Project Report: AAS-2013-28

Tonle Sap Scoping Report

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Executive summary

The scoping mission team was composed of 14 people representing research institutions (RUPP), government (FiA, IFReDI), NGOs (ANKO, ADIC) and CGIAR institutions (WorldFish and Bioversity). The scoping trip was carried out over a 7-day period from April 28 to May 4 within eight (8) communities in Kampong Thom, Siem Reap, Battambang, Pursat and Kampong Chhnang. In addition, panel discussions were held with local government, fishery, agriculture and water management institutions, NGOs, the private sector and communities, and were convened in Siem Reap, Battambang and Pursat.

The AAS scoping team focused their enquiries on five themes, and the findings of this report are presented in sections that highlight the opportunities, challenges and knowledge gaps related to each theme. The sections have been lightly edited to maintain the style and intention of the authors. The themes are:

1. AAS production systems—fish, rice, aquaculture.
2. Livelihoods, poverty, and gender equity .
3. Value chains and markets.
4. Institutions and governance.
5. Knowledge management and partnerships.

Aquatic agricultural systems (AAS) are defined as those farming, fishing and herding systems where the annual production dynamics of natural freshwater and/or coastal ecosystems contribute significantly to household livelihoods, including income and food security. The AAS research program is focused on improving the welfare of AAS-dependent people and in particular the poor and marginalized. The geographical focal area (hub) of the AAS scoping reported here is the Tonle Sap, where it is estimated that 1.5 million people live and rely on the productivity of the lake and floodplain. Of these people, about 900,000 live in what are termed floating and stilted villages (Sithirith, 2011).

The AAS economy in Cambodia is dominated by rice production and fisheries. Rice is grown by more than 70% of the rural population, occupies 80% of the total cropping area, and accounts for 70% of overall crop production. In the past decade, rice production per capita has grown by 8.7% per year, increasing from 339 kg in 2000 to 535 kg in 2008. However, paddy yields per hectare remain the lowest in Asia. The fisheries sector provides income and livelihood to 46% of the total population, or about 6.7 million people, and represents over 10% of GDP. Fish and other aquatic animals contribute 80% of animal protein in the typical Cambodian diet.

The scoping mission targeted districts where there is a high dependency on fisheries[1] and where communities and villages derive their livelihoods from three inter-related ecological systems governed by the flood pulses of the Tonle Sap Lake. These are referred to as aquatic, terrestrial, and aquatic-terrestrial eco-systems. In the terrestrial eco-systems, villages are "land-based" and are engaged more in farming and depend less on fishing for livelihoods. In the aquatic systems, villages are "water-based" and include floating villages where fishing is the primary occupation for villagers. The third group is the "water-land based villages" located in aquatic-terrestrial eco-systems, which are located on water for six months and land for six months. These villages are in the ecological zone most affected by seasonal water level changes. The succeeding table provides the number of villages by type (See Table 1).

Table 1. Typology of fishing villages by province in the Tonle Sap.

Province	Water-based villages	Water-land based villages	Land-based villages	Total
Battambang	10	2	117	129
Siem Reap	12	14	269	295
Kampong Thom	10	0	109	119
Kampong Chhnang	6	16	63	85
Pursat	15	1	238	254
Banteay Meanchey	0	3	152	155
Total	53	36	948	1037

Source: Sithirith, 2011.

The selection of villages for the AAS program will be based on a number of factors including the fishing dependency score (FDS) that currently acts as a proxy for AAS dependency in a community. Other factors that will contribute to the selection of villages and their participation in the initial stages of AAS include the presence of development issues that are of wide concern across the hub; potential for partnerships and scaling up; potential to capitalize on current or planned development efforts; the presence of a high degree of poverty, marginalization and vulnerability. In addition, the geographical location of communities in the Tonle Sap and representation of the ecological zones (land-based, land-water based and water based villages) will play an important part in the selection criteria.

The view on the Tonle Sap that emerged from the scoping and that was articulated by the team can be summarized in the points below.

- The Tonle Sap is an important system for food (primarily fish and rice) production for 1.5 million people living and relying on the AAS resources of the Tonle Sap;
- It is characterized by diverse aquatic agricultural systems whose productivity is determined by the flood pulses of the lake and different land and water management practices;
- It has a diverse range of capture fisheries systems in the lake, rivers, floodplains and natural ponds that contribute to the livelihoods and incomes of those dependent on AAS resources;
- Small-scale aquaculture is still emerging and is not well developed as an alternative livelihood;
- Diverse and complex value chains for fisheries products exist that are adding limited value and benefits to the poor;
- Despite diverse livelihood strategies, many fishing and farming households, especially those highly dependent on AAS resources, are entrenched in poverty;
- Services delivery (extension, credit etc.) to poor households is patchy and has had an adverse effect on productivity;
- Migration is very widespread, especially among young women, affecting the livelihoods of households in positive and negative ways;
- Deregulation of the fishing lot system is impacting supply chains and creating chronic competition for fish resources.

[1] A fishery dependency score has been developed by WorldFish under the ACIAR Valuation Project 2012 and uses national census data to develop a village-level variable which equals the probability that a randomly selected household engages in some level of fishing activity.

Based on these insights, a hub development challenge (HDC) was developed. This challenge consists of a mission statement describing the intent of the AAS program and its proposed impact. The HDC identifies the "triggers" or actions that can be used to unlock the "potentiality" of the system to deliver "impact" or shared vision. The HDC for the Tonle Sap is summarized in the following mission statement:

To make more effective use of knowledge networks and of practices for improving land and water management and value chains in order to optimize the productivity of the flood pulses and to assist the people that depend upon the flood pulses to diversify their livelihoods, ensure food and nutrition security and maintain a healthy ecosystem.

The HDC was derived from a synthesis of the findings of the scoping team, looking at the Tonle Sap through various lenses. The following sections detail the findings of the scoping mission presented by themes, highlighting knowledge gaps for further investigation.

1. AAS production systems
The Tonle Sap Great Lake is widely known to be rich in fisheries resources and to be a productive area for rice paddy production. The communities residing in the lake region rely heavily on fish and rice for their livelihoods. There are a number of challenges that need to be addressed to maintain both the health of the people and their livelihoods and to sustain ecosystem services. These include but are not limited to the following.

- **Rice** – questions about the cost, opportunities and risks of using intensified systems and species/variety selection to take advantage of the pulse cycle as an alternative to more highly regulated irrigation systems;
- **Water management** – the capacity to regulate water while the situation provides at times too little and at other times too much. Key knowledge gaps include a better understanding of which water management strategies, including reservoirs and irrigation systems, are most suited to the region and how much water would be needed to boost dry season production. Related to this question is a clearer understanding of the trade-offs between reservoir density and size (depth and width);
- **Lake fishing** – knowledge of the fisheries populations and their changes over time may be available, but does not appear to be commonly known by local officials, nor does it appear to be used in fisheries management arrangements;
- **Nutrition environment and water quality** – greater access to sanitation facilities and water for human consumption and fishing are important improvements that could be made in this sector. The effects of environmental contamination and fish handling on the quality of fish are largely unknown.

2. Livelihoods, poverty, and gender equity
Livelihoods are characterized by occupational pluralism and diversified income-generating activities based on agriculture, natural resource use, labor sales and small business enterprises. The AAS livelihoods are organized around the cultivation of rice (wet and dry season), fishing, fish processing, fish marketing, and the collection of forest products and firewood, aquatic animals and plants. The annual flood pulse is followed by a livelihood pulse, with the livelihoods very closely connected with the annual hydrological cycle of the lake. Adaptation to, rather than control of, the area's exceptional water regime is a typical characteristic of the Tonle Sap region. Occupational diversity in the Tonle Sap area is much greater within households than it is within and between villages, as the main source of livelihoods in each village and commune appears to be surprisingly uniform.

