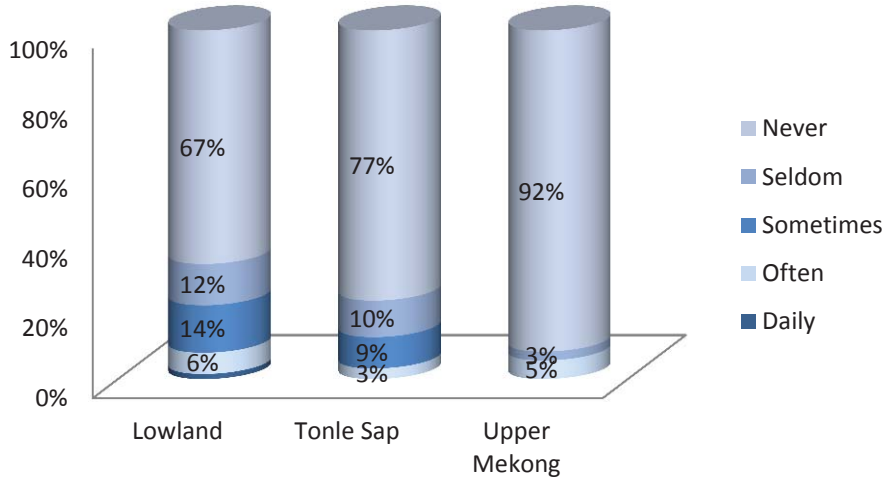


Figure 57. Percentage of households who collected floodplain resources as a mitigation measure

While a vast majority or perhaps all households never suffered food deprivation for 24 consecutive hours[29], a fair proportion reported facing food deprivation to some degree in the four weeks preceding the interview. This amounted to 25% of Tonle Sap households, 24% of Lowland households and 22% of Upper Mekong households.

[29] Mean estimate is over 94% and upper boundary of 95% confidence interval is 100% in either agro-ecological zone for the indicator under scope, opening the likely possibility that the entirety of households in agro-ecological zones under study never had to face food deprivation for a consecutive 24 hours.

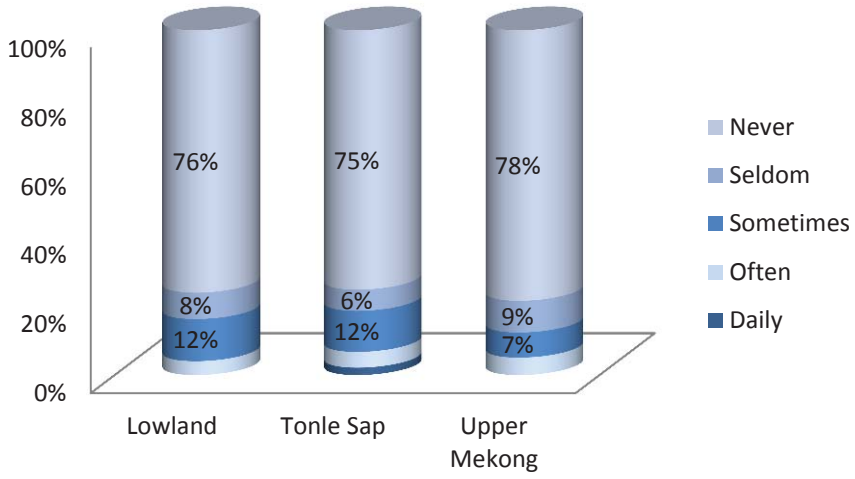


Figure 58. Percentage of households who ever experienced total deprivation of food

A predominant proportion of Tonle Sap (57%) and Lowland households (55%) and a significant proportion of Upper Mekong households (42%) experience severe dietary constraints. This was defined as having to eat daily, often or sometimes foods that they really did not want to eat because of a lack of resources. Incidence of food security tends to follow a similar order of prevalence across the three zones. Compromising on food quantity daily, often or sometimes is reported by 50% of Tonle Sap households, 45% of Lowland households and 34% of Upper Mekong households. Compromising on variety of diet daily, often or sometimes is reported by 49% of Tonle Sap households, 45% of Lowland households and 29% of Upper Mekong households. Compromising on frequency of meals daily, often or sometimes is reported by 46% of Tonle Sap households, 35% of Lowland households and 36% of Upper Mekong households.

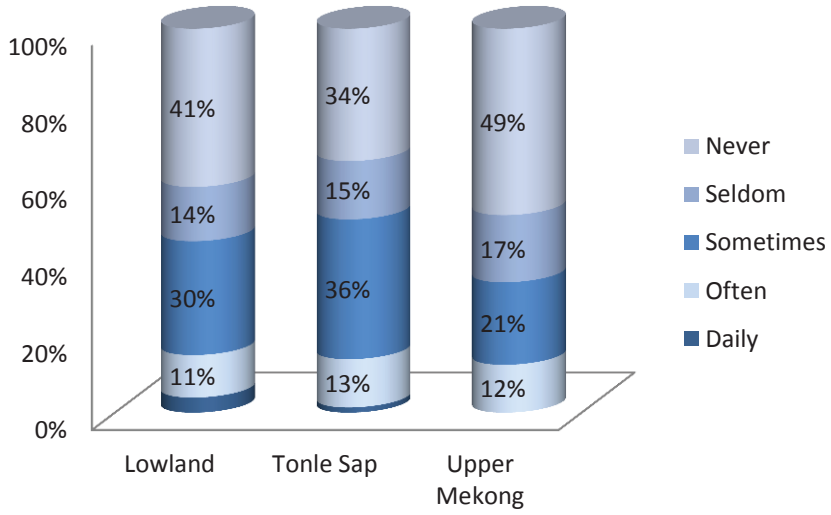


Figure 59. Percentage of households for which quantity of food was compromised

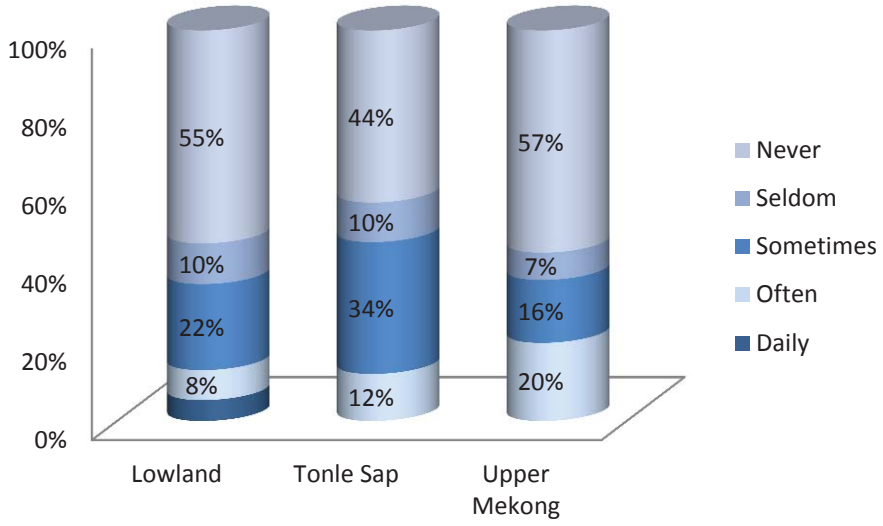


Figure 60. Percentage of households for which frequency of meals was compromised

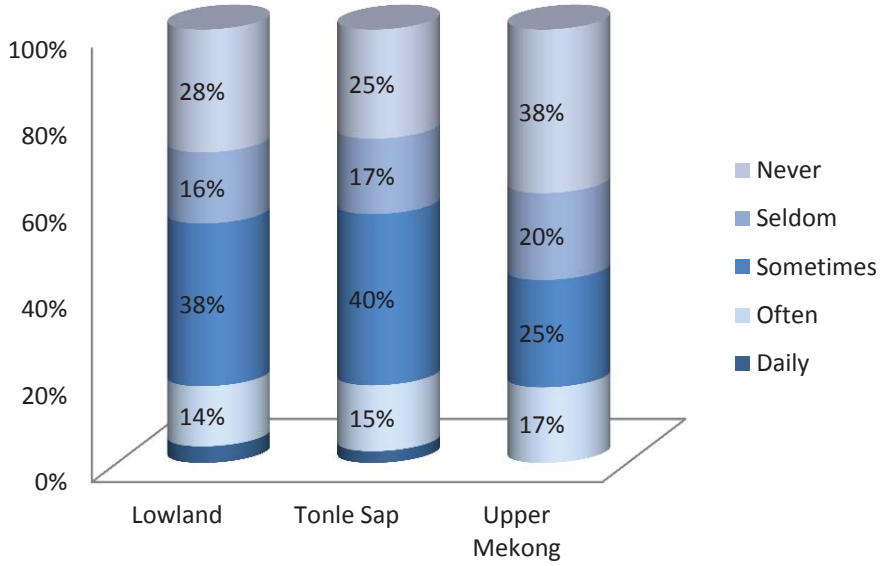


Figure 61. Percentage of households who were constrained to shift diets

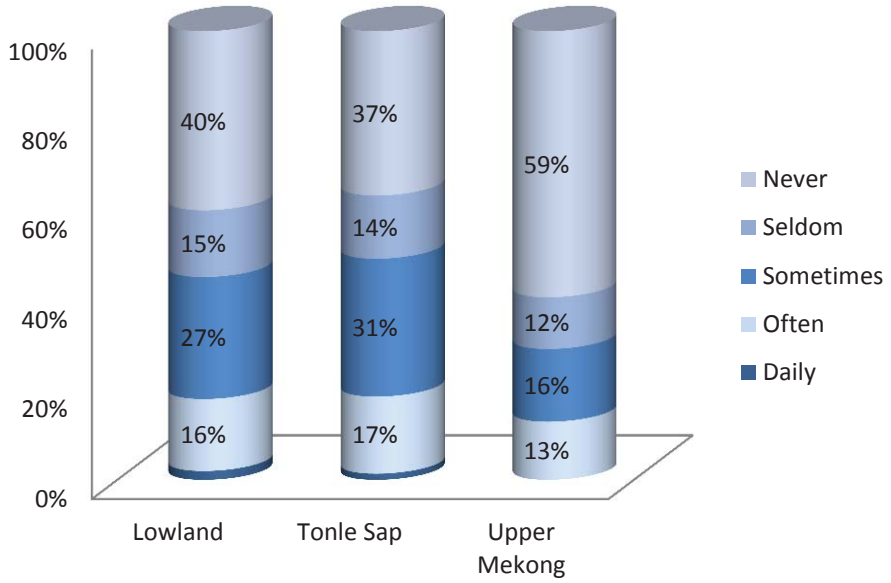


Figure 62. Percentage of households for which variety of diet was compromised

9.7 HEALTH SITUATION OF HOUSEHOLDS IN EACH AGRO-ECOSYSTEM

A significant proportion of households across all three zones have children showing malnutrition symptoms. Children with decayed teeth are present in comparable proportions in the Upper Mekong zone (37%), the Tonle Sap zone (37%) and the Lowland zone (34%). Children with permanently swollen bellies seem more prevalent in Upper Mekong households (25%) compared with Tonle Sap households (17%) and Lowland households (9%)— the third being significantly lower compared with the first two zones [α = 0.05 significance]. Similarly, children who have developed blond hair are present in a higher proportion in the Upper Mekong (21%) followed by the Tonle Sap (18%) with the rate falling to 12% in Lowland households which is significantly lower compared with the Upper Mekong [α = 0.05 significance].

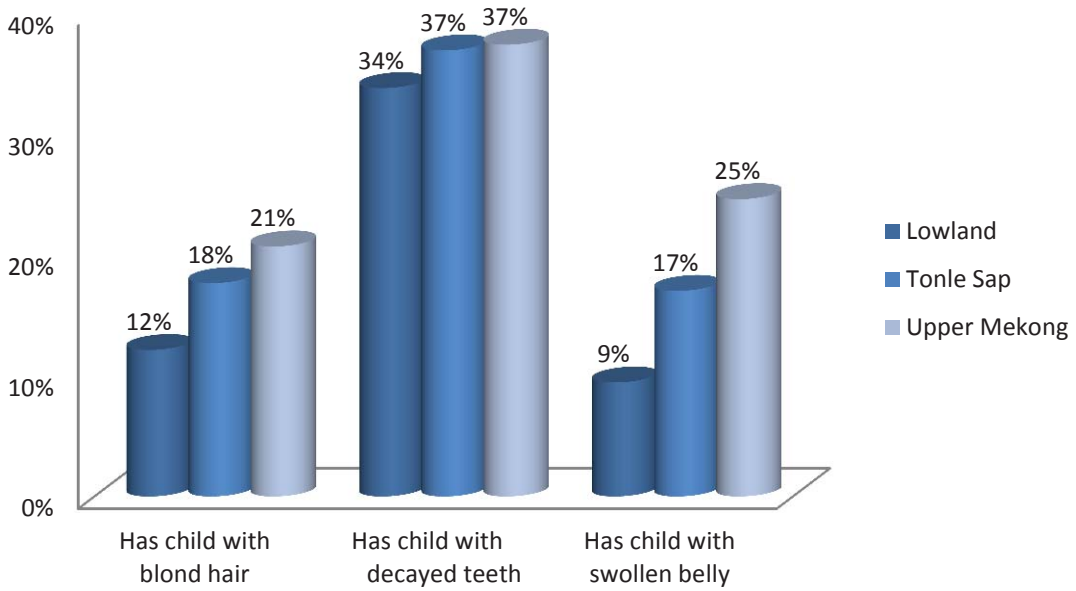


Figure 63. Child malnutrition symptoms across all agro-ecological zones.

While a vast majority of households in all three zones report owning enough mosquito nets, only 25% of Tonle Sap households, 16% of Lowland households and 15% of Upper Mekong households have access to safe drinking water all year round. Boiling and chlorinating water are widely practiced by households in all three zones, reaching as high as 82% for households in the Upper Mekong zone.