The poorest households have very small land holdings and no livestock, capital or savings. Households located downstream appear to be poorer than those located upstream. Among the landless poor, some of the poorest families are found in "floating villages", scattered around the Tonle Sap Lake and along major river channels. Migration is widespread and most villages report that 30-50% of households migrate to other provinces, Phnom Penh, or nearby countries (Thailand, Vietnam or Malaysia). They provide farm labor for cassava and corn harvests and wage labor in garment factories, as domestic help, and as construction workers, etc. Even though land-based households produce rice, due to small land holdings and low yields, the rice produced is not adequate to last the whole year. Most households report food shortages for at least four months during the year (Sept.-Dec.). In addition, due to the lack of clean drinking water, sanitation and accessible health care, the disease incidence (particularly gastro-intestinal) is high, leading to low productivity. Pre-natal and post-natal care is also very limited and not easily accessible.

The number of Micro Finance Institutions (MFIs) in the Tonle Sap area has increased rapidly over the last few years. Each village has 4-7 MFIs. The MFIs need collateral to lend money and large proportions (40-50%) of households are indebted. A range of savings groups initiated by development organizations and programs exist in the villages. There have been mixed results with regard to the success and sustainability of these groups.

Households in several villages visited mentioned the difficulty of obtaining financial capital as a major obstacle to engaging in value addition activities by starting new enterprises or to relocating to a new place and starting new enterprises. Access to vocational education and other skills is missing. Hence, the livelihood choices available to men, women and youth are particularly limited. This is also resulting in migration to take up unskilled and low-paid jobs. Most young men and women interviewed aspire to leave their villages and go to cities in search of remunerative livelihood choices. However, they also lack the capital and skills required to do so.

Traditionally there is a gendered division of labor, roles and responsibilities within the household and in livelihood activities. However, this division appears to be flexible, and women and men are able to take up livelihood activities as necessary. Women in leadership positions are rare.

3. Value chains and markets
Interviews were held mainly with fishers, fish traders and processors during the scoping, and the information on the rice value chains requires further analysis. However, the reliance of the poor and in particular of the landless and asset-less households on fisheries means that understanding and improving the fishery value chain is a high priority for AAS-dependent households in the Tonle Sap area.

The supply chain and distribution of inland fish is complex and diverse with numerous transactions taking place before fish and fish products reach the consumer or export markets. Despite poor marketing infrastructure in terms of landing, storage, preservation, transport and retail facilities, the market chain and networks are relatively well managed and based on long-term relationships. These relations are often formalized through traditional credit arrangements between fisher, collector, processor, trader, wholesaler and exporter that sustain the networks. The traditional market and supply chain for fish and fish products appears quite resilient to changes although there is evidence that the deregulation of the fishing lots through the opening up of the micro-finance markets is uncoupling the links between traders and fishers within the chain.

All respondents in all village types reported a decline in the amount of fish caught over the last 5 years. The price of fish has increased dramatically during this period and prices are determined by the (domestic and export) wholesalers in Phnom Penh and also by the export wholesalers working on the Thai border. Many of the smaller traders, particularly those without transport, process fish themselves, and this is an important value addition activity for households. However, the profit margin is low. New opportunities to diversify processed fish products need to be considered based on an assessment of market demand. Many traders reported informal fees, and the prevalence of informal rules and fees in the supply and market chain appears to reduce profits.

Despite the liberalization of the credit market and the deregulation of the lot fishery, the poor particularly those living in marginalized areas such as floating villages and floodplains continue to have limited access to well-managed fishery resources, technologies, capital markets, good marketing and transport infrastructure and have low levels of skills. The deregulation of the fishing lots reduced traded volumes through competition, and easy access to technology, inputs and services crucial to the improvement of fish value chain are limited to resource-poor households that lack the social, human, financial, physical and natural capital to benefit from improved value chains.

4. Institutions and governance
Governance of the Tonle Sap is complex and has been changing over time from a focus on fishery management, based on the commercial exploitation of fishery resources, to community-based fishery management and conservation of biodiversity. Recently, the Royal Government of Cambodia (RGC) terminated the 100 year old fishing lot system in the lake and returned the whole lake to open access and conservation. This has led to new institutional and legal arrangements for Tonle Sap management, and the Tonle Sap Authority (TSA) was established in part to address governance needs.

The change in governance has happened rapidly without any clear plan or strategy; however, the policy changes at the national level are not necessarily being translated into action at the local level.

The community is still struggling to define their governing system to manage their water and fisheries. Given the weak governance, the whole system still suffers from too much water in the wet season and too little in the dry season. The conflict over the use of water for irrigating rice and catching fish is still widespread. The implementation of governance interventions is weak due to the lack of resources and skills.

5. Knowledge management and partnerships
In the visited villages, there are many networks and groups but they are fragmented. There is no mechanism for coordination of existing networks and groups to share their knowledge and experiences with regard to fish processing, fish culture, and rice cultivation. Some groups have been established based on the interests of NGOs or government institutions, and these do not always reflect the genuine interests of the local villagers.

Information has not been widely shared among farmers and fishermen. Many fishers and farmers mention learning new skills via word of mouth or learning by conducting their own experiments through trial and error. In some villages, the villagers mentioned that NGOs had trained them in new skills, such as how to cultivate dry season rice and raise livestock, but these skills were not widely practiced because the conditions were not suitable, such as the lack of water for dry season rice cultivation.

List of abbreviations

AAS	Aquatic Agricultural System
AARR	Alliance Association of Rural Restoration
ADB	Asian Development Bank
ADIC	Analysing Development Issues Center
ANKO	Akphiwat Neary Khmer Organization
AS	Aphiwat Strey
CGIAR	Consultative Group on International Agricultural Research
CRP	CGIAR Research Program
CRS	Catholic Relief Services
CNMC	Secretariat within the Cambodian National Mekong Committee
COWS	Cambodian Women Support Organization
DDT	Design and Diagnosis Team
FGD	Focus Group Discussion
FSN	Food Security and Nutrition
HARVEST	Helping Address Rural Vulnerabilities and Ecosystem Stability (USAID)
HDI	Human Development Index
IFReDI	Inland Fisheries Research and Development Institute
INGO	International Non-Governmental Organization
FiA	Fisheries Administration
HURREDO	Human Resource and Rural Economic Development Organization
M & E	Monitoring and Evaluation
MAFF	Ministry of Agriculture, Forestry and Fisheries
MFI	Micro-Finance Institutions
MoWRAM	Ministry of Water Resources and Meteorology
MoE	Ministry of Environment
NGO	Non-Governmental Organization
NSA	Non-State Actors
RUPP	Royal University of Phnom Penh
SRI	System of Rice Intensification
TSA	Tonle Sap Authority
TSSLP	Tonle Sap Sustainable Livelihood Project
TSBR	Tonle Sap Biosphere Reserves

Introduction

Globally over 700 million people depend on aquatic agricultural systems (AAS), and some 250 million live on less than US$1.25 a day. Living in coastal zones and along river floodplains, these communities are not only poor but also vulnerable to multiple drivers of change, notably demographic trends, climate change, sea level rises, and increasingly frequent and severe extreme weather events. They live there despite their vulnerability because these are highly productive systems that provide multiple opportunities for growing or harvesting food and generating income.

The CGIAR research program called "Aquatic Agricultural Systems" is coordinated by WorldFish, IWMI and Bioversity and focused on understanding how commodities and drivers of change interact and provide opportunities for the poor. By focusing on food security and rural development and improving the ways in which stakeholders work together, the Consultative Group on International Agricultural Research (CGIAR) has developed a new generation of global agricultural research programs.

The overall goal of the AAS CRP is to improve the well-being of people dependent on aquatic agricultural systems. More specifically the program is focused on understanding and taking action to address the challenges facing the agricultural systems in inland floodplains, major river deltas, and coastal environments to improve the livelihoods and nutritional status of the poor and marginalized. AAS uses a participatory approach to engage a wide range of global and regional organizations to make an impact at scale together with a range of partners.

The purpose of AAS is to confront the paradox of high ecological productivity and high levels of poverty, vulnerability and inequities among social groups relying on these aquatic agricultural systems. Its goal is to transform these systems so that they can realize their full development potential while remaining resilient to societal and environmental change.

In Cambodia, AAS is focused on important geographical areas or hubs where there is a predominance of AAS resources. The Tonle Sap Lake and its floodplain is the first AAS hub in Cambodia. AAS through its roll-out, which is a planning, scoping, diagnostic and design process, is engaged with different stakeholders and communities to identify the main development challenge for the Tonle Sap and to develop a program of work together.

The scoping mission and debriefing discussions provided the basis for identifying a hub development challenge for the Tonle Sap that can be addressed by the AAS program. A number of supplementary reports and studies were provided to the team to assist in the discussion and to provide useful background information and data. These included the National Analysis Report[2], Study on Food Security and Nutrition[3], Self-Help Groups[4] and Gender[5].

Objective of the scoping

The purpose of the scoping was to gain a broad and shared understanding of the development issues and opportunities in the hub as related to AAS, the main factors and drivers affecting the people in Tonle Sap, any past and on-going development efforts. It also aimed to identify important stakeholders and the likely geographical focus of activities and potential partners.

The objectives of the scoping mission were to:

1. Provide a situation analysis and draft hub development challenge for the Tonle Sap;
2. Identify a network of local partners that can be engaged in the AAS process around the Tonle Sap and confirm their priorities;
3. Identify action research interventions that can be undertaken and contribute to building action research capacity with local partners in the Tonle Sap;
4. Make preliminary recommendations for target communities for the AAS program and their program priorities; and
5. Identify the composition of the Design and Diagnosis Team and/or Guiding Coalition and produce a draft agenda for the DD team orientation

Table 2. The scoping team consists of people having the following skills and expertise.

Thematic categories	Interest areas	Participants
Production systems and ecology • aquaculture, capture fisheries, other aquatic animals (OAA), crops (rice, vegetables)	Small-scale aquaculture & capture fishery status; rice and fish; water resource and hydrology; deforestation, ecology	1. Dr. Seak Sophat (DES/RUPP) 2. Mr. Mam Kosal (WorldFish) 3. Dr. Fabrice De Clark (Bioversity) 4. Mr. Chan Sokheng (IFReDI)
Livelihoods and food security, and gender	Poverty; migration and landlesness; livelihoods diversity	5. Dr. Ranjitha Puskur (WorldFish) 6. Mr. Suon Sokheng (CRS)
Governance and institutions	Policy, institutions, reforms, CFI, CRFs, co-management	7. Dr. Mak Sithirith (WorldFish) 8. Mr. Pech Bunna (FiA)
Value chain and markets	Markets, processing, supply chain; role of women in trade; credit; post-harvest value added	9. Dr. Gareth Johnstone (WorldFish) 10. Ms. Rest Sameth (IFReDI) 11. Mr. Proum Kimhor (WorldFish)
Knowledge, information management and partnerships	Community networks, information exchange, natural, social and economic data	12. Ms. Hak Sochanay (WorldFish) 13. Mr. Il Oeur (ADIC) 14. Ms. Lov Samnan (ANKO)

Gender Methodologies in the AAS for Tonle Sap Area (2013), produced by AIDA for AAS in Cambodia.

[2] Un B., Pech S., Baran E. 2013 Aquatic agricultural systems in Cambodia: national situation analysis. Report for the CGIAR Research Program on Aquatic Agricultural Systems. WorldFish.
[3] Study on Household Food Security and Nutrition and Assistance Provided in the Tonle Sap Region Cambodia (2013), produced by CRS for the AAS program in Cambodia.
[4] Cambodian Self-Help Groups Type Identification & Effectiveness Review Technical Report (2013), produced by Oxfam USA for the AAS program.
[5] Aid Effectiveness on Gender-Based Approaches in Aquatic Agriculture Systems in the Tonle Sap Region: Incorporating Gender Methodologies in the AAS for Tonle Sap Area (2013), produced by AIDA for AAS in Cambodia.

Methodology

The scoping mission team was composed of 14 people representing research institutions (RUPP), government (FiA, IFReDI), NGOs (ANKO, ADIC) and CGIAR institutions (WorldFish and Bioversity). The experts from each theme were expected to review available literature and provide an assessment of the development issues, highlighting areas in which insufficient information was available and would require further investigation and studies. A drop-box of essential documents was made.

The scoping trip was carried out over a 7-day period from April 28 to May 4 and eight (8) communities in Kampong Thom, Siem Reap, Battambang, Pursat and Kampong Chhnang were visited.In addition, in Battambang, Siem Reap and Pursat seminar meetings were held with key stakeholders from local governments, fisheries and agriculture departments, water management professionals, community leaders, NGOs and private sector representatives.

The panel discussions provided an opportunity for the scoping team to ask the specific questions and discuss issues relevant to AAS (see Annex One for a list of participants). The methodology for the panel discussions was to develop a set of questions that were specific to the work and activities of each panel member. The first set of questions focused on policy, the second set on practices and the last set on opportunities and challenges. The panel members were shown the questions several hours in advance and had time to prepare their answers. A question was put to each panel member by the "question reader" and the member had 3-4 minutes to respond to each question. After each panel member had answered each set of questions, 10 minutes was given for a few additional questions to come from the floor. The session was run in Khmer to encourage wide participation.

The scoping team visited in total eight communities. The communities were selected for the scoping because they represented villages in each of the ecological zones—land-based, land-water-based and water-based communities across the flood gradient.

In each community generally four groups were formed representing: (1) village leaders; (2) fishers and farmers; (3) traders and processors; and (4) women. Background data and demographics for each of the communities were provided so that the teams could focus on the key issues related to AAS. Different participatory methods were used to engage the community groups in the discussion including resource mapping, time-lines and seasonal calendars. A list of community participants can be found in Annex One.

Location and sites visited

We visited the following provinces and villages in order to get an impression of each of these zones in these provinces:

1. Kampong Thom province
    a. Phat Sanday—a floating community where large fishing lot areas were cancelled and returned to open access and conservation.
    b. Chambak—a land-based community in Santuk district.

2. Siem Reap province:
    a. Santey village—a stand-stilt community in Sotr Nikum district where villagers do both farming and fishing, but farming is in conflict with fishing.
    b. Chong Kneas—a floating community in Siem Reap district.

3. Battambang province
    a. Rohal Suong—a farming-fishing community in Ek Phnom district with a focus on community fisheries and farming communities.
4. Pursat province
    a. Tram Per community—farming-fishing communities with a focus on community fisheries and community-based irrigation.
    b. Metuk community—a land-based community.