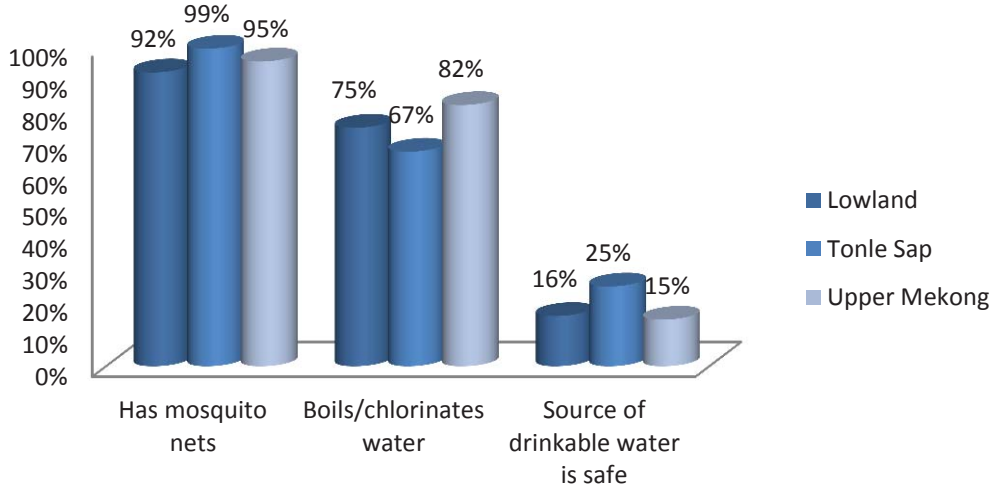


Figure 64. Adoption of preventative measures across agro-ecological zones.

All or most households report having access to a hospital or health centre nearby. This amounts to 100% of Tonle Sap households, 94% of Lowland households and 83% of Upper Mekong households with the Upper Mekong proportion being significantly lower compared with the Tonle Sap [$\alpha = 0.05$ significance]. A vast majority have access to medical supplies other than aspirine or paracetamol: 97% of Tonle Sap households, 91% of Lowland households and 91% of Upper Mekong households. However, only 77% of Tonle Sap households, 72% of Lowland households and 71% of Upper Mekong households have access to obstetrics centers. Seventy-four percent of Upper Mekong households,

59% of Tonle Sap households and 55% of Lowland households have access to traditional healers. Between 74% and 78% of households in all zones can afford medical treatment, procedures and medicine up to KHR 80,000. However, only 43% to 49% can afford medical costs exceeding USD 100.

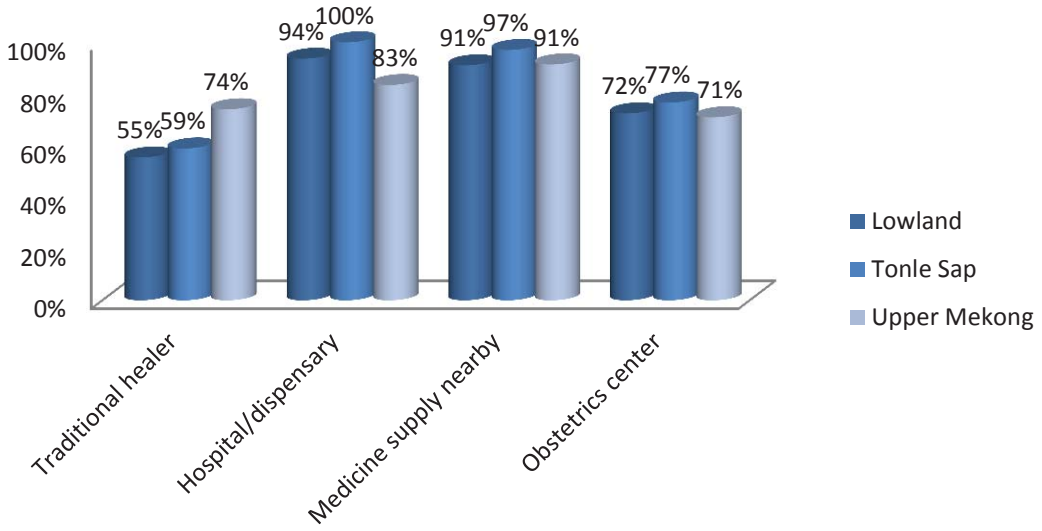


Figure 65. Access to hospitals, obstetrics centers and traditional healers

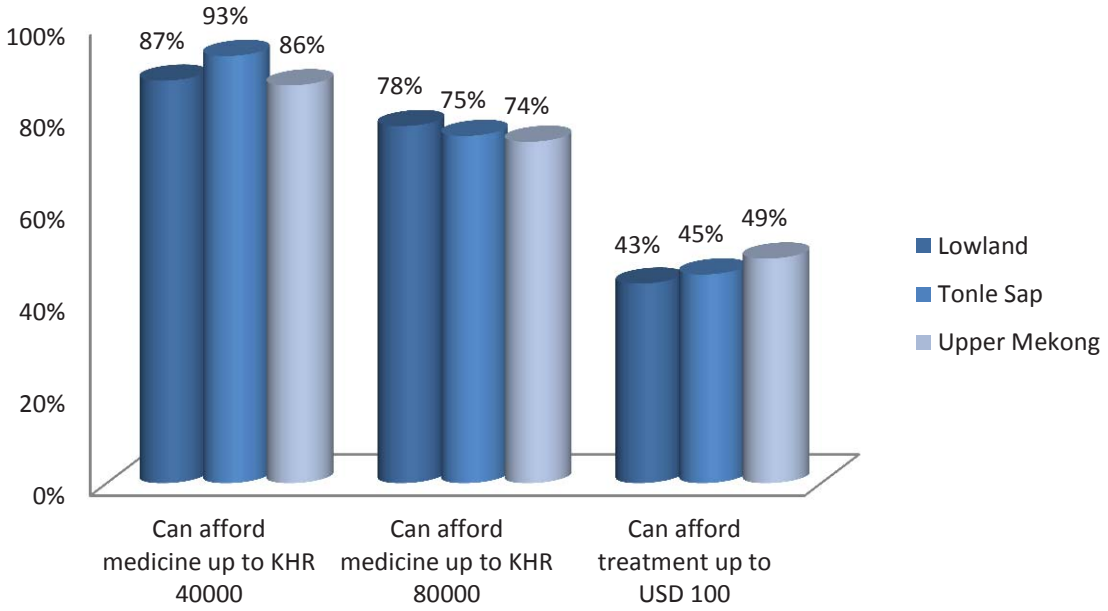


Figure 66. Affordability of medicine, treatment or procedures

10 COMPARISONS ACROSS GENDERS

To draw comparisons and inferences across gender, the survey sample was segmented into three gender prevalence groups labeled and defined as:

- Male-prevalent or M-prevalent households — where 60% or more household members are male;
- Female-prevalent or F-prevalent households — where 60% or more household members are female; and
- Gender-balanced households otherwise.

10.1 HOUSEHOLDS GENDER STATISTICS

About eight in ten households are male-headed, regardless of gender prevalence within the household. Of the remaining 20.5% of female-headed households, about 12% are female-prevalent, 5% are gender-balanced and 4% are male-prevalent. See Table 30 for details.

Table 30. Partitioning of gender statistics according to prevalence and household gender head

Gender of head:	Male	Female
M-prevalent	27.5%	3.5%
F-prevalent	25.3%	11.6%
Balanced	26.7%	5.3%
TOTAL	*79.5%*	*20.5%*

As indicated in Section 8.1, the youngest age groups are 12 to 17-year-olds for girls involved in fishing, 6 to 11-year-olds for girls involved in fish processing and 12 to 17-year-olds for girls involved in fish marketing. As indicated in Section 8.2, the youngest age group for girls involved in aquaculture (farming, processing and marketing) is 12 to 17-year-olds.

10.2 GENDER AND WEALTH

Across all economic activities, household net income tends to be more influenced by the gender of the head of the household rather than gender prevalence and male-headed households generally earn more than female-headed households regardless of gender prevalence[30]. In households headed by males, female-prevalent households earn the highest net income (USD 4 428). In households headed by females, however, male-prevalent households generate the highest income (USD 3 362), as shown in the table below. Regarding net asset value, male-headed households are in a more favorable position compared with female-headed households. See Table 31 and Table 32. Debt, however is lower in female-headed households compared with male-headed households, as shown in Table 33.

[30] Confidence intervals linked to mean estimates overlap and therefore preclude establishing statistically significant differences.

Table 31. Household net income vs. gender

Gender of household head	Household gender prevalence	Net income mean estimate (USD/ household/yr.)	95% Confidence interval	
			Lower	Upper
Female-headed	Balanced	3 110	1 751	4 468
	F-Prevalent	2 740	1 362	4 118
	M-Prevalent	3 362	2 201	4 524
Male-headed	Balanced	3 775	2 572	4 978
	F-Prevalent	4 428	3 025	5 831
	M-Prevalent	3 911	2 934	4 887

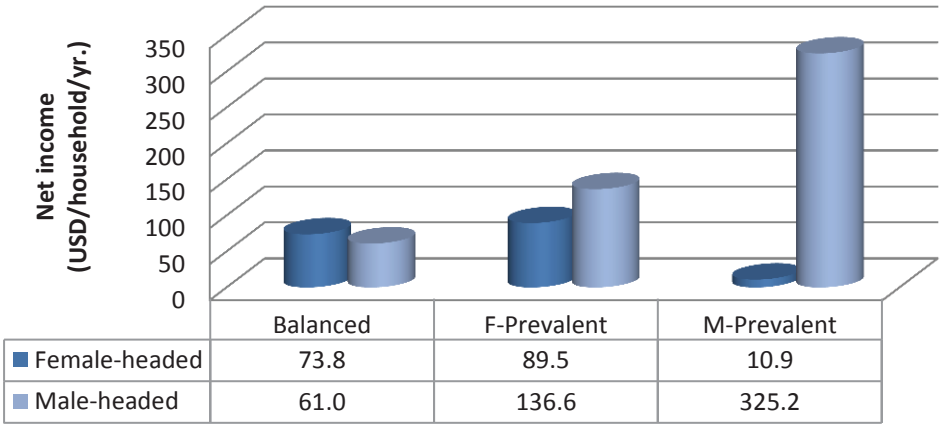
Table 32. Household net asset value vs. gender

Gender of household head	Household gender prevalence	Net asset value mean estimate (USD/household)	95% Confidence interval	
			Lower	Upper
Female-headed	Balanced	11 153	3 794	18 512
	F-Prevalent	10 501	6 265	14 736
	M-Prevalent	11 037	6 683	15 391
Male-headed	Balanced	13 033	10 445	15 620
	F-Prevalent	13 017	10 670	15 365
	M-Prevalent	13 400	10 953	15 846

Table 33. Household debt value vs. gender

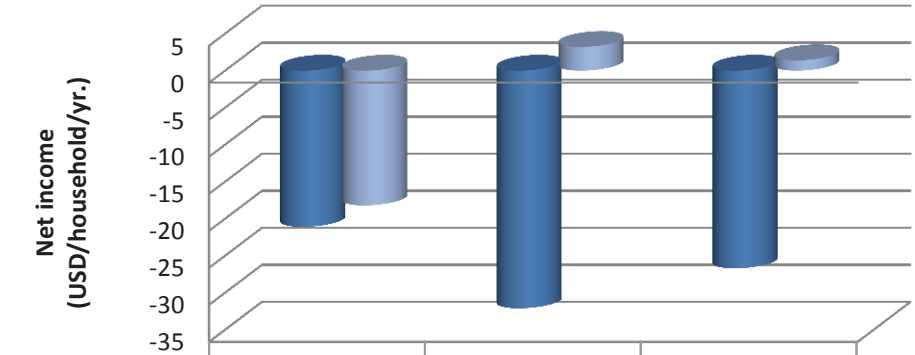
Gender of household head	Household gender prevalence	Debt value mean estimate (USD/household)	95% Confidence interval	
			Lower	Upper
Female-headed	Balanced	330	60	600
	F-Prevalent	369	207	530
	M-Prevalent	257	93	422
Male-headed	Balanced	476	302	650
	F-Prevalent	555	374	737
	M-Prevalent	461	151	772

Male-headed and male-prevalent households generate the most income in capture fisheries. Gender-balanced and female-prevalent households tend to perform at similar levels, regardless of the gender of household head. Regarding processing linked to capture fisheries, income is slightly more favorable for male-headed households. A similar pattern applies to aquaculture in which male-headed households generate the highest incomes, particularly the gender-balanced households.



	Balanced	F-Prevalent	M-Prevalent
Female-headed	73.8	89.5	10.9
Male-headed	61.0	136.6	325.2

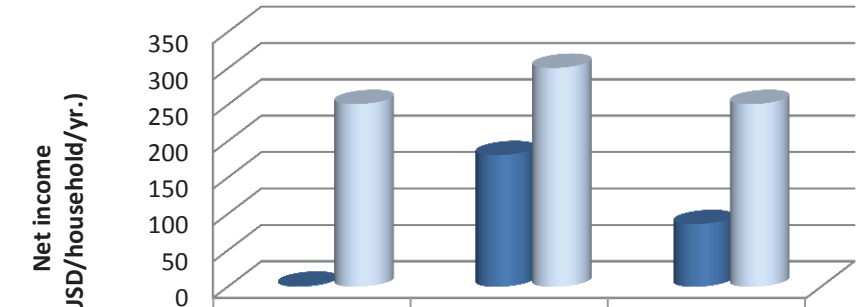
Figure 67. Net income from capture fishery — gender-based comparisons



	Balanced	F-Prevalent	M-Prevalent
Female-headed	-21.1	-32.1	-26.7
Male-headed	-18.2	3.2	1.4

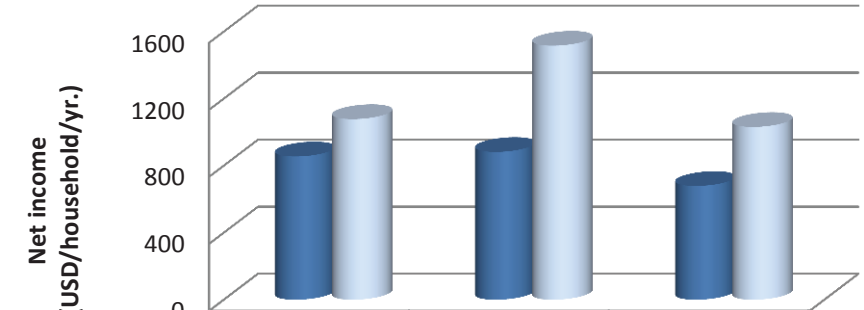
Figure 68. Net income from processing of fish capture — gender-based comparisons

Livestock is also more profitable in male-headed households. Crop farming other than rice tends to depend less on household gender (male-headed households earn more). Net income from renting land, albeit modest, is higher in households that are female-headed and male-prevalent.