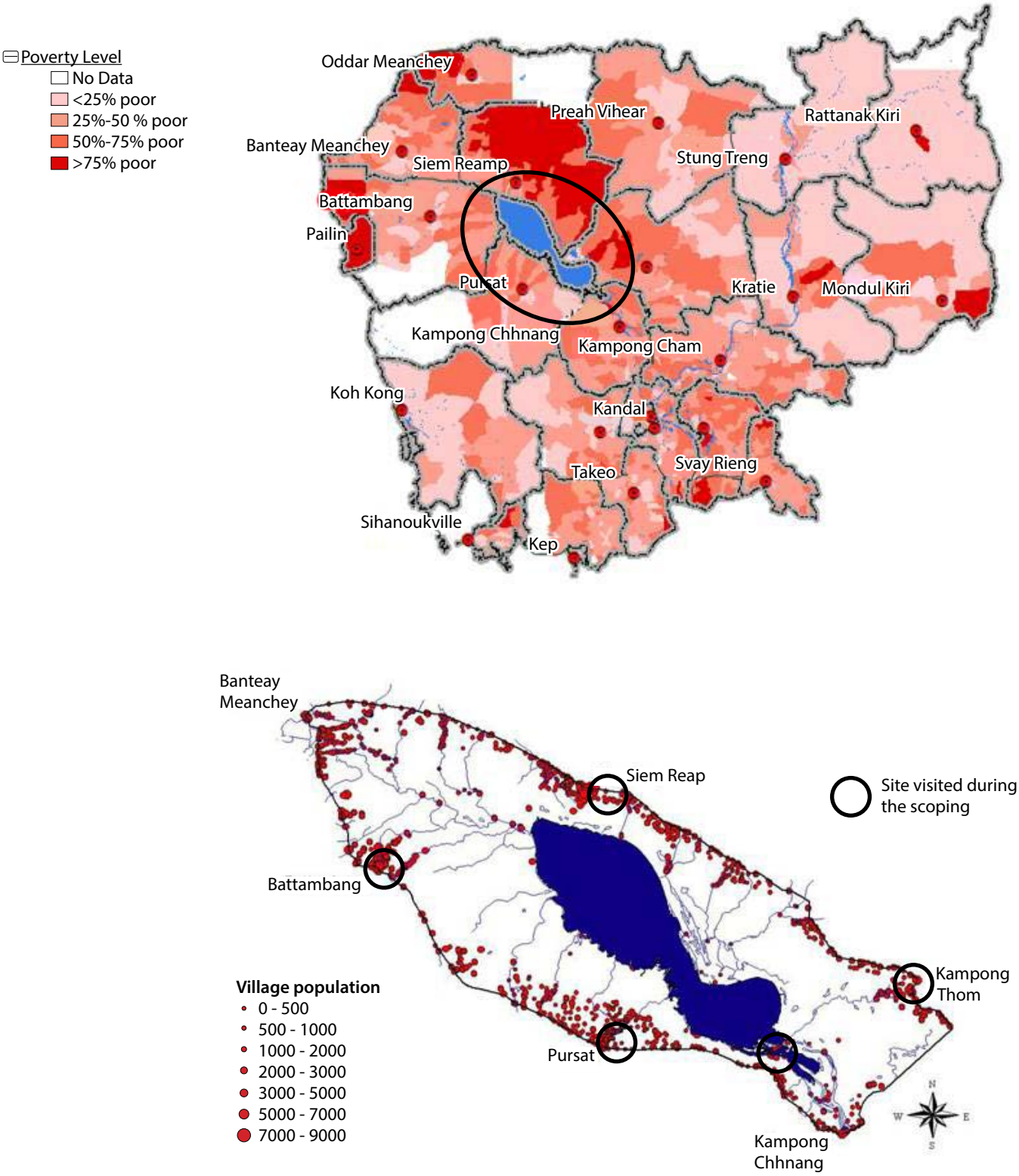
Activities of the scoping team

- Map recent past, present and planned development programs and interventions in the Tonle Sap. This provided an initial look at the scope of interventions in the Tonle Sap hub and the partnership landscape and networks.
- Detail potential studies and interventions that can help build knowledge related to AAS and action research capacity with local partners.
- Recommend a potential set of target areas in the Tonle Sap. From within the target areas, the scoping team should recommend priority communities.

Table 3. Villages visited and their ecological zones.

Province	Land-based villages	Land-water-based villages	Water-based villages
1. Siem Reap	Santey	Chong Khneas	
2. Battambang	Rohal Suong		
3. Pursat	Metuk	Tram Per	
4. Kampong Thom and Kampong Chhnang	Chambak		Chhnoc Tru Phat Sanday

Map 1. Map of the Tonle Sap hub.



Key findings and hub development challenge

The findings and insights from the scoping teams are presented for each of the five themes below and are based on a series of debriefings that were held daily during the scoping. The group in the final debriefing in Phnom Penh identified what they felt is the key development challenge for the Tonle Sap, which provided a basis for a narrative to be created that drew upon all discipline perspectives.

1. AAS production systems—fish, rice, aquaculture.
2. Livelihoods, poverty, and gender equity.
3. Value chains and markets.
4. Institutions and governance.
5. Knowledge management and partnerships.

The view of the Tonle Sap that emerged from the scoping can be articulated in the points below:

- The Tonle Sap is an important system for food (primarily fish and rice) production for 1.5 million people living and relying on the AAS resources of the Tonle Sap;
- It is characterized by diverse aquatic agricultural systems whose productivity is determined by the flood pulses of the lake and the land and water management practices employed by government and stakeholders;
- It has a diverse range of capture fisheries systems in the lake, rivers, flood plains and natural ponds that contribute to the livelihoods and incomes of those dependent on AAS resources;
- Small-scale aquaculture is still emerging and is not well developed as an alternative livelihood;
- Diverse and complex value chains for fisheries products exist that are adding limited value and benefits to the poor;
- Despite diverse livelihood strategies, many fishing and farming households, especially those highly dependent on AAS resources, are entrenched in poverty;
- Services delivery (extension, credit etc.) to poor households is patchy and has had an adverse effect productivity;
- Migration is very widespread, especially among young women, affecting the livelihoods of households in positive and negative ways;
- Deregulation of the fishing lot system is impacting supply chains and creating chronic competition for fish resources.

Based on these insights, a hub development challenge (HDC) was developed that consists of a mission statement outlining the intent of AAS program and its proposed impacts. The HDC identifies the "triggers" or actions that can be used to unlock the "potentiality" of the system to deliver "impact." At the core of the HDC is the view that people who depend on AAS resources have the potential to grow and develop, and that this can benefit the poor. The HDC illustrates in a basic statement the hub level theory of change and what the hub AAS program will trigger to achieve impact at scale. The AAS CRP hub-level theory of change builds on the idea that research in development will contribute to achieving impact in the hub. In the diagram below, impact is depicted by a horizontal line that occurs within the context of the hub depicted by the circle. The triggers are activities that the AAS program will undertake and that will enhance the potential of the people and the AAS resources on which they rely, triggering the desired impact or shared vision.

The development of the HDC started with identifying the main challenges to reducing poverty in the Tonle Sap. Three were highlighted, the first being land and water management to optimize the benefits of the seasonal flood pulses for continued productivity of the ecosystem. The second, which is linked to the first, is governance and coordination between government agencies, donors, stakeholders and communities and in particular the ability to share information and data across and between the sectors. The weak networks and knowledge sharing capabilities connecting the main stakeholders is impacting the third main challenge, which is the opportunity to diversify livelihoods and in particular use the market and supply chains to add value and benefits to the poor.

The scoping team considered that these challenges to reducing poverty could be best tackled through a work program that focused on strengthening the existing networks within communities and developing new ways to exchange information and knowledge that has improved agricultural production. The knowledge networks would function as a trigger for innovation and experimentation and would help scale out good examples to other communities. Integrated land and water management and planning would be central to this effort and would need to reflect ways of optimizing both modern and traditional farming systems and improving irrigation in the context of the flood pulses. Stimulating market demand for AAS products and pro-poor AAS value chains would be another way of taking advantage of the de-regulated market. This could involve supporting entrepreneur behavior though credit and improved skills.

The impact of these triggers on the potential of the AAS resources and people that depend on them is envisaged as increasing food and nutrition security. This will result from better fishery and farming systems producing higher yields and productivity, which will lead to healthier people, better and more diversified livelihoods, and more stable ecosystem services.

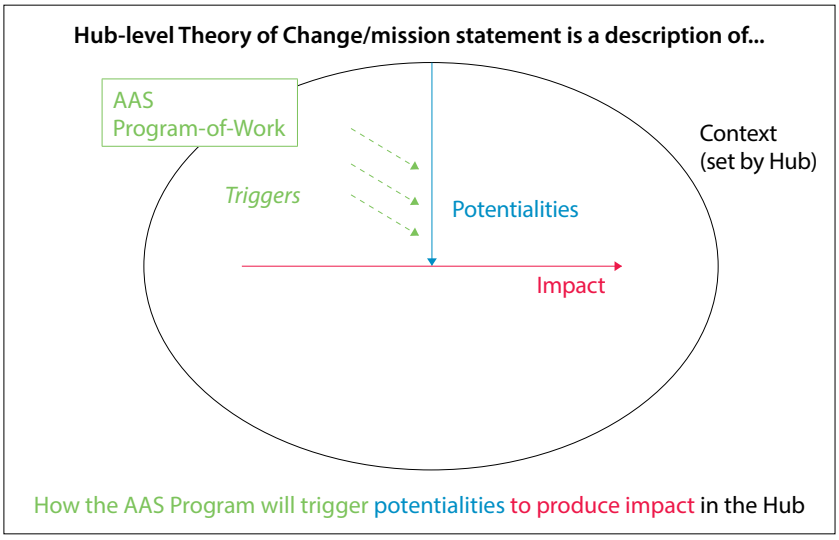


Figure 1. Concept of hub theory of change and mission statement.