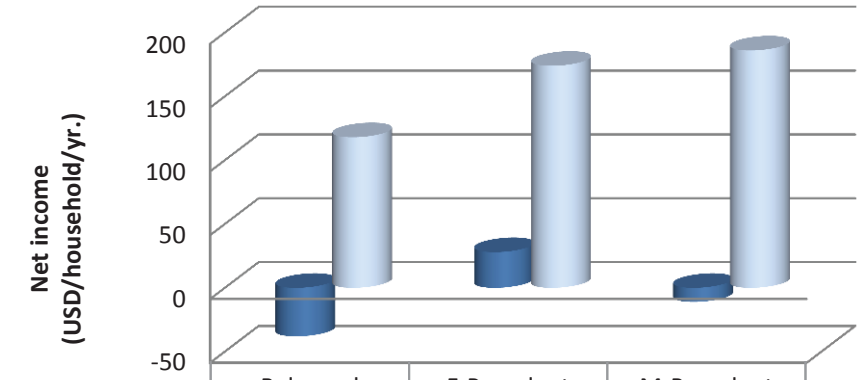
	Balanced	F-Prevalent	M-Prevalent
Female-headed	1.5	180.9	86.1
Male-headed	251.1	300.8	251.1

Figure 69. Net income from rice farming — gender-based comparisons



	Balanced	F-Prevalent	M-Prevalent
Female-headed	855	882	679
Male-headed	1,078	1,516	1,031

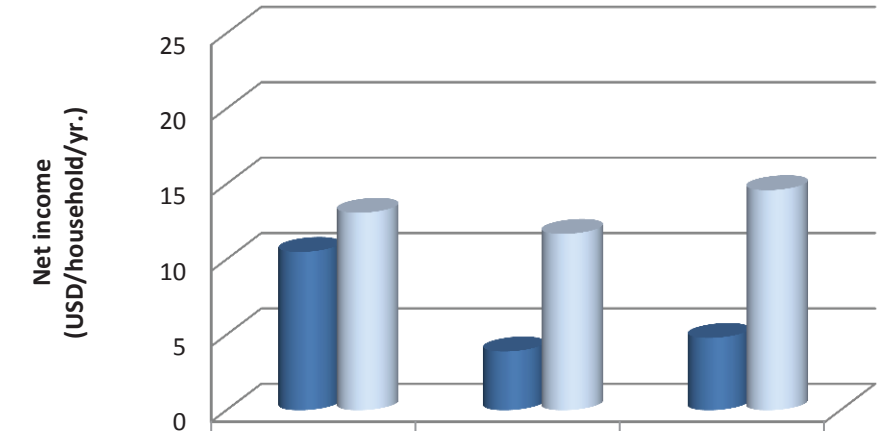
Figure 70. Net income from other crop farming — gender-based comparisons



	Balanced	F-Prevalent	M-Prevalent
Female-headed	-38	28	-11
Male-headed	118	174	186

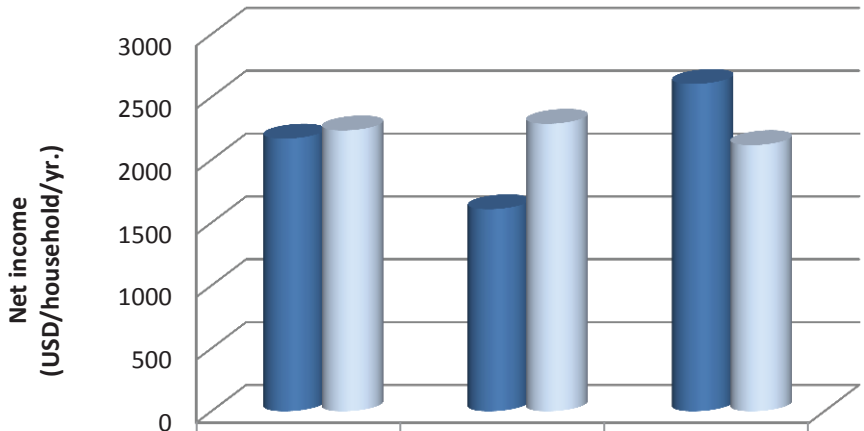
Figure 71. Net Income from livestock farming — gender-based comparisons

Female-headed households tend to perform slightly better than male-headed households in net income from terrestrial resource collection. On the other hand, gender seems to have little influence on incomes from collecting floodplain resources or economic activities independent from local agro-ecosystems.



	Balanced	F-Prevalent	M-Prevalent
Female-headed	10.5	3.9	4.8
Male-headed	13.1	11.7	14.6

Figure 72. Net income from floodplain resource collection — gender-based comparisons



	Balanced	F-Prevalent	M-Prevalent
Female-headed	2,170	1,608	2,605
Male-headed	2,235	2,288	2,118

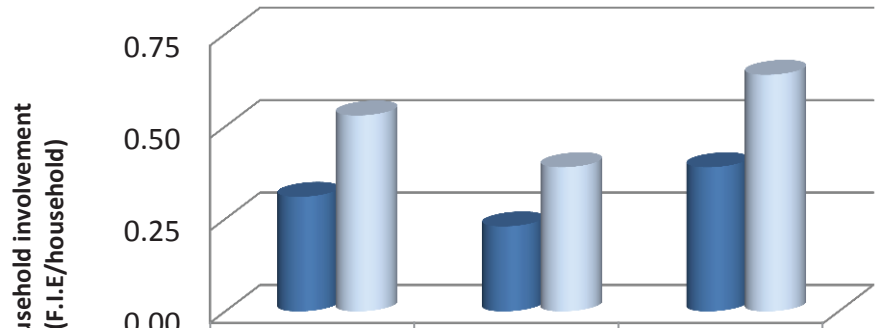
Figure 73. Net income from environment-independent activities — gender-based comparisons

10.3 GENDER AND FISHING

In male-headed households, the number and value of fishing gears owned, involvement in fishing and quantity of fish caught are higher, especially in male-prevalent households. Several findings establish stronger involvement from females in fish processing activities. Male-headed households own a higher number of fishing assets compared with female-headed households. The difference is significant when comparing male-prevalent households headed by males, which own about 14 fishing assets on average, with male-prevalent households headed by females, which own an average of about 4 fishing assets [α = 0.05 significance]. The difference is also significant when comparing female-prevalent households headed by males, which own about 13 fishing assets, with female-prevalent households headed by females, which own 4 fishing assets [α = 0.05 significance] — see Figure 75. Accordingly, the average fishing asset value is estimated to be higher for male-prevalent households headed by males (USD 101) compared with male-prevalent households headed by females (USD 23) [α = 0.05 significance] — see Figure 76.

A similar pattern is observed with fishing where the highest involvement is noted for male-prevalent households headed by males with an average of 0.64 FIE, significantly higher than for male-prevalent households headed by females with an average of 0.39 FIE [α = 0.05 significance] — see **Figure 74** .

Another indicator of labor allocation is the number of days spent fishing per month and per households (the total number of days available being 30.4 days/month x 5.3 persons/household = 161 days/month). The highest number is in male-prevalent households headed by males, at 97 days, significantly higher than male-prevalent households headed by females with 37 days [α = 0.05 significance] — see Figure 77. Quantity of average annual fish catch also appears to be highest in male-prevalent households headed by males at 388 kg. Also worth remarking is that the average annual catch of 57 kg by male-prevalent households headed by females is significantly lower compared to the 254 kg of female-prevalent households headed by males and 200 kg of gender-balanced households headed by males [α = 0.05 significance].



	Balanced	F-Prevalent	M-Prevalent
Female-headed	0.31	0.23	0.39
Male-headed	0.53	0.39	0.64

Figure 74. FIE in capture fisheries—gender-based comparisons

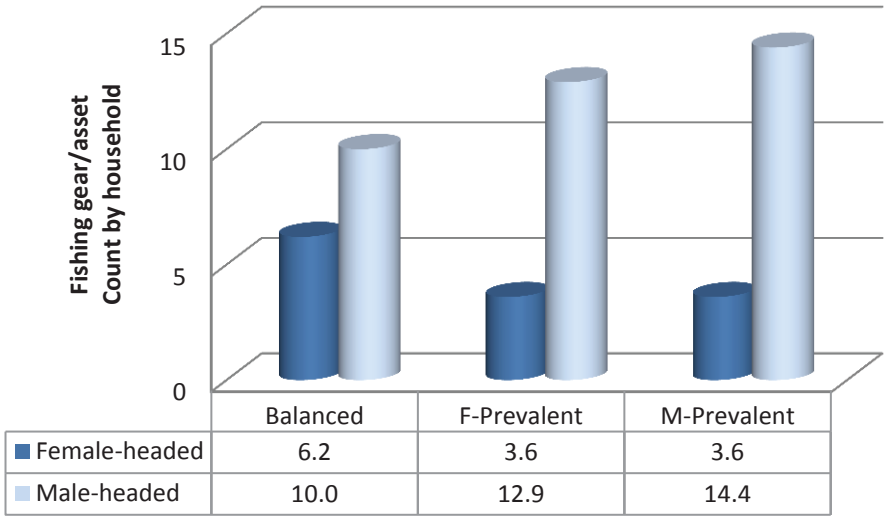


Figure 75. Number of fishing gears/assets owned (/household) — gender-based comparisons

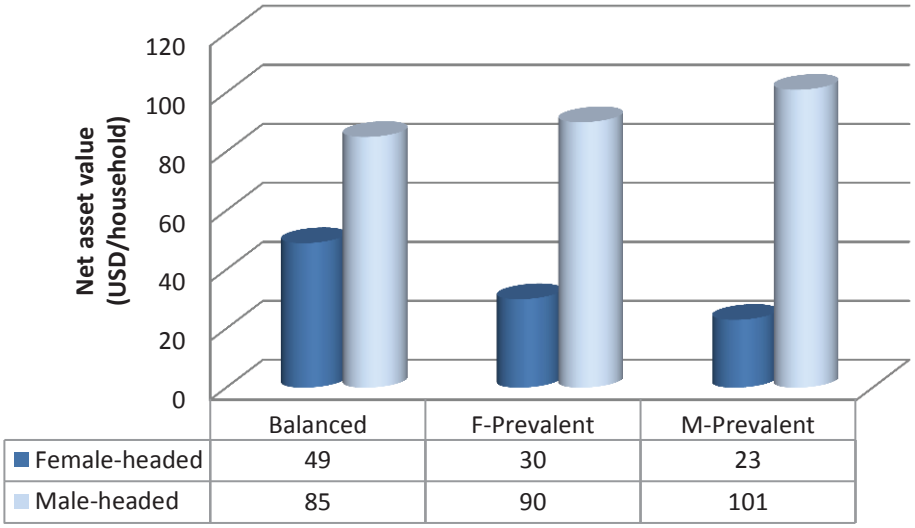
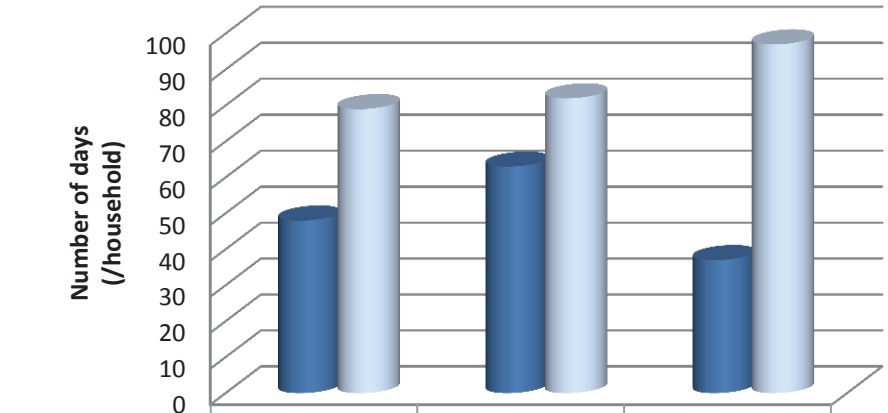
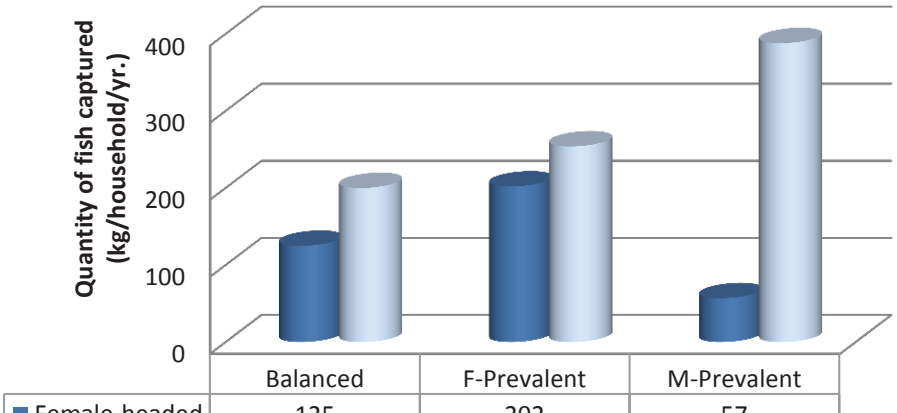


Figure 76. Net value of fishing assets — gender-based comparisons



	Balanced	F-Prevalent	M-Prevalent
Female-headed	48	63	37
Male-headed	79	82	97

Figure 77. Labor allocation in capture fishery — gender-based comparisons

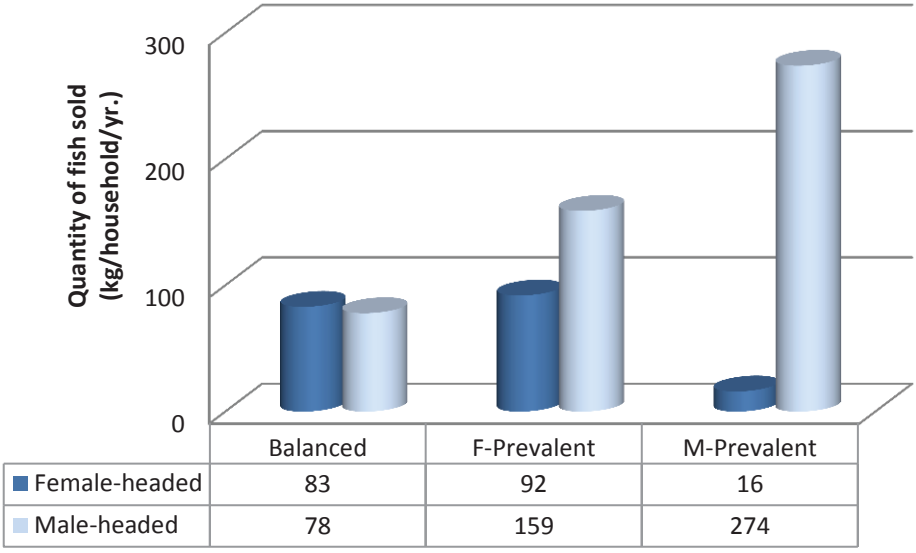


	Balanced	F-Prevalent	M-Prevalent
Female-headed	125	202	57
Male-headed	200	254	388