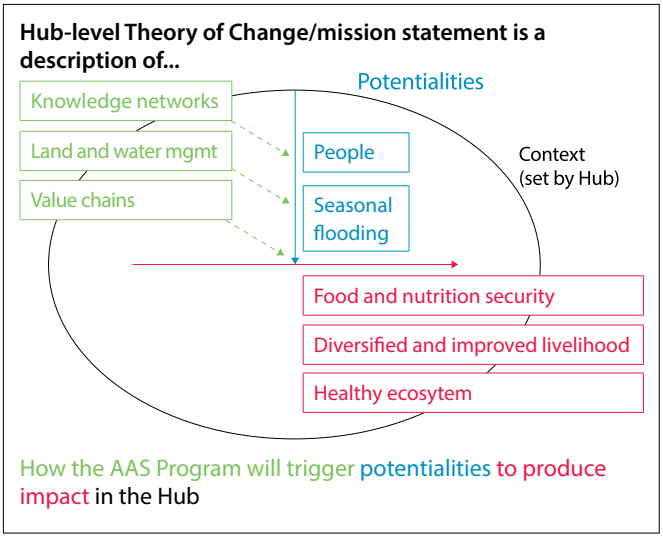


Figure 2. Concept of hub theory of change and mission statement.

The HDC for the Tonle Sap is illustrated in figure 2 and can be summarized in the following mission statement:

> *To make more effective use of knowledge networks and of practices for improving land and water management and value chains in order to optimize productivity from the flood pulses and assist the people that depend on the flood pulses to diversify their livelihoods, ensure food and nutrition security and maintain a healthy ecosystem.*

AAS production systems

Background

The Tonle Sap Great Lake is widely known to be rich in fishery resources and a productive area for rice paddy production. However, Kampong Thom is categorized as one of the six rice deficient provinces of the 24 provinces in the country, and the average rice yield for the region ranges from 1.4 to 2.2 tonnes per hectare for Kampong Thom and Battambang respectively (SCW, 2006). Keskinen (2003) reported 15.5 and 20% of households in the Tonle Sap have fishing, and 17.1 and 28.5% have fishing-related activities (selling, processing, culture, gear making) as their primary and secondary occupation respectively.

The local communities residing in the lake region rely heavily on fish and rice for their livelihoods. For the visited villages, the degree of dependence on the lake's resources varies from village to village. For instance, the land-based villages have more dependency on rice farming than fishing and fish culture, as their village locations are farther from the lake. In contrast, water-based villages have fishing and fish culture as the primary occupation because they are permanently next to water and they have adapted to this environment over generations. Land-water-based communities depend on both rice farming and fishing, their dependency varying according to the hydrological pattern and level of Tonle Sap Lake. For example, when there are more fish, these villagers put more time and effort into fishing. When fisheries are low, they focus on dry season farming. These villages have a wider range of adaptation strategies to the flooding variability than the land-based and water-based villages.

For part of the year, most rural people also access rice field fisheries. Mean standing crop in the one-hectare rice field in Battambang was in the range of 65 kg/ha, of which about 70% was fish, with carnivorous black fishes, and crabs and snails proportionately more abundant than in catches, and fewer species recorded than in catches, which reflect a diversity of habitats targeted by fishers (Hortle *et al*. 2008).

Villages established on high ground only suffer from high floods. However, the vast majority of productive land, including rice paddy and cash crop land, is flooded every year, particularly between August and September. Villages located along the river system of the floodplain are subject to flash flooding in addition to flooding from the lake. Villages located on the lower part of the floodplain close to the shore have houses built on stilts. In these villages, the flood waters are present from August to October and are about four meters deep. Floating villages are on water for most of the year, with only about 3-4 months on dry land at the edge of the lake in the dry season.

Seven villages were visited during scoping by the production team. These represented three land-based; three land-water-based and one water-based village. All villages were located in the Tonle Sap floodplain and are subject to varying degrees of seasonal flooding along the floodplain gradient.

The AAS production and supporting systems reported in these villages can be divided into seven (7) systems and themes;

1. Rice cropping
2. Cash crops/home gardening
3. Capture fisheries
4. Natural pond culture and aquaculture
5. Livestock
6. Non-timber forest products
7. Potable water

Rice

The villagers have varying degrees of dependence on rice farming. Villages in higher areas have rice farming as their main livelihood activity and more land is used for both wet season rice (WSR) and also dry season rice (DSR). Water-based communities rely mainly on fishing with the average land holding reported to be less than 1 ha to 2 ha, which contrasts with villages in the upper part of the floodplain, where villagers have access to land for DSR including flooded forests where land title is not given.

Villages situated close to the lake have limited land suitable for rice farming because of the short time between floods. Thus, they have limited dependence on rice production as a source of income. Villages close to lake reported fishing activities occupying 70% of laborers' time while this contrasted with villagers on higher land, who reported 70% of their income coming from rice farming.

Where water and irrigation systems are available, three rice crops are reported (one WSR and two DSR). Although farming technology remains simple, following traditional seeding practices, more short-term varieties, including flood resistant ones such as IR66, are being used. However, rice farming also depends on soil quality, and this has an impact on the rice production combined with the short growing period between flood events (i.e. closest to the dry season lake edge).

The national policy to increase rice production is evident in the Tonle Sap floodplain, where there is reportedly an expansion of DRS into former floating rice areas along the edge of the lake, though significant areas of floating rice still remain. Using IR504 in these areas, just one crop can yield 9 tonnes per ha, and this has been possible with better land preparation (by making the land surface even), securing sufficient water provision and mixing three fertilizer types. Fertilizer use varies and can be as high as 200 to 350 kg per ha. Pesticides are reported and observed to be a big potential problem for cash crops and vegetable gardening.

Cash crops
Large tracts of flooded forest close to the lake shore have long been cleared for cash crops (mungbean and sesame) with only a few cash crops and orchards planted in well-established villages. The cash crop plantations often belong to outside investors from Phnom Penh and provincial towns, rather than the local community. While orchards are planted by mostly non-poor households with built-up residential lands, vegetable gardens are commonly seen in floodplain villages including long bean, corn, morning glory, cabbage, maize and watermelon among other crops. These can be planted in rice fields adjacent to the village following the rice harvest with irrigation water pumped from rivers and wells.

Fishing
Fishing is reported as the second most important livelihood option in all land-based communities, while it is the main income source in floating villages or villages close to the lake shore. The number of households engaged in fishing for subsistence varies depending on their access to land and their proximity to the lake or other fishing areas. Land-based communities are reported to make long fishing trips between October and December with about 20% of fishers staying on until April. All households in floating villages fish all year round. It is worth noting that no more than half of the catch is processed as there is high demand for fresh fish and much of the processed fish is for home consumption. While fishing provides additional options for subsistence, several informants suggested that it is no longer a viable livelihood option as commercial access to fishery remains illegally.

Natural pond culture and aquaculture
Natural ponds or barrow pits were observed and were reported in almost all communities visited. However, aquaculture is reportedly still low, though on the increase. Barrow pits provide household water supply. The few fish ponds in operation are often supported by projects. Water availability and technologies to grow indigenous species is a constraint. Many villages in the floodplain have adapted a two-step approach to fish culture. First, they stock fingerlings in a cage in August when the area starts to flood, and then they transfer them to ponds in October-November and grow them out to market size until April when the land is dry. A combination of pellet feed bought from the market and kitchen refuse is used as fish feed.

Livestock
Family-based livestock and animal farming was reported in all visited communities except the floating village. While people report some success in livestock and animal farming, they also face problems with diseases. The well-established land-based communities are more active in livestock farming. Although some technical support has been provided, the respondents claimed more capacity and skills are needed and animal health services are a priority.