Figure 78. Quantity of fish captured — gender-based comparisons

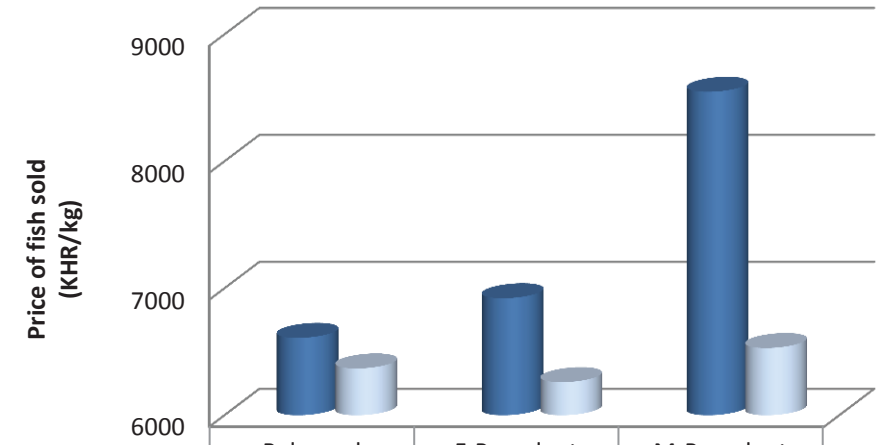
On average, the quantity of fish sold each year is highest in male-prevalent households headed by males at 274 kg and lowest in male-prevalent households headed by females at 16 kg. Annual fish consumption tends to be higher in male-headed households, especially gender-balanced households (66 kg) and male-prevalent households (59 kg) where consumption is significantly higher than gender-balanced households headed by females (23 kg) [α = 0.05 significance].

Interestingly, the price of fish sold is generally higher in female-headed households and highest for male-prevalent households headed by females at KHR 8 548/kg on average — see Figure 80.



	Balanced	F-Prevalent	M-Prevalent
Female-headed	83	92	16
Male-headed	78	159	274

Figure 79. Quantity of fish sold — gender-based comparisons



	Balanced	F-Prevalent	M-Prevalent
Female-headed	6,610	6,922	8,548
Male-headed	6,369	6,261	6,530

Figure 80. Price of fish sold — gender-based comparisons

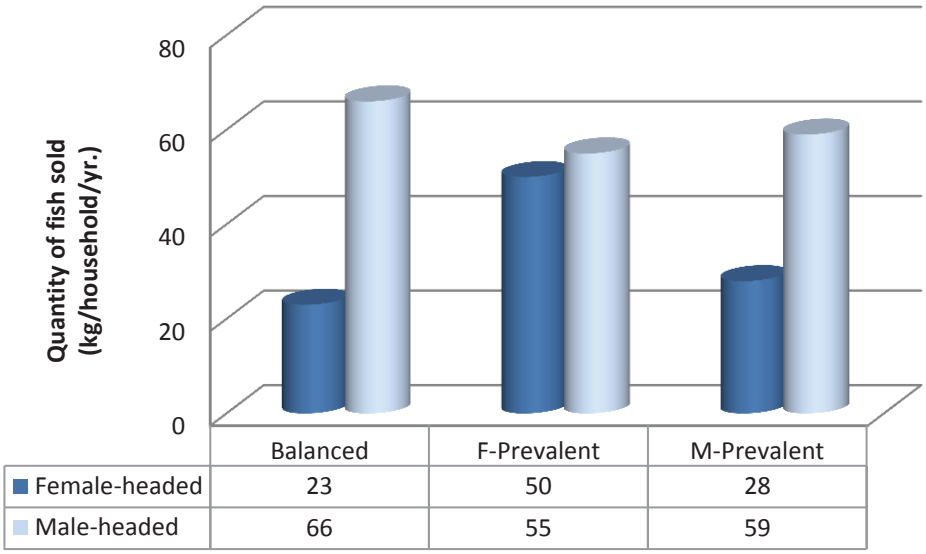
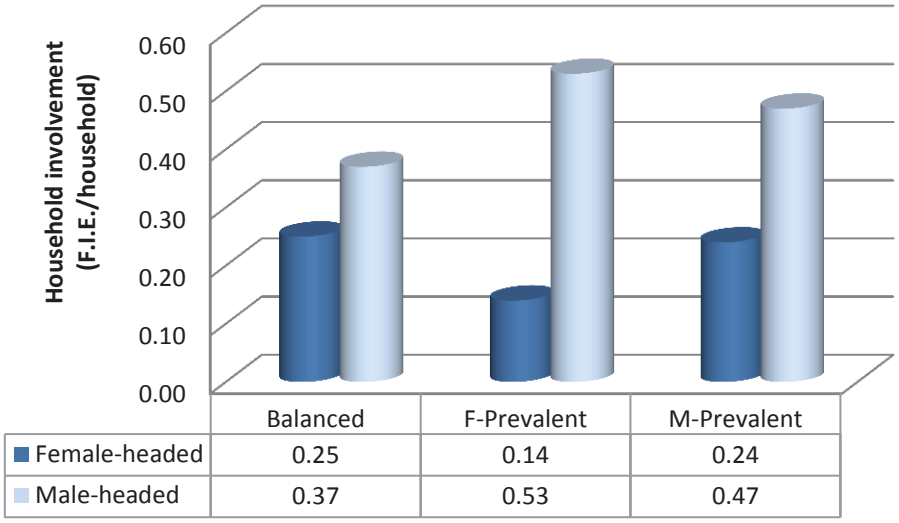


Figure 81. Quantity of captured fish — gender-based comparisons

Female household members are more involved in fish processing (Section 8.1). A second indicator is the percentage of household members involved in fish processing which was then averaged over gender-based groups with results showing higher rates in female-prevalent households in comparison with gender-balanced and male-prevalent household (see Table 34). Thirdly, absolute levels of involvement were calculated using an FIE as in Section 8.6 regardless of household size — reflecting relatively modest levels of involvement compared with actual fishing activities, and showing highest FIE in female-prevalent households headed by males. As noted in Section 0, the situation with net income is generally problematic but less so in male-headed than female-headed households.

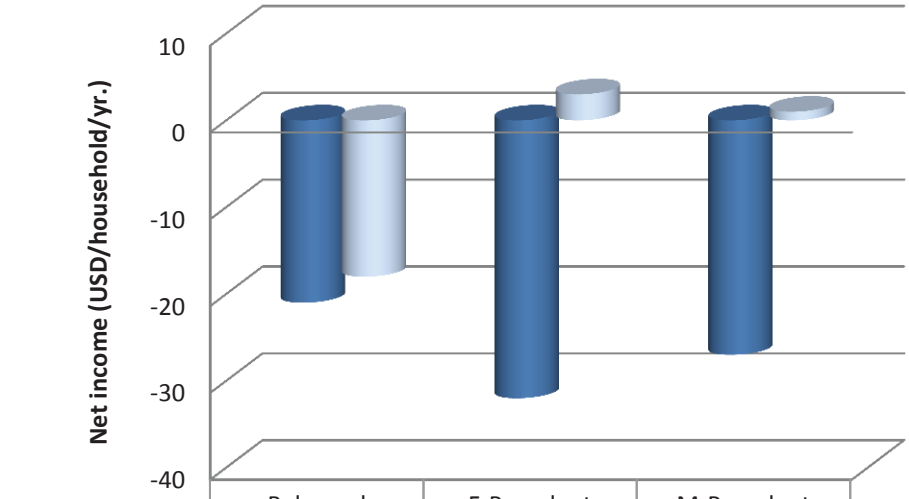
Table 34. Proportion of households with some degree of involvement in fish processing

	Female-headed	Male-headed
Balanced	27%	28%
F-Prevalent	29%	32%
M-Prevalent	26%	28%



	Balanced	F-Prevalent	M-Prevalent
Female-headed	0.25	0.14	0.24
Male-headed	0.37	0.53	0.47

Figure 82. Involvement in fish processing — gender-based comparisons

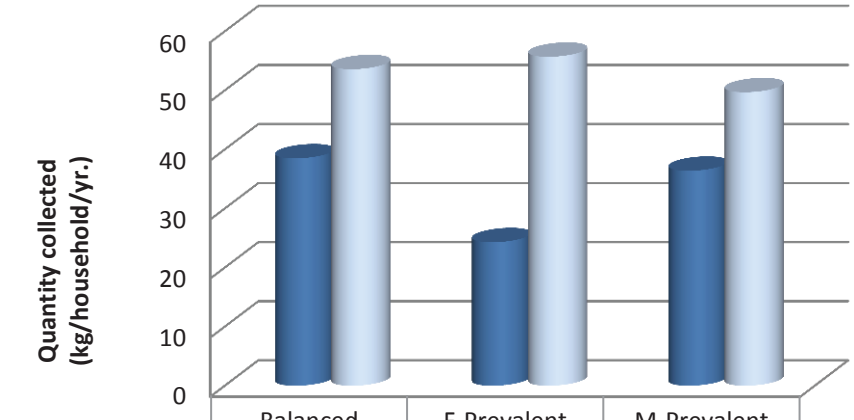


	Balanced	F-Prevalent	M-Prevalent
Female-headed	-21	-32	-27
Male-headed	-18	3	1

Figure 83. Net income from fish processing — gender-based comparisons

10.4 GENDER AND FLOODPLAIN NATURAL RESOURCES

The quantity of floodplain natural resources collected each year is highest in female-prevalent households headed by males and lowest in female-prevalent households headed by females. That quantity reaches 56 kg/household/year in male-headed female-prevalent households and only 24 kg/year in female-prevalent households headed by females. Similarly, the average quantity of floodplain natural resources sold each year is slightly higher in male-headed households, highest in female-prevalent households headed by males at 31 kg/yr and lowest in female-prevalent households headed by females at 7 kg/yr. The quantity of floodplain natural resources consumed unprocessed is comparable across all gender groups, and slightly lower in female-prevalent households.



	Balanced	F-Prevalent	M-Prevalent
Female-headed	38.5	24.3	36.4
Male-headed	53.6	55.7	49.7

Figure 84. Quantity of floodplain natural resources collected — gender-based comparisons

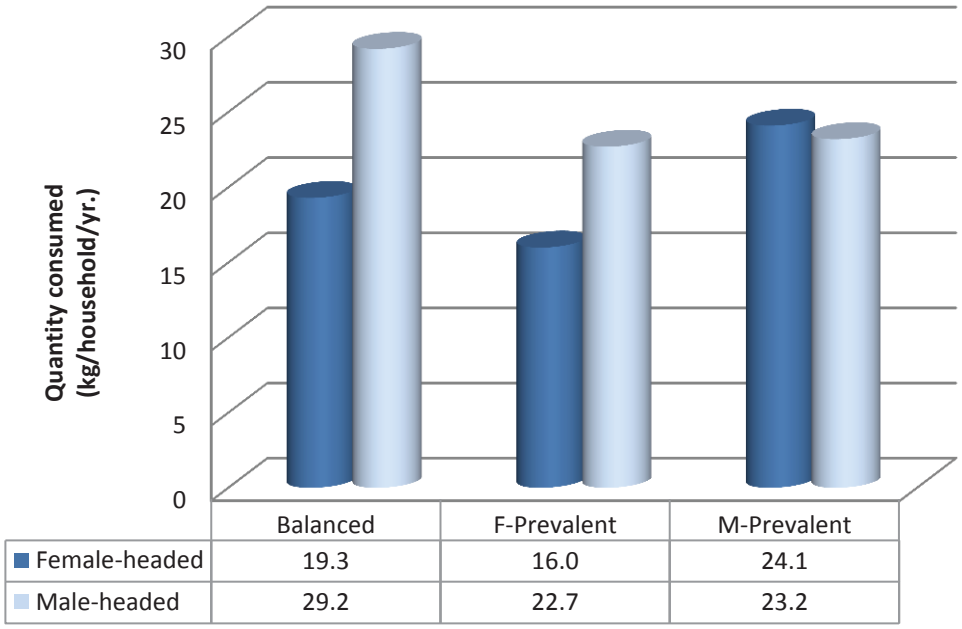


Figure 85. Quantity of floodplain natural resources consumed — gender-based comparisons

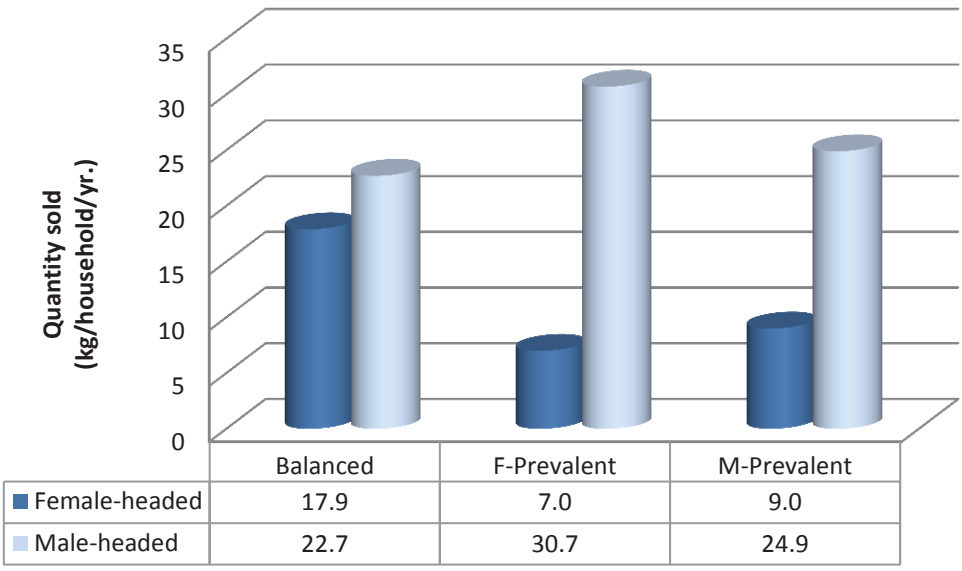


Figure 86. Quantity of floodplain natural resources sold — gender-based comparisons

10.5 GENDER AND HEALTH

Households with children showing malnutrition symptoms are found in comparable proportions across gender groups, the situation appearing to be slightly more favorable for female-headed or female-prevalent households. Children who have developed blond hair seem to be present in comparable proportions in households across gender groups except in female-prevalent households headed by females, which report fewer cases. Cases of children with decayed teeth tend to be reported less frequently in female-prevalent households headed by females and gender-balanced households headed by females. Cases of children with permanently swollen bellies tend to be reported less frequently in female-prevalent households headed by females.

Table 35: Households with malnutrition symptoms- gender-based comparisons

Households with children with blond hair			Households with children with decayed teeth			Households with children with permanently swollen bellies		
	Female-headed	Male-headed		Female-headed	Male-headed		Female-headed	Male-headed
Balanced	16.3%	14.5%	Balanced	20%	36%	Balanced	18%	16%
F-Prevalent	5.5%	15.7%	F-Prevalent	27%	38%	F-Prevalent	8%	16%
M-Prevalent	18.4%	16.2%	M-Prevalent	47%	38%	M-Prevalent	11%	15%

A minority of households report trusting the safety of their main source of drinking water all year round. The proportion of such reports by balanced-gender households headed by females is particularly low.

Table 36. Households with a safe source of drinking water year round - gender based comparisons

	Female-headed	Male-headed
Balanced	6%	20%
F-Prevalent	15%	24%
M-Prevalent	14%	20%

Survey data also reflect a slightly higher proportion of female-headed households reporting cases of incapacitating/chronic disease or disability. See Table 37 below for details.

Table 37. Households with cases of incapacitating/chronic diseases - gender-based comparisons

	Female-headed	Male-headed
Balanced	32%	26%
F-Prevalent	28%	29%
M-Prevalent	41%	25%

With regards to affordability of medical consultations and treatment, the situation appears to be fairly balanced across gender groups (see Table 38 below):

Table 38. % of households able to afford medical expenditure- gender-based comparisons

% of households able to afford medical expenditure up to KHR°40,000			% of households able to afford medical expenditure up to KHR°80,000			% of households able to afford medical expenditure up to USD°100		
	Female-headed	Male-headed		Female-headed	Male-headed		Female-headed	Male-headed
Balanced	79%	90%	Balanced	66%	79%	Balanced	32%	26%
F-Prevalent	84%	92%	F-Prevalent	69%	76%	F-Prevalent	28%	29%
M-Prevalent	89%	91%	M-Prevalent	85%	77%	M-Prevalent	41%	25%

10.6 GENDER AND EDUCATION

The average number of years of education per household member shows little variation across gender groups. It is similar in male-headed households at 4.7 years regardless of gender prevalence and highest in male-prevalent households headed by females at 5.3 years.

Table 39. Household education level- gender-based comparisons

Completed years of school		
	Female-headed	Male-headed
Balanced	4.0	4.7
F-Prevalent	4.2	4.7
M-Prevalent	5.3	4.7

10.7 GENDER AND ABSENCE

Absence is significantly higher in male-prevalent households headed by females at 2.7 months per household member per year and about half as long in other households. Absence of household members is otherwise similar across gender-based groups at about 1.4 months per year. The 2.7 month absence in male-prevalent households headed by females is significantly higher compared with male-headed households and female-prevalent households headed by females [$\alpha = 0.05$ significance]. A similar pattern is observed for wage labor in Cambodia, where the count of household members is higher in male-prevalent households headed by females with 1.3 members on average. Wage labor outside Cambodia seems to apply more to male-headed households, especially gender-balanced households headed by males with 0.34 members on average being away from home. Also, gender-balanced households tend to have more members absent on an intermittent basis than other households. The number of members leaving to become students or monks seems rather even across households regardless of gender groups. See Table 40 below for details.

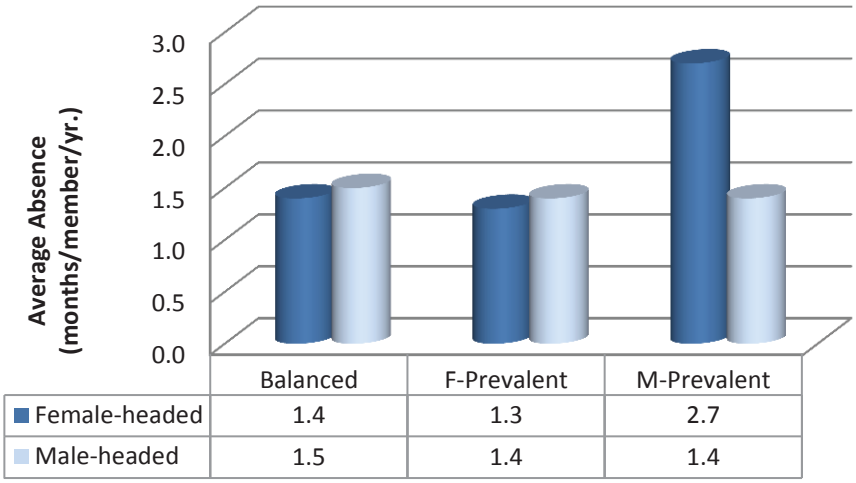


Figure 87. Absence from households — gender-based comparisons

Table 40: Household members absent due to labor, studies or monkhood - gender-based comparisons

Wage labor in Cambodia — member count per household		
	Female-headed	Male-headed
Balanced	0.9	0.7
F-Prevalent	0.5	0.5
M-Prevalent	1.3	0.7

Wage labor outside Cambodia — member count per household		
	Female-headed	Male-headed
Balanced	0.14	0.34
F-Prevalent	0.08	0.26
M-Prevalent	0.23	0.23

Students or monks — Member count per household		
	Female-headed	Male-headed
Balanced	0.11	0.13
F-Prevalent	0.09	0.08
M-Prevalent	0.10	0.06

Members intermittently absent — Member count per household		
	Female-headed	Male-headed
Balanced	0.28	0.17
F-Prevalent	0.10	0.10
M-Prevalent	0.18	0.06

10.8 GENDER AND RESILIENCE

In responding to unexpected shocks, household coping strategies reflect mild variations depending on gender. Gender-balanced households headed by females appear to adopt more discerning strategies compared with the other five gender groups, resorting to unspecified strategies less often than most other households. Moreover, they appear to choose popular coping strategies more often than other households by:

- spending cash savings (ranging from 20% of gender-balanced households headed by females to 9% of male-prevalent households headed by females);
- decreasing consumption of lower priority goods such as cigarettes, alcohol and washing powder (ranging from 16% of gender-balanced households headed by females to 4% each for male-prevalent households headed by both females and males);
- decreasing meat consumption (ranging from 12% of gender-balanced households headed by females to 5% for male-prevalent households headed by males and 5% for gender-balanced households headed by males);
- decreasing consumption of food other than rice, fish and meat (ranging from 10% of gender-balanced households headed by females to 4% for female-prevalent households headed by females); and
- decreasing fish consumption (ranging from 9% of gender-balanced households headed by females to zero for both female and male-prevalent households headed by females).

11 COMPARISONS ACROSS WEALTH SITUATIONS

To draw comparisons and inferences across wealth, the survey sample was segmented into four quadrants based on household net income and net asset values as follows:

	Net income per capita per day equals or exceeds USD°1:	Net income per capita per day is less than USD°1:
Net asset value equals or exceeds USD°5 000	*Financially sound*	*Income-insufficient*
Net asset value is less than USD 5000:	*Asset-insufficient*	*Financially vulnerable*

11.1 WEALTH SITUATION VS. INVOLVEMENT IN ACTIVITIES

Income-insufficient and financially sound households tend to allocate more labor to activities dependent on the natural environment than asset-insufficient and vulnerable households. Income-insufficient households allocate the highest labor input into poultry farming with 1.87 FIE and rice farming with 1.66 FIE, followed by cattle farming, collecting terrestrial resources and floodplain resources, other livestock activities, catching fish (0.67 FIE), processing fish and marketing fish. Financially sound households come next with labor inputs into poultry farming, rice farming, cattle, collecting terrestrial resources for household use, collecting floodplain resources and catching fish as well as processing and marketing the catch. Financially sound households also allocate higher labor inputs into fish farming and processing farmed fish than income-insufficient households.

FIE mean estimates and confidence intervals are displayed in Table 41, where red and blue fonts are used to help locate non-overlapping confidence intervals and hence statistically significant differences in FIE mean estimates [α = 0.05 significance].

Table 41. Labor allocation to natural environment related activities by wealth groups. Table continued on page 85

	Poultry farming FIE (/household/yr.)			Rice farming FIE (/household/yr.)		
	Mean	95% Confidence Interval		**Mean**	95% Confidence Interval	
	Estimate	Lower	Upper	**Estimate**	Lower	Upper
Financially sound	**1.46**	1.23	1.70	**1.14**	0.93	1.36
Income-insufficient	**1.87**	1.45	2.29	**1.66**	1.32	2.00
Asset-insufficient	**1.11**	0.89	1.33	**0.56**	0.34	0.77
Vulnerable	**1.22**	0.95	1.48	**0.73**	0.46	1.00

	Cattle farming FIE (/household/yr.)		
	Mean	95% Confidence Interval	
	Estimate	Lower	Upper
Financially sound	**1.00**	0.77	1.24
Income-insufficient	**1.54**	1.23	1.86
Asset-insufficient	**0.51**	0.28	0.74
Vulnerable	**0.62**	0.35	0.89

	Collecting terrestrial Resource for Home usage FIE (/household/yr.)		
	Mean	95% Confidence Interval	
	Estimate	Lower	Upper
Financially sound	**0.87**	0.70	1.03
Income-insufficient	**1.36**	1.07	1.65
Asset-insufficient	**0.83**	0.61	1.05
Vulnerable	**0.87**	0.74	1.01

	Collecting floodplain natural resources FIE (/household/yr.)		
	Mean	95% Confidence Interval	
	Estimate	Lower	Upper
Financially sound	**0.70**	0.54	0.85
Income-insufficient	**1.10**	0.86	1.34
Asset-insufficient	**0.50**	0.36	0.64
Vulnerable	**0.74**	0.62	0.86

	Other livestock farming FIE (/household/yr.)		
	Mean	95% Confidence Interval	
	Estimate	Lower	Upper
Financially sound	**0.48**	0.29	0.68
Income-insufficient	**0.96**	0.52	1.41
Asset-insufficient	**0.26**	0.10	0.42
Vulnerable	**0.21**	0.09	0.33

	Capturing fish FIE (/household/yr.)		
	Mean	95% Confidence Interval	
	Estimate	Lower	Upper
Financially sound	**0.45**	0.36	0.54
Income-insufficient	**0.67**	0.48	0.87
Asset-insufficient	**0.34**	0.23	0.45
Vulnerable	**0.47**	0.32	0.62

	Processing captured fish FIE (/household/yr.)		
	Mean	95% Confidence Interval	
	Estimate	Lower	Upper
Financially sound	**0.37**	0.17	0.57
Income-insufficient	**0.54**	0.39	0.70
Asset-insufficient	**0.37**	0.25	0.49
Vulnerable	**0.36**	0.16	0.57

	Marketing captured fish FIE (/household/yr.)		
	Mean	95% Confidence Interval	
	Estimate	Lower	Upper
Financially sound	**0.23**	0.13	0.32
Income-insufficient	**0.36**	0.19	0.53
Asset-insufficient	**0.25**	0.09	0.41
Vulnerable	**0.20**	0.06	0.34

	Fish farming FIE (/household/yr.)		
	Mean	95% Confidence Interval	
	Estimate	Lower	Upper
Financially sound	0.07	0.03	0.11
Income-insufficient	0.03	0.01	0.06
Asset-insufficient	0.02	0.00	0.04
Vulnerable	0.00	0.00	0.01

	Processing farmed fish FIE (/household/yr.)		
	Mean	95% Confidence Interval	
	Estimate	Lower	Upper
Financially sound	0.05	0.01	0.09
Income-insufficient	0.01	0.00	0.02
Asset-insufficient	0.02	0.00	0.04
Vulnerable	0.00	0.00	0.00

11.2 WEALTH SITUATION VS. HOUSEHOLD INCOME

Annual net income of financially sound households is highest in female-prevalent households headed by males (USD 6,148) and lowest in female-prevalent households headed by females (USD 4,767). Significant income differences are noted between financially sound and asset-insufficient households (even though both are income-sufficient for the purpose of this analysis). Net income in male-headed financially sound households is significantly higher than female-headed asset-insufficient households — as shown in the tables below. In the two income-insufficiency quadrants, most gender groups have comparable incomes except female-prevalent households headed by females which perform at significantly lower levels [α = 0.05 significance].

Table 42. Household net income by wealth situation and gender group (USD/household/yr.)

Wealth group	Gender of household head	Household gender prevalence	Mean estimate	95% Confidence interval	
				Lower	Upper
Financially sound	*Female-Headed*	*F-Prevalent*	4,767	1,925	7,608
		M-Prevalent	5,010	2,705	7,315
	Male-Headed	*F-Prevalent*	6,148	4,315	7,981
		M-Prevalent	5,729	4,309	7,148
Asset-insufficient	*Female-Headed*	*F-Prevalent*	1,934	1,600	2,267
		M-Prevalent	2,577	1,728	3,426
	Male-Headed	*F-Prevalent*	4,009	2,031	5,986
		M-Prevalent	3,822	1,910	5,734
Income-insufficient	*Female-Headed*	***F-Prevalent***	**734**	511	956
		M-Prevalent	1,640	1,229	2,051
	Male-Headed	*F-Prevalent*	1,088	860	1,317
		M-Prevalent	1,346	957	1,735
Financially vulnerable	*Female-Headed*	***F-Prevalent***	**800**	581	1,018
		M-Prevalent	625	567	684
	Male-Headed	*F-Prevalent*	1,089	755	1,423
		M-Prevalent	1,091	870	1,312

The contribution of fish catches to household net income varies across gender groups and is higher in female-prevalent households from income-insufficient quadrants as shown in Table 43.