NTFP (Non-timber forest products)
Fuel wood from the flooded forest remains the main source of energy for cooking. Although respondents claimed that they only take deadwood, sources of such wood were located at significant distances for several of the communities. It cannot be verified if the claim is true regarding the source and type of fuel wood used. Of the visited communities, the land-water-based villages reported serious forest fires, possibly due to negligence cooking, and these fires had spread to nearby rice fields. No visited communities reported use of improved cook stoves or bio digesters.

Potable water
Of all the visited communities, only Rohal Suong had access to safe drinking water. Other communities either have to buy water at a high price from private sellers or resort to consuming contaminated water from stagnant pools in the river bed or swamp area. Water quality may be one of the most significant health issues in the region.

Situation analysis

A. **Chambok village** is a land-based village. The primary occupations of villagers are rice farming and fishing, followed by animal husbandry and vegetable planting.
   - Vegetables are grown during the dry season after the flood recedes. About 99% of villagers grow rice (rainfed) and depend on flood water from the Tonle Sap Lake for irrigation water.
   - The farming area is located in what is designated zone III of the Tonle Sap Authority, and each household owns farmland of between 0.10 and 3 ha. Its production is about 1,500 kg/ha. Dry season rice farming covers approximately 50% of the total rice farming land, reportedly with approximately 6-7 tonnes/ha, while 10% of households (HHs) grow lotus.
   - The farming techniques have remained traditional. Although modern machinery was introduced in recent years, many rice farmers have returned to using small traditional tractors (*kour yon*) for ploughing. Fishing grounds are found along Stung Chinit (the most productive fishing place for people in Kampong Thom province). Villagers designated Boeng Rompe as a community fishery and conservation area, and it is located approximately 1 km from the village center. The flooded forest is the most important fish sanctuary, located about 10-15 km from the village centre.

B. **Santey** is a land-water-based village situated on the lake's shoreline. Villagers' occupations in descending order of importance are fishing, rice farming, and livestock husbandry.
   - Fishing is the most important source of food security, covering about 8 to 10 months during the year, while rice farming covers about 2 to 4 months. About 20% of villagers are full-time fishers, and as many as 80% are engaged in fishing and farming. As this village is close to the Tonle Sap Lake's shore, villagers are active in dry season cropping, though much of the farmland on the shore is owned by outsiders from Siem Reap town and Phnom Penh.
   - Households own about 1 ha of farmland on average. The farmland is established between flooded forests that are used as natural reservoirs to store water for crops in the dry season. Production of rice farming in the dry season depends upon water availability and rice variety (IR66, IR504, Senpidor). It is about 1.5 tonnes/ha when there is a lack of water and 5 tonnes/ha when there is sufficient water.
   - Farmland on the lake shore is planted with soybeans, green beans and sesame. Water use is a problem as water is pumped directly from the Tonle Sap Lake. Smallholder farmers still practice traditional farming techniques, for example using animals for ploughing and natural fertilizer depending on the type of rice farming. Outsiders, in contrast, use modern and heavy machinery, increasing the yield gap between smallholder farmers and the more intensive large-scale agriculture that is growing in the region.
   - Water shortages due to lack of irrigation are a major concern for smallholder farmers whose land is located far from the lake. There is an informal committee to manage water use for dry season rice farming. However, this committee is not very active.
   - There are 9 fish ponds in the village for fish culture but only a few are working due to the lack of canals for water supply in the dry season. Using cage culture during the wet season is common with the major farmed fish species, which are catfish and sometimes snakehead.
   - The fish market operates according to market demand. People prefer selling fresh fish over processed fish, as it commands higher prices and involves less expense and labor. Fermented fish known as prahok is a common processed product in the village, though the market for this may be saturated. Animal husbandry remains challenging because the village is flooded half of the year.

C. Chong Khneas is a land-water-based village consisting of 7 villages. Of these, 6 are floating villages:

- There are three main occupations:
  1) fisher (mostly living on floating houses),
  2) boat service operator for tourists, and
  3) laborer.
- The village is closed to Siem Reap town and a very active tourist destination for viewing the Tonle Sap Lake. About 3,000-4,000 visitors per day visit the lake.
- Around 280 HHs conduct fish culture by cage with catfish and snakehead species. The poorest people belong to about 190 HHs where the main occupation is laborer. Many of farmers interviewed rent rice fields from rich people in Siem Reap township and Phnom Penh, and these farmers are also asked to guard the land as well. Common rice varieties are those of IR504 and IR66 which command low prices.

D. Rohal Suong village is a land-water-based village about 20 km from the Tonle Sap. The occupations of villagers are farming, fishing and fish culture, and animal husbandry.

- About 70% of the population in the village is engaged in fishing and farming activities, while 30% of people are full-time fishers. Only 5% of households in the village cultured fish to generate additional income.
- Livestock raising is the third most important livelihood option for villagers, with 10% of households raising pigs, 20% cows and chickens. The village is known to supply vegetables to the town.
- A household on average owns 1 ha for rice farming. There are two crops per year, dry and wet season rice farming. Dry season farming (normally IR504 and IR66 varieties) has higher yields of approximately 8 tonnes/ha than wet season farming, which produces about 2 tonnes/ha with local varieties.
- Dry season rice production is primarily regulated by the availability of water. However, fertilizer is applied for farming in the village, including NPK and urea? Water used for farming is mostly pumped from Stung Songkae river, which flows to the Tonle Sap Lake.
- Fuel wood is needed for cooking because the village floods for more than half the year. People collect fuel wood from the flooded forest about 15 km away from village center, and this is shouldered mostly by men.

E. Metuk is a land-based community, consisting of 15 villages, of which 3 are floating villages. 80% of the population are farmers and fishers, while 15% are full-time fishers and the remaining 5% are laborers.

- There are 300 ha for dry season rice farming. Livestock raising is the third source of income generation for people.
- People are concerned about floods due to its impacts on rice farming and fish culture.
- There are 102 ponds in the commune supported by H.E. Suy Sem (Minister of Industry, Mines and Energy) since 2010, but due to a lack of water, not many of the ponds are functional for fish-rearing.

F. Tramper is a land-based village about 15 km from the Tonle Sap. 60% of households are engaged in farming and fishing, while 30% migrate for employment within the country and to Thailand.

- Agricultural activity is regarded as the first income source for households in this village. Rice farming is conducted twice a year, during the wet and dry seasons. The variety of rice is Sen Pidor, IR66, Noun Anong, IR504, Rom Duol and Somaly.
- Each household owns on average 2 ha of farmland. Mice are a major concern for rice production in the village.
- Aquaculture in the village is not so active, as there is insufficient water during the dry season. It was reported that one household did catfish farming with little success. There are three conservation ponds in the village, which is located close to a reservoir that was dry while the scoping team was visiting. One pond is being dug for domestic water use with the support of local NGOs (Woman Development Organization) based in Pursat province.

G. Koh Monour village is located in Chhnok Tru commune and is a water-based village. People live on fishing and farming.

- Not many people own farmland, but about 20% of households own on average 0.25 ha each. This farmland is in the flooded forest and cannot be farmed in the wet season.
- Varieties of rice seed are IR66 and IR70. Water for dry season rice cultivation is not a problem as farmland is close to the Tonle Sap River.
- 80% of people in the village raise chicken, ducks and pigs, but on a small scale. 10% undertake fish culture with species of catfish and trey bra. Additionally, 2 HHs have home gardens thanks to financial and technical support from Live and Learn Organization (a local NGO).
- Illegal fishing is common in the village, as the fishing area for the community is so small. Fishers feel compelled to fish inside the conservation area because of hunger, though they are aware doing so is illegal.
- In the past, fishers only caught fish, but now they collect clams by dragging nets from motorized boats.
- Migration to seek employment is common in this village, even though it sits on a river rich in fish. At least 1 or 2 members of each household (aged 18 or below) migrate for jobs outside their village in Phnom Penh, nearby provinces, Thailand or Malaysia. All households borrow money from micro-finance institutions. When they cannot catch enough fish, villagers migrate for to find jobs to repay their debts.
- Waterborne diseases are common, including typhoid and stomach aches caused by poor water quality for domestic use.