Table 43. Contribution of capture fishery to net income in wealth/gender groups (USD/household)

Wealth group	Gender of household head	Household gender prevalence	Mean estimate	95% Confidence interval Lower	Upper
Financially sound	*Female-Headed*	*F-Prevalent*	15.1%	3.4%	26.8%
		M-Prevalent	1.6%	1.6%	1.6%
	Male-Headed	*F-Prevalent*	7.6%	3.7%	11.5%
		M-Prevalent	13.8%	7.1%	20.5%
Income-insufficient	*Female-Headed*	*F-Prevalent*	60.2%	24.7%	95.7%
		M-Prevalent	5.3%	-1.1%	11.7%
	Male-Headed	*F-Prevalent*	10.8%	-3.7%	25.3%
		M-Prevalent	8.1%	-4.8%	21.0%
Asset-insufficient	*Female-Headed*	***F-Prevalent***	**16.3%**	-3.3%	35.9%
		M-Prevalent	1.9%	-0.1%	3.8%
	Male-Headed	***F-Prevalent***	**14.9%**	-3.2%	33.0%
		M-Prevalent	24.3%	-3.0%	51.6%
Financially vulnerable	*Female-Headed*	***F-Prevalent***	**20.0%**	-14.3%	54.3%
		M-Prevalent	13.3%	13.3%	13.3%
	Male-Headed	***F-Prevalent***	**24.2%**	-4.5%	52.9%
		M-Prevalent	9.0%	0.6%	17.3%

11.3 WEALTH SITUATION VS. ASSET VALUE

Among financially sound households, male-headed households tend to possess more valuable assets than female-headed households. A similar observation applies to male-headed households in the asset-insufficient quadrant compared with female-headed households in that quadrant.

Table 44. Household net asset value, by wealth quadrants and gender-based groups

Wealth group	Gender of household head	Household gender prevalence	Mean estimate	95% Confidence interval Lower	Upper
Financially sound	*Female-Headed*	*F-Prevalent*	**18,444**	10,644	26,244
		M-Prevalent	**15,165**	10,153	20,178
	Male-Headed	*F-Prevalent*	**19,290**	15,346	23,235
		M-Prevalent	**20,504**	16,834	24,174
Income-insufficient	*Female-Headed*	*F-Prevalent*	**14,408**	8,340	20,477
		M-Prevalent	**16,537**	-680	33,755
	Male-Headed	*F-Prevalent*	**9,339**	7,420	11,258
		M-Prevalent	**12,919**	9,100	16,737
Asset-insufficient	*Female-Headed*	*F-Prevalent*	**1,899**	1,322	2,477
		M-Prevalent	**1,949**	586	3,312
	Male-Headed	*F-Prevalent*	**2,270**	1,739	2,802
		M-Prevalent	**2,428**	1,786	3,070
Financially vulnerable	*Female-Headed*	*F-Prevalent*	**2,500**	1,669	3,330
		M-Prevalent	**1,956**	1,542	2,369
	Male-Headed	*F-Prevalent*	**2,435**	1,488	3,381
		M-Prevalent	**2,559**	1,803	3,316

Debt is generally higher for households that are financially sound and lower for households that are income insufficient. Within each wealth quadrant, debt tends to be marginally higher in male-headed households compared with female-headed households as shown in Table 45. Accordingly, the proportion of debt-free households is generally lower in income-insufficient households and higher in asset-insufficient households as shown in Table 46.

Table 45. Household debt level, by wealth quadrants and gender-based groups (USD/household)

Wealth group	Gender of household head	Household gender prevalence	Mean estimate	95% Confidence interval Lower	Upper
Financially sound	*Female-Headed*	*F-Prevalent*	573	189	957
		M-Prevalent	256	0	535
	Male-Headed	*F-Prevalent*	740	487	993
		M-Prevalent	501	76	926
Income-insufficient	*Female-Headed*	*F-Prevalent*	211	0	519
		M-Prevalent	133	0	288
	Male-Headed	*F-Prevalent*	156	76	236
		M-Prevalent	414	146	683
Asset-insufficient	*Female-Headed*	*F-Prevalent*	274	69	478
		M-Prevalent	381	49	712
	Male-Headed	*F-Prevalent*	550	252	848
		M-Prevalent	518	161	875
Financially vulnerable	*Female-Headed*	*F-Prevalent*	165	68	261
		M-Prevalent	260	41	479
	Male-Headed	*F-Prevalent*	196	11	380
		M-Prevalent	334	184	485

Table 46. Percentage of debt-free households in wealth quadrants and gender-based groups

Financially sound	*Female-Headed*	F-Prevalent	41%
		M-Prevalent	49%
	Male-Headed	F-Prevalent	60%
		M-Prevalent	49%
Income-insufficient	*Female-Headed*	F-Prevalent	35%
		M-Prevalent	49%
	Male-Headed	F-Prevalent	53%
		M-Prevalent	69%
Asset-insufficient	*Female-Headed*	F-Prevalent	40%
		M-Prevalent	76%
	Male-Headed	F-Prevalent	58%
		M-Prevalent	65%
Financially vulnerable	*Female-Headed*	F-Prevalent	51%
		M-Prevalent	78%
	Male-Headed	F-Prevalent	63%
		M-Prevalent	72%

11.4 WEALTH SITUATION VS. HOUSEHOLD FISHING ACTIVITIES

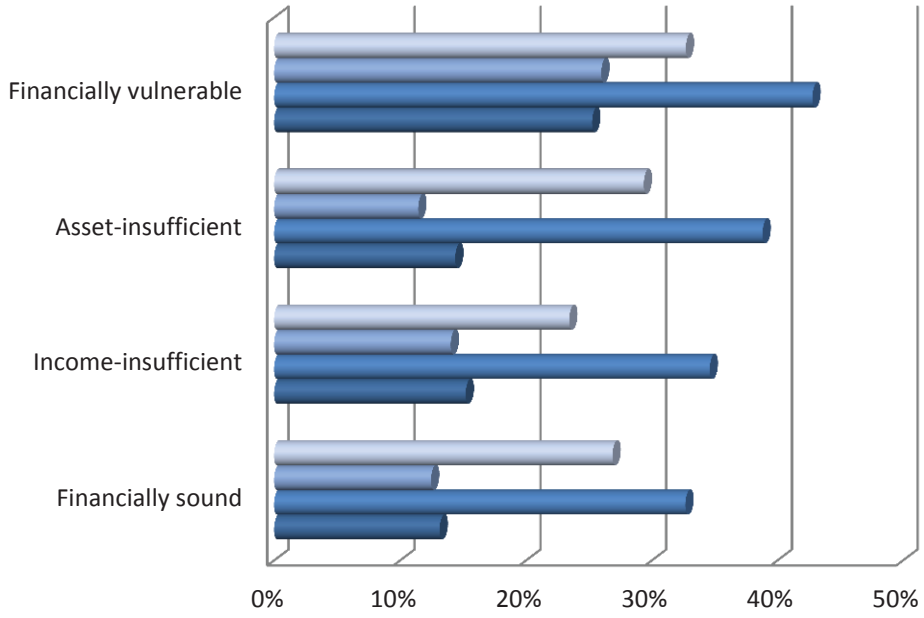
Income-insufficient households are more likely to engage in capture fisheries then asset-insufficient households followed by the financially vulnerable and the financially sound. Male-prevalent households are generally more likely to engage in capture fisheries, especially those headed by females that are either income-insufficient or asset-insufficient, reaching 100% in the survey sample.

Table 47. Percentage of households involved in fishing, by wealth quadrants and gender-based groups

Financially sound	*Female-Headed*	*Balanced*	52%
		F-Prevalent	37%
		M-Prevalent	56%
	Male-Headed	*Balanced*	64%
		F-Prevalent	63%
		M-Prevalent	69%
Income-insufficient	*Female-Headed*	*Balanced*	78%
		F-Prevalent	77%
		M-Prevalent	100%
	Male-Headed	*Balanced*	70%
		F-Prevalent	85%
		M-Prevalent	88%
Asset-insufficient	*Female-Headed*	*Balanced*	54%
		F-Prevalent	45%
		M-Prevalent	100%
	Male-Headed	*Balanced*	53%
		F-Prevalent	68%
		M-Prevalent	78%
Financially vulnerable	*Female-Headed*	*Balanced*	57%
		F-Prevalent	36%
		M-Prevalent	77%
	Male-Headed	*Balanced*	88%
		F-Prevalent	67%
		M-Prevalent	83%

11.5 WEALTH SITUATION VS. HOUSEHOLD HEALTH SITUATION

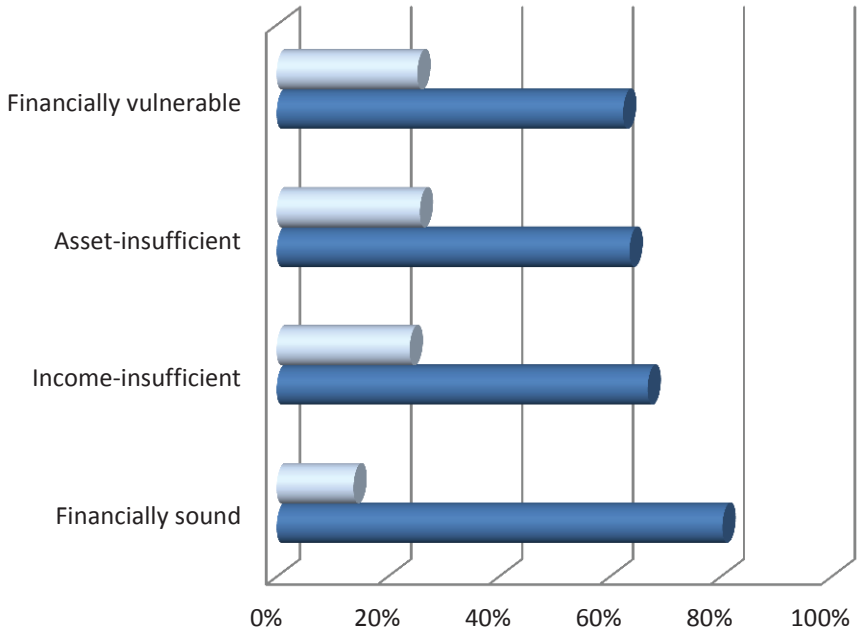
Financially vulnerable households seem more likely to have children with malnutrition symptoms compared with other households. Children with decayed teeth tend to be found less frequently in financially sound households (33%) followed by income-insufficient households (35%), asset-insufficient households (39%) and financially vulnerable households (43%). Children who have developed blond hair or permanently swollen bellies are found in higher proportions in financially vulnerable households and in comparable proportions in other households. Again, the proportion of households having members with incapacitating chronic disease or disability is higher in financially vulnerable households (33%) as shown in Figure 88.



	Financially sound	Income-insufficient	Asset-insufficient	Financially vulnerable
Member with chronic disease	27%	23%	29%	33%
Child with swollen belly	12%	14%	11%	26%
Child with decayed teeth	33%	35%	39%	43%
Child with blond hair	13%	15%	14%	25%

Figure 88. Children malnutrition and members with chronic diseases — % of households by wealth quadrant

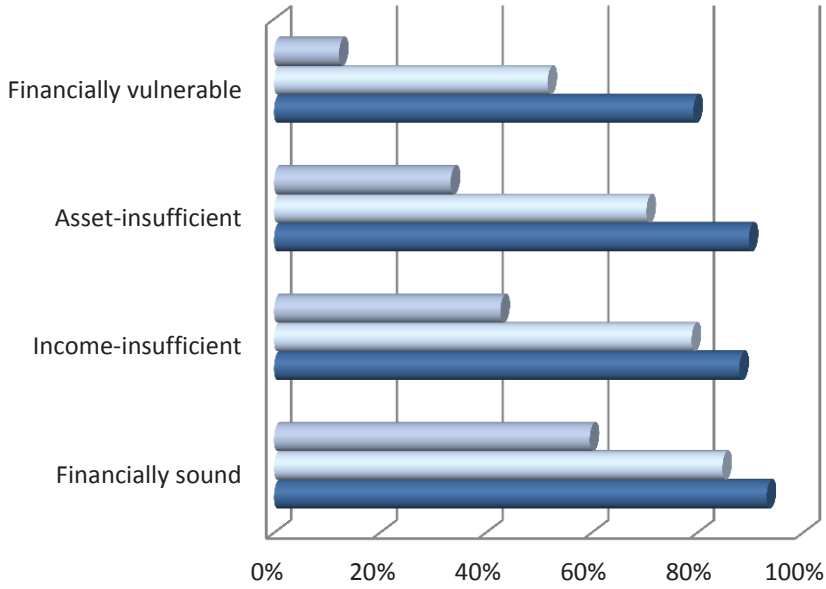
Only 14% of financially sound households consider their primary source of drinking water sufficiently safe all year round against about 25% households in the other three wealth categories. Symmetrically, about 80% of financially sound households boil or chlorinate water against lower and comparable proportions in the other three wealth groups.



	Financially sound	Income-insufficient	Asset-insufficient	Financially vulnerable
Has safe source of drinking water all year long	14%	24%	26%	25%
Resorts to boiling or chlorinating water	80%	67%	64%	62%

Figure 89. Situation with drinkable water — % of households by wealth quadrant.

Affordability for medical consultations up to KHR 40,000 is comparable. But only 12% of the financially vulnerable can afford treatment up to USD 100 compared with 33% for asset-insufficient households, 43% of income-insufficient households and 60% of the financially sound as shown in Figure 90.



	Financially sound	Income-insufficient	Asset-insufficient	Financially vulnerable
Can afford treatment up to USD 100	60%	43%	33%	12%
Can afford medicine up to KHR 80000	85%	79%	70%	52%
Can afford medicine up to KHR 80000	93%	88%	90%	79%

Figure 90. Affordability of medical consultations and treatments — % of households by wealth quadrant

11.6 WEALTH SITUATION VS. HOUSEHOLD NUTRITION

Weekly food consumption patterns show little variability across wealth groups except for income-insufficient households which are more frequent consumers of rice and floodplain resources such as snails, other shellfish, crab and snake as well as other meat such as game.