Table 4. Common issues highlighted across the villages.

Common issues	Land-based	Land-water-based	Water-based
Technical skills	• Lack of technical skills on fish raising and animal husbandry. • Change of rice farming patterns.	• Lack of farming techniques.	
Irrigation and water management	• Lack of irrigation infrastructure, and reliance on one small pond for dry season rice farming.	• Water scarcity. • Lack of irrigation infrastructure for dry season rice farming.	
Credit and loans	• High debt as villagers borrow from several micro-finance institutions. • Seek jobs in Thailand to repay debts.	• Limited access to credit as villagers have no proper land title to secure their loan by bankers.	• High debts are recorded in this village.
Chemical fertilizer and pesticide use	• Pesticides, herbicides and fertilizers are used to increase production.	• Indiscriminate use of pesticides and herbicides, especially on the lakeshore.	
Migration	• Low incomes and lack of technical skills and extension lead to migration.	• Migration to Thailand and Phnom Penh.	• Migration for jobs in nearby provinces, Phnom Penh, Thailand and Malaysia. • 1-2 person/HHs and mostly teenagers.
Food security		• Reliance on fishing for 8-10 months; rice for 2-4 months	
Land issues		• Large farms on the lakeshore are owned by outsiders; local people have less land to cultivate.	• Lack of land for farming, because people on high ground mostly own large farms in villages.
Fishery management and illegal fishing	• Fishing in rice fields and natural ponds, resulting from the end of fishing lots.	• Illegal fishing, and fishing in conservation areas. • Limitations of CFi and 50% of CFi members do not actively participate in conservation activities.	• Small fishing grounds, fishers feel compelled to fish inside conservation areas for their living.
Waste disposal		• Solid waste disposed indiscriminately.	
Flooded forest	• Forest fires by hunting.	• Flooded forest clearance for farming and collection of wood for fuel.	
Post-harvest	• Poor post-harvest skills for fish products.		

Challenges and opportunities

Population growth: Population growth is a major challenge for the Tonle Sap Lake. The limited knowledge and awareness of the environment and the lack of options for waste disposal mean people dispose of both solid and liquid waste into the lake. This includes plastic and materials contaminated with chemicals and therefore presents a major risk to agriculture fisheries, human health and tourism. Poverty and the sole reliance of local people in the floating communities on fishing mean people resort to using illegal and destructive fishing practices. The rate of illegal fishing is on the increase and the situation is exacerbated by the lack of financial resources for law enforcement.

Clearing of the flooded forest for agriculture: Clearing of the flooded forest for agriculture remains a chronic issue for the lake and has degraded or destroyed large parts of the lake ecosystem. This has resulted in the loss of fish habitats and excessive sedimentation in many waterholes in the flooded forest systems. Forest fires occur almost every year in many places surrounding the lake, particularly in the dry season. The main cause of fires is the negligence of local people who fail to put out their cooking fires or who carelessly discard burning cigarette butts.

Development of irrigation schemes: The development of irrigation schemes also represents an important challenge to maintaining runoff into the lake. Local people require water to irrigate their crops, and rice yield remains low except for floating communities, which do not grow rice.

The selection of rice varieties and application of chemical fertilizers and pesticides also need to be managed. Empty packs of chemicals were seen almost everywhere including rice fields and waterholes and more research is needed on the impact of chemicals on fish and other aquatic organism and on human health.

Limited alternatives production systems: Fishing is an important livelihood option for all visited villages, though in many cases it is seen as a subsistence activity and sometimes is done when villagers are free from farming in order to generate additional food or income.

Aquaculture has yet to be developed in the area and is done by very few households. Provision of capacity and skills for cultivating, selecting seed, and applying inputs would therefore be an important contribution to reducing dependence on fishing and improving livelihoods.

Climate change: Climate change has the potential to have a significant impact on agrarian livelihoods. It has been reported that extreme climate-related events such as prolonged droughts and frequent flooding or excessive low floods could become more common.

Efforts have to be made to address some of the opportunities, which are as follows:

- Awareness-raising on the potential impacts of improper waste disposal;
- Task forces established to control illegal fishing;
- Flooded forest clearance controlled and forest fires contained by sectoral agencies;
- Training on aquaculture increased, particularly on fish farming;
- Awareness and capacity provided by provincial department of agriculture on appropriate application of agriculture inputs including seed, fertilizers, and pesticides in accordance with local soil conditions and farming methods;
- Community fisheries actively participate in controlling illegal fishing along with other stakeholders.

Knowledge gaps

Knowledge gaps identified here focus on agricultural and aquaculture production systems.

Rice cultivation: Rice cultivation is a significant economic activity in the region, and in the communities visited it is practiced by following receding flood waters. Technification is low in most communities, highlighting important knowledge gaps in rice managements systems including access to and selection of appropriate cultivars, nutrient application rates, and pest management. Farmers regularly suggested using fast-growing but low-quality varieties and mentioned high losses to pests and diseases and low access to markets. Understanding the primary limiting factors such as parcel size, soil quality, appropriate intensification techniques (including agro-ecological intensification), opportunities for crop diversification, and irrigation management remain significant. Irrigated water is currently derived from receding flood waters making use of the annual flood pulse. Questions remain (costs, opportunities and risks) as to whether intensified systems and species/variety selection can allow farmers to continue making use of the pulse cycle while providing an alternative to more highly regulated irrigations systems.

Water management: Water management was highlighted as key by all stakeholders involved from individual farmers to the Ministries of Agriculture, Forestry and Fisheries and Water. Key comments related to the lack of capacity to regulate water with the situation oscillating from too little to too much. Dry season access to water is a major limitation for production functions. Lack of access to land during the rainy season also limits the number of cultivation cycles allowable in a year and the varieties of rice used. Key knowledge gaps include an understanding of which water management strategies, including reservoirs and irrigation systems, are most suited to the region and how much water would be needed to boost dry season production. Related to this question is a clearer understanding of the trade-offs between reservoir density and size (depth and width).

Aquaculture: Aquaculture systems were invariably used both within the floodplain of the lake and on the outskirts of the high water line. Stakeholders visited discussed several difficulties with pond management including the low water holding capacity of the shallow points, loss of water though permeable soils, loss of fish during the flooded season (associated with a general lack of information systems tied to the flood regime), difficulty accessing fingerlings to stock ponds. Knowledge gaps exist relating to the improvement of these systems including appropriate depth of the ponds, systems to maintain fish in the ponds during the flooded season, and appropriate species mixtures for both ecological management of the ponds and market-based options.

Lake fishing: The Tonle Sap Lake fisheries are currently suffering from a classic "tragedy of the commons" type scenario with the abandoning of the fishing lots. No clear leadership has emerged in the face of this abandonment leaving a free-for-all bordering on chaos for small-scale fishers. Knowledge gaps are significant here including who these fishers are, what value chain is being used to get these fishes to markets, what opportunities exist for improving the value chain, and what the legality status of these value chains is. The decentralization of the fishing lots will also reduce the capacity of local authorities to assess fishery stocks. Knowledge of the fisheries populations and their changes over time may be available, but does not appear to be common among local officials, nor does it appear to be used in fisheries management.

Tenure: Tenure, not only to land but also to other resources, was identified as a key issue both during the scoping study as well as in subsequent conversations. Parcel size and low soil fertility/ productivity make the contribution of rice farming to poverty alleviation questionable. Small-scale aquaculture is promising. However, its role in subsistence versus market-based activities should be considered. Tenure to several common-pool resources remains a central question/knowledge gap in the region. This included tenure to fishing areas in the lake, tenure to fishing areas during the monsoon season, access to communal fishing ponds, and access to water for irrigation. Benefit and risk-sharing mechanisms for rice cultivation and fisheries-based activities will be central and should be addressed in a coordinated fashion.

Integrated systems: The Tonle Sap is highlighted as a particularly dynamic and complex system with production systems arranged according to a flood pulse gradient equal to the time that the land is under water. Definitions of property rights and land use are dynamic in space and time; the interaction and resource flow between the aquatic and terrestrial phases of the systems remain focused on specifics related to each production system (fishing or rice cultivation), with little information on the dynamics between the two. Key production-based knowledge gaps persist related to the impact of agriculture on fisheries production, notably the impact agricultural intensification (mechanization, agrochemical use, increase in parcel size, improved irrigation, improved water storage, reduction in flooded forest area) will have on fisheries stocks and quality.

Nutrition environment and water quality: Stakeholders infrequently raised the issue of water quality and environmental quality. However, observations in the field suggested that access to clean water and sanitation facilities for the floodplain and floating village communities may be important. A first glance at the communities visited suggests that dietary diversity remains high. Malnourishment did not appear to be a critical issue, though it is worth investigating. In contrast, waterborne diseases were mentioned as being prevalent. The close proximity of sanitation facilities, water for human consumption and water for fishing suggests important improvements that could be made in this area. The effects of environmental contamination and fish handling on the quality of fish are largely unknown.

Externalities: While the Tonle Sap has critical local and regional issues that were well captured by the scoping study, it also became quite clear that several significant external pressures loom large over the region. These include: 1) impacts of climate change mentioned by some focus groups, 2) impacts of Mekong hydropower development on energy production and the length of the flood pulse, 3) impacts of migration from rural areas and rapid economic development in the region, 4) effects and implications of working in a biosphere reserve regarding conservation impacts of agricultural development. Many of these externalities remain significant unknowns.

Livelihoods, food security, and gender in the Tonle Sap region

Background

This report is based on a scoping mission undertaken in the Tonle Sap region. FGDs were conducted as per Table 5 to discuss issues related to livelihoods, food security and gender.

Table 5. Details of FGDs conducted during scoping.

Location	# of FGDs	Total Participants	Total Women
Kampong Thom – Chambak village	1	6	6
Kampong Thom – Phat Sanday	1	15	11
Siem Reap – Santey village	1	11	11
Siem Reap – Chong Khneas	1	4	4
Battambang – Sdey village	1	9	9
Pursat – Traim pair	1	6	4
Kampong Chhnang – Chhnok Trou	1	8	5
Total	**7**	**59**	**50**

Situation analysis

Rural livelihoods

Rural livelihoods in the Tonle Sap have developed in unison with the seasons and in particular the flood pulse of the Tonle Sap Lake and associated floodplains and wetlands. Livelihood activities are timed to coincide with the availability of water, fish and other animals and plants upon which the majority of the people depend for their fuel, food, timber and medicinal needs. The lifestyle of the people has adapted to these seasonal changes.

Livelihoods are partly shaped by the environments in which people live, being diverse (depending on a wide range of resources and assets), dynamic (changing in response to the seasonal patterns of flood and recession) and adaptive (displaying a capacity for learning and adapting livelihood activities, resource use and management, both responding to change and generating change).

Livelihood strategies are characterized by occupational pluralism and diversified income-generating activities based on agriculture, natural resource use, labor sales and small business enterprises. They are essentially AAS livelihoods, organized around the cultivation of rice (wet and dry season), fishing, fish processing, fish marketing, collection of forest products and firewood, aquatic animals and plants. Seasonal calendars presented in Annex 4 in different villages visited (landed, land-water and floating) reflect the livelihood portfolios of households in the Tonle Sap region, the similarities and diversity based on their locations. The annual flood pulse is followed by a livelihood pulse, with the livelihoods very closely connected with the annual hydrological cycle of the lake. Adaptation to, rather than control of, the area's exceptional water regime is a typical characteristic of people in the Tonle Sap (Keskinen 2006). Occupational diversity in the TS area is much greater within the households than within and between villages, as the main source of livelihoods in each village and commune appear to be surprisingly uniform (*ibid*).

Predominantly, land-based village households are engaged in farming and fishing as their major occupations. Landless households in floating villages depend mainly on fishing for their incomes and appear to be poorer and more vulnerable.

Rice farming is affected by the cyclical flooding and droughts during the year. The yields reported from dry season rice cultivation are higher than those in the wet season or from recession farming. The yields however are small due to low and further declining soil fertility. In addition, the land holdings are small. The profit from rice cultivation reported is also rather low due to high input costs, especially for fertilizer and pesticides. Use of high-yielding rice varieties is reported. Mechanization appears to be on the rise. Some villages mentioned that households have been selling their bullocks to buy hand tractors for tillage. This, however, has led to decreased availability of manure and hence the high dependence on chemical fertilizers. High-value crops like peanuts are grown in some areas. Pesticides are also used to control rats/mice in rice fields. However, this does not seem to be effective.

Some vegetable cultivation is being taken up on homesteads. Cultivation of high-value horticultural crops like watermelon and cucumber was reported in some places.

Most households rear livestock, primarily cattle and backyard poultry. High livestock disease incidence and mortality, especially in poultry, contributes to income and asset losses, particularly in the dry season (Mar-April). All the communities visited mentioned this as an important constraint that has adversely affected their livelihoods. Veterinary services, where available, are expensive. Pigs and piglets seem to fetch a good price, but the feed costs are prohibitive and most households do not have the capital to invest in these animals.

Households mostly engage in small-scale fishing. However, they reported a decline in fish catch over the years and also lack of good gear. This enterprise again did not appear to be very remunerative. No value is added to the product and they seemed much less competitive than producers in neighboring countries like Thailand or Vietnam.

The practice of aquaculture is limited in TS. The main obstacle is the high capital investment required for equipment and infrastructure, such as pond digging or fish cages, as well as the recurring cost of fish feed. Market access is another challenge for farmers.

Population/poverty/migration

The population of Cambodia is heavily concentrated in the plains around the capital city Phnom Penh and along the Mekong River and the Tonle Sap Lake, emphasizing the importance of immediate access to water bodies. Although the poverty rate in Cambodia has declined by 1-1.5% per annum over the last 15 years, over 5 million people, or 40% of the total population, still live in extreme poverty according to the latest poverty line benchmark of US$1.25 a day (World Bank 2006).

Most poor and food-insecure households are rural small-holder farming households (MAFF 2005). Thirty percent of rural households are headed by females, and the percentage seems to have increased slightly since the late 1990s (NIS 2004). Many of these women are widows who lost their husbands during the civil war or the Khmer Rouge era, or the men in their family have left the village in search of wage labor opportunities elsewhere and never came back. Rural women contribute to an estimated 80% of food production in the country but their contribution is underappreciated; 78% of them work as unpaid workers for their family farms.

The poorest households have very small land holdings and no livestock, capital or savings. Households located downstream appear to be poorer than those located upstream. Among the landless poor, some of the poorest families are found in "floating villages", scattered around the Tonle Sap Lake and along major river channels. Although no comprehensive census or estimate of the population has been conducted, thousands of families live in these communities that are often composed of ethnic Vietnamese, Khmer and Cham Muslim families, established shortly after the fall of the Khmer Rouge regime. Many of them are not officially recognized as Cambodian citizens and thus have no or limited access to land ownership, land-based livelihood activities, and social services such as education and health.

Migration is widespread and most villages reported that 30-50% of households migrate to other provinces, Phnom Penh, or other neighboring countries (Thailand, Vietnam) or Malaysia. They work as farm labor for cassava and corn harvests and provide wage labor in garment factories, as domestic help, for construction work, etc. For the families who have land for growing rice, migration occurs only during the non-rice season (January to April). Sometimes entire families migrate; sometimes couples migrate leaving their children with their grandparents. But predominantly, it is young women above the age of 18 who migrate. While some of these migrations result in good outcomes like remittances to invest in farming or household and associated wealth creation, sometimes young women run the risk of being trafficked. Villagers also lamented that this leads to lack of skills and able-bodied people in the villages. Even if one introduces new technologies, there is no one to take those up. We need a more in-depth study to understand further the dynamics and impacts of migration in TS.

Food and nutrition security
Even though landed households produce rice, due to small land holdings and low yields, the rice produced is not adequate to last the whole year. Most households reported food shortages for at least four months during the year (Sept