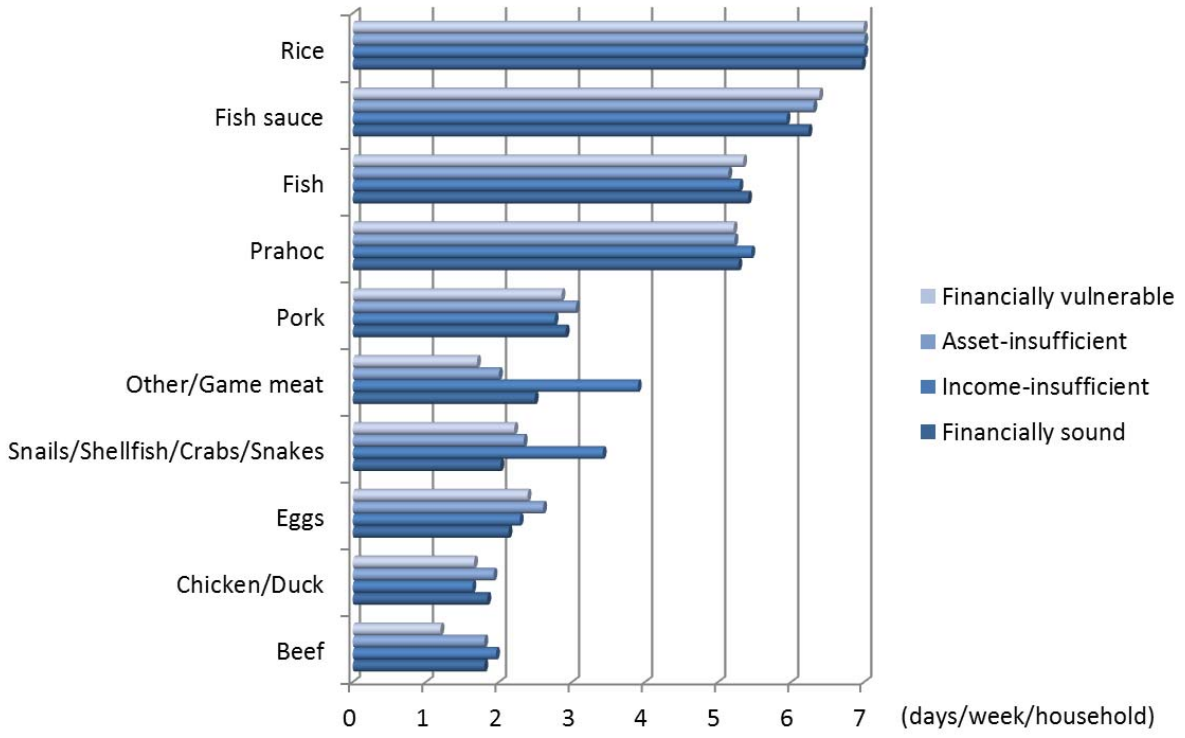


Figure 91. Household weekly consumption of food (frequency) — by wealth quadrant

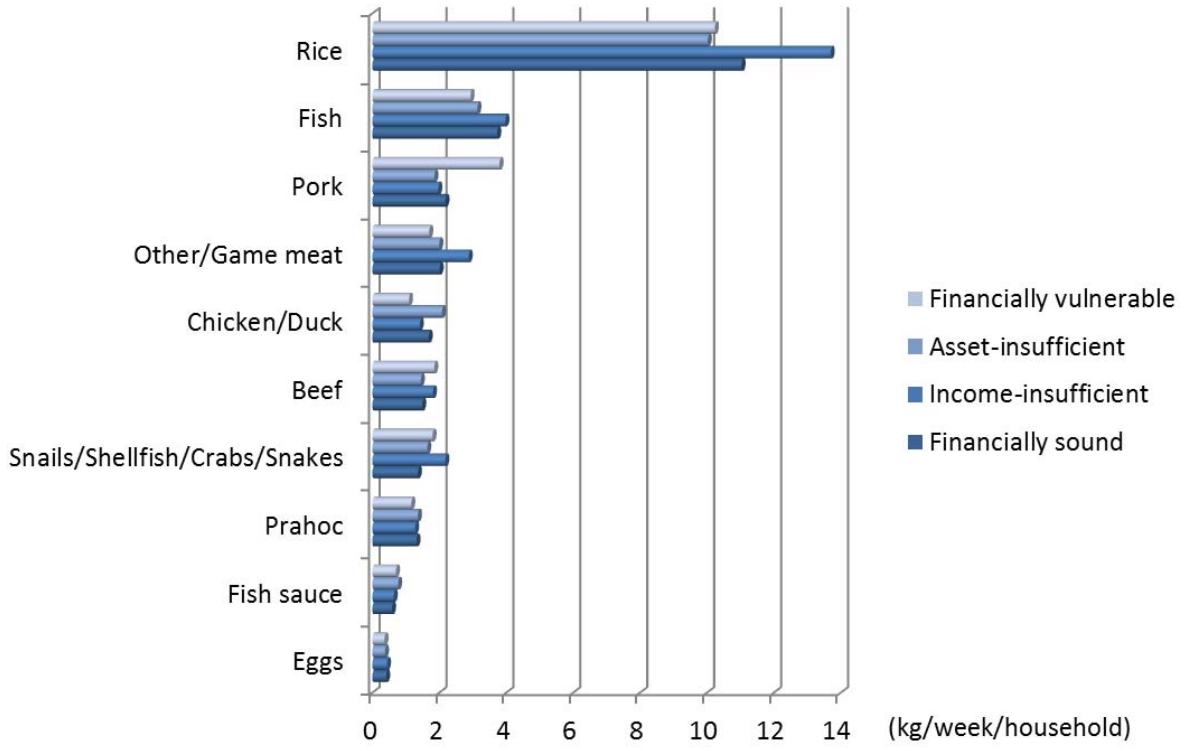
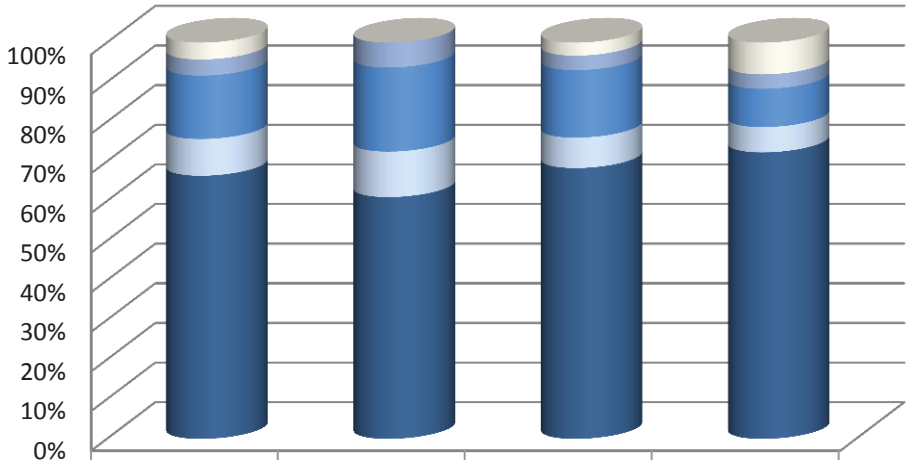


Figure 92. Household weekly consumption of food (quantity) — by wealth quadrant.

Household exposure to food insecurity and engaging in fish as a mitigation measure are comparable across all wealth groups.



	Financially sound	Income-insufficient	Asset-insufficient	Financially vulnerable
Daily	4.3%	0.0%	3.3%	8.0%
Often	4.1%	6.3%	3.7%	3.7%
Sometimes	16.0%	21.2%	17.0%	9.6%
Seldom	9.3%	11.5%	7.7%	6.4%
Never	66.4%	61.0%	68.3%	72.3%

Figure 93. Percentage of household who engaged in fishing as a mitigation measure — by wealth quadrant

12 CONCLUSION

A survey of comprehensive and unprecedented scope has been conducted in Cambodia in fishing-dependent areas of the Tonle Sap, Upper Mekong and Lowland agro-ecological zones. Important data have been collected on household welfare from the point of view of wealth, labor, nutrition, health and resilience. A quantitative analysis ensued, based on descriptive statistics — possibly generalizing to 3.7 million inhabitants of Cambodia living in rural and fishing-dependent areas.

Results and findings have drawn a general depiction of households across the entire population under study and have also uncovered statistically significant differences between household groups based on gender, wealth, fishing dependency and location. A first and important implication for policy efforts is the necessity for analysts to take the aforementioned parameters into consideration while formulating policy directions. Relevant findings and suggestions are summarized below, with particular attention to post-harvest capabilities for capture fishery and aquaculture value chains.

The study concludes that fish plays an important, yet variable, role within the population of households in focus. From a nutrition point of view, fish represents the first source of protein, in terms of both quantity and frequency of food intake. Fishing is a mitigation strategy against food insecurity (a risk feared by a majority of households across all zones) — and is chosen regularly by 37% of Tonle Sap households and 36% of Lowland households. Net income from capture fisheries or aquaculture — similar to net income from other farming or natural environment-dependent activities — represents a secondary source of overall income with the primary source originating from salaries, wages or businesses. Among secondary sources, both capture fisheries and aquaculture feature particularly high labor efficiency compared with non-fishing related activities. In addition, capture fisheries features favorable returns on assets (requiring equipment of more modest value than non-fishing related activities for the same level of net income). The latter aligns with another finding that capture fishery profit margins are significantly higher in asset-insufficient households. However, 75% of fish processed by households is for their own consumption. **Higher leverage may be gained for capture fisheries by building capacity at post-harvest levels of the value chain, namely (a) fish-processing capabilities to better align production with demand and increase profit margins (b) marketing capacity to enhance market access, possibly concentrating on segments of the population already found to be showing a fair performance (households located in high and very high fish-dependency areas of the Tonle Sap zone).**

The behavior of Upper Mekong households tends to differ significantly from that of Tonle Sap and Lowland households. For instance, Upper Mekong households allocate labor inputs that are significantly higher than Tonle Sap and Lowland households for poultry farming, collecting terrestrial resources for household use, cattle, rice farming, catching fish, processing floodplain resources and collecting terrestrial resources for selling — activities that all depend on the natural environment. Upper Mekong households derive income from livestock that is significantly higher compared with Tonle Sap and Lowland households. They possess aquaculture assets of significantly higher value, but do not appear to outperform Tonle Sap or Lowland households in terms of either fish production or income from aquaculture. Even though they allocate higher labor inputs into capture fisheries, the inputs do not translate into stronger economic performance. On the contrary, the gross margin ratio for capture fisheries in Upper Mekong households tends to be weaker than for Tonle Sap and Lowland households. At the same time, Upper Mekong household debt appears to be significantly lower than in the other two zones, which suggests more conservative behavior and weaker investment in productive assets. From the point of view of nutrition, Upper Mekong households

consume rice in significantly higher quantities, and their yearlong patterns of fish consumption are less prone to seasonal variations (which may be due to their upstream position in Cambodia's water system). Nonetheless, cases of children with malnutrition symptoms are reported in significantly higher numbers in Upper Mekong households, with 25% reporting cases of children with permanently swollen bellies and 21% reporting children who have developed blond hair. Despite 83% of Upper Mekong households having access to a hospital or health center, the proportion is significantly lower compared with Tonle Sap and Lowland zones. **Further research focusing on the Upper Mekong zone is warranted to understand the root causes of nutrition, subsistence and resilience issues.**

In contrast, the role of fish in the Tonle Sap zone is more commercially oriented — households catch a lower quantity of fish compared with the Upper Mekong each year but retain a smaller share of the catch for their own consumption, leaving a larger share for commercialization. Tonle Sap capture fisheries also feature high profitability with a 92% gross margin ratio that is significantly higher compared with Lowland households. Fish as a consumption product appears more "elastic" in Tonle Sap households than in Upper Mekong households, as reflected by stronger seasonality of consumption. **Further leverage may be gained around capture fishery and aquaculture value chains in the Tonle Sap zone by harnessing opportunities linked to the proximity of the three largest cities of Cambodia by exploring options for enhancing infrastructure and market access.**

Engaging in farming and other natural environment-dependent activities is an option generally favored by income-insufficient households, which allocate a significantly higher input of labor than asset-insufficient households towards capture fisheries, rice farming, poultry, cattle, collecting floodplain natural resources and collecting terrestrial resources. However, financially sound households mobilize a significantly higher input of labor into aquaculture in comparison with financially vulnerable households — probably due to a higher value of aquaculture assets and cash-flow requirements linked to higher operation costs. **Skills development may be considered as a worthwhile option while addressing issues specific to income-insufficient households, while technology transfer may prove beneficial to aquaculture entrepreneurs.**

Finally, survey results confirm the influence of gender on a range of indicators. Interestingly, they also suggest that gender in terms of leadership (whether a household is headed by a male or a female) has a stronger influence on household choices than household gender ratios (whether a household is male-prevalent, female-prevalent or balanced). For example, male-prevalent households headed by males own a significantly higher number of fishing assets (representing a significantly higher value) compared with male-prevalent households headed by females. As expected, labor input in capture fisheries is significantly higher in male-prevalent households headed by males compared with male-prevalent households headed by females. Also, quantity of fish catches is significantly higher in gender-balanced households headed by males compared with male-prevalent households headed by females. Quantity of fish consumed by gender-balanced male-headed households and also male-prevalent male-headed households, is significantly higher than fish consumed by gender-balanced female-headed households. Households that incur longer absences of members are male-prevalent households headed by females, where absences are significantly longer than in male-headed households. In general, within income-insufficient and financially vulnerable wealth groups, male-headed households earn net income that is significantly higher than female-headed households. **Such findings suggest prioritizing skills development primarily to household heads and tailoring related training programs according to the gender of household heads.**

APPENDIX 1. Activity by fishing gear

Seventy-five per cent of the fishing effort corresponds to the use of castnets, gillnets, hooked line and traps. The most productive gears (in terms of yield per time unit) are seine/drag nets, fyke nets, funnel trap and bamboo/rattan traps — Production and income were compared across fishing gears, showing a predominance of castnets, gillnets, hooked line and traps over other kinds of gears — see Figure 94 and Figure 95. Results were further analyzed from the standpoint of *production ratio* (quantity caught per day of labor), *profitability ratio* (net income per day of labor) and *gross margin ratio* (net income to gross sales) — see detailed results in Table 48 below. While 75% of the fishing effort (i.e. days of use in a year) concentrates on castnet (16 days/yr.), 1/2/3-finger gillnets (29 days/yr.), hooked line (4 days/yr.) and trap (4 days/yr.) equipment, it was found that:

- highest production ratios are derived from seine/drag net (13 kg / day of use), fyke net made of mosquito net (8 kg / day of use), bamboo/rattan trap (6 kg / day of use)[31];
- highest profitability ratios are noted for fyke net (USD 20 net income / day of use), seine/drag net (USD 12 / day of use), bamboo/rattan trap (UDS 7 / day of use); and
- highest gross margin ratios are realized while using fyke net (100% gross margin ratio), funnel trap (100% gross margin ratio), bamboo/rattan trap (98% gross margin ratio).

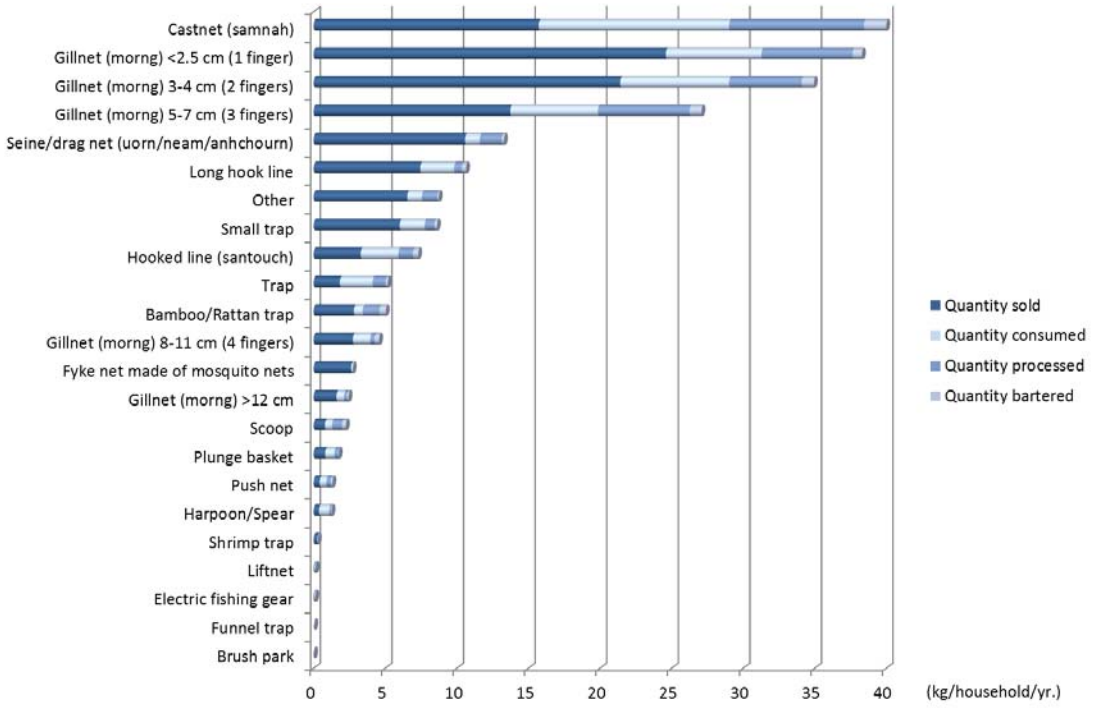


Figure 94. Annual fish catch (in kg) per household and per gear, and use of the catch.

[31] Brush park also shows superior production and profitability ratios. However this fishing method was excluded from further analyses due to its low frequency.

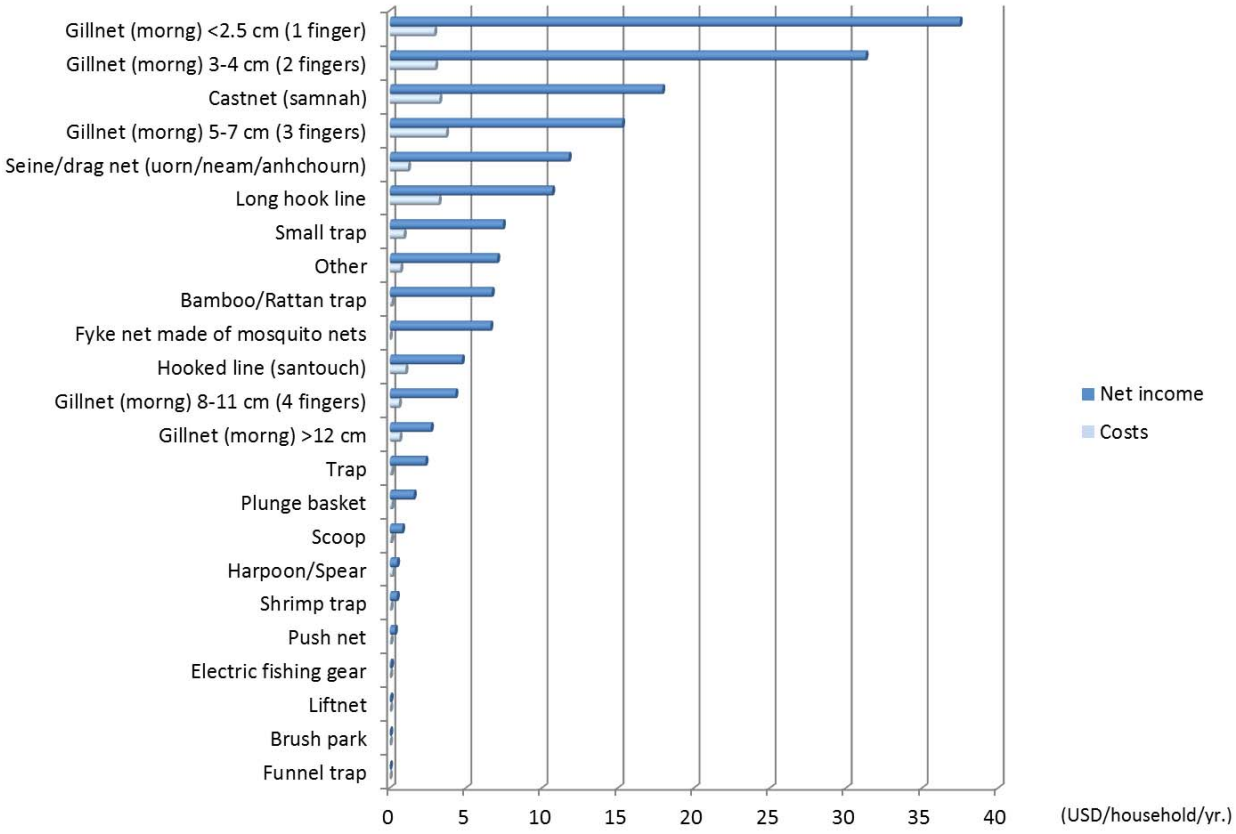
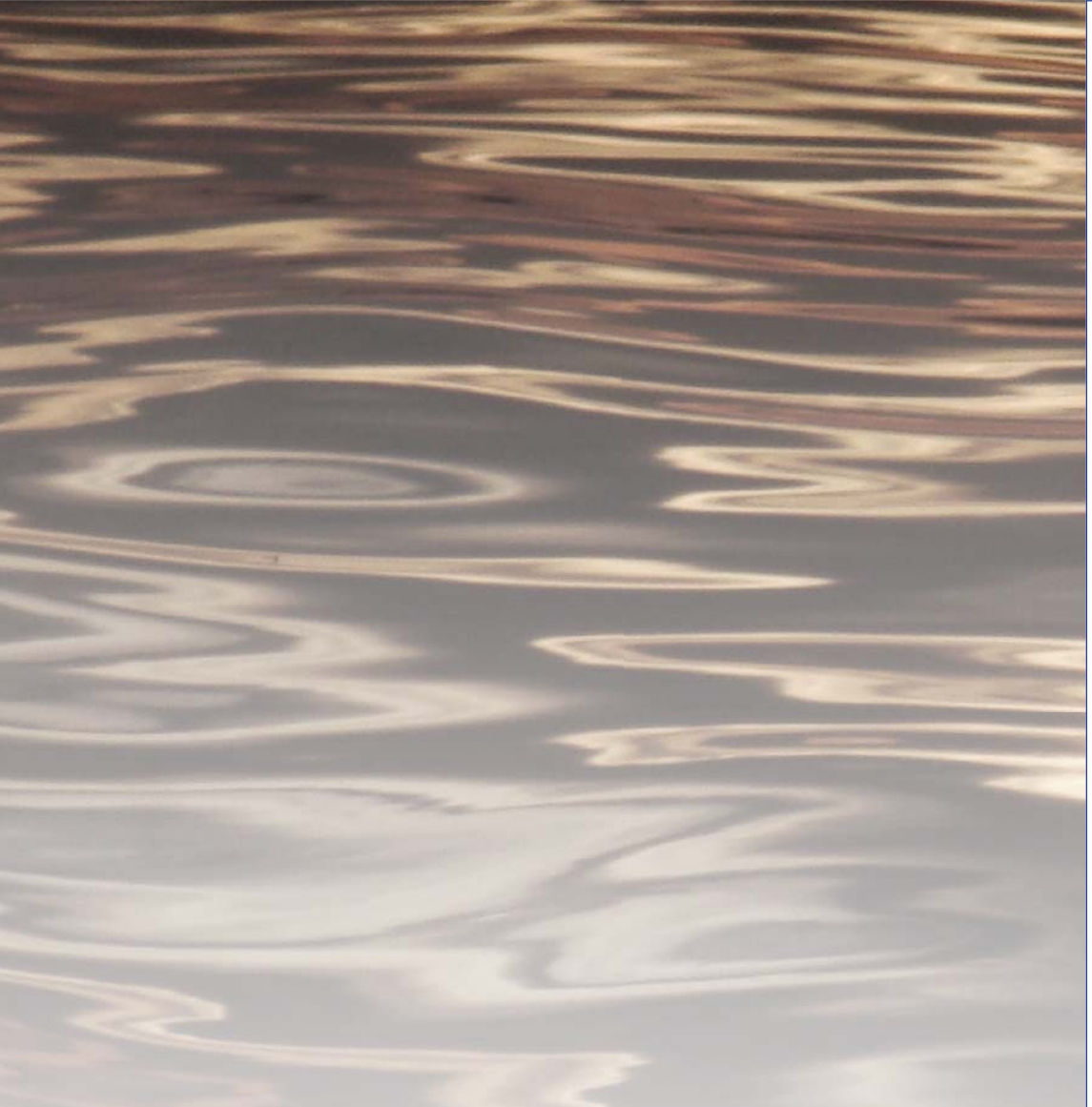


Figure 95. Annual net income and costs from capture fishery by gear (USD/household/yr.)

Table 48. Fishing equipment, production and profitability

EQUIPMENT	Days Used Per Year	Quantity Caught (kg)	Quantity Sold (kg)	Quantity Consumed (kg)	Quantity Processed (kg)	Quantity Bartered (kg)	Value Of Production (USD)	Sales Revenue (USD)	Costs (USD)	Net Income (USD)	Net Income (%)	Production Ratio (kg Per Labor Day)	Profitability Ratio (Net Income Per Labor Day)	Gross Margin Ratio
Gillnet (morng) <2.5 cm (1 finger)	9.3	38.3	24.6	6.7	6.4	0.7	58.8	40.4	2.9	37.5	22.0%	4.1	4.0	93%
Gillnet (morng) 3-4 cm (2 fingers)	11.4	34.9	21.4	7.6	5.1	0.9	55.4	34.3	3.0	31.3	18.4%	3.1	2.7	91%
Castnet (samnah)	16.4	40.0	15.7	13.3	9.4	1.6	57.3	21.2	3.3	17.9	10.5%	2.4	1.1	85%
Gillnet (morng) 5-7 cm (3 fingers)	7.8	27.1	13.7	6.1	6.4	0.8	39.6	19.0	3.7	15.3	9.0%	3.5	2.0	80%
Seine/drag net (uorn/neam/anchourn)	1.0	13.3	10.6	1.0	1.5	0.2	17.8	13.0	1.2	11.8	6.9%	13.4	11.8	91%
Long hook line	3.3	10.7	7.5	2.4	0.5	0.3	19.5	13.9	3.2	10.7	6.3%	3.2	3.2	77%
Small trap	3.9	8.6	6.0	1.8	0.7	0.2	12.8	8.3	0.9	7.4	4.4%	2.2	1.9	89%
Other	2.1	8.7	6.5	1.0	1.1	0.1	11.1	7.8	0.7	7.1	4.2%	4.2	3.4	91%
Bamboo/Rattan trap	0.9	5.0	2.8	0.6	1.2	0.4	10.9	6.8	0.1	6.7	3.9%	5.6	7.4	98%
Fyke net made of mosquito nets	0.3	2.7	2.6	0.1	0.0	0.0	6.9	6.6	0.0	6.6	3.9%	8.3	20.1	100%
Hooked line (santouch)	4.2	7.3	3.3	2.6	1.0	0.4	12.1	5.8	1.0	4.7	2.8%	1.7	1.1	82%
Gillnet (morng) 8-11 cm (4 fingers)	1.6	4.6	2.7	1.2	0.3	0.3	8.2	4.9	0.6	4.3	2.5%	2.8	2.6	88%
Gillnet (morng) >12 cm	0.6	2.4	1.6	0.5	0.2	0.1	4.7	3.3	0.6	2.7	1.6%	3.8	4.1	81%
Trap	3.9	5.2	1.8	2.3	0.9	0.2	7.3	2.5	0.1	2.3	1.4%	1.3	0.6	96%
Plunge basket	1.2	1.8	0.8	0.6	0.3	0.0	3.3	1.7	0.1	1.6	0.9%	1.5	1.3	93%
Scoop	0.7	2.3	0.8	0.5	0.7	0.3	3.0	0.9	0.1	0.8	0.5%	3.4	1.2	90%
Harpoon/Spear	1.0	1.3	0.4	0.7	0.1	0.1	2.0	0.6	0.2	0.5	0.3%	1.2	0.5	73%
Shrimp trap	0.3	0.3	0.3	0.0	0.0	0.0	0.6	0.5	0.1	0.5	0.3%	1.1	1.7	89%
Push net	0.7	1.3	0.4	0.5	0.3	0.1	1.4	0.4	0.1	0.3	0.2%	2.0	0.5	85%
Electric fishing gear	0.1	0.1	0.1	0.1	0.0	0.0	0.2	0.1	0.0	0.1	0.0%	1.9	1.1	75%
Liftnet	0.0	0.2	0.0	0.0	0.1	0.0	0.3	0.1	0.0	0.1	0.0%	3.3	1.1	65%
Brush park	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0%	14.0	10.1	77%
Funnel trap	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0%	0.6	0.0	100%



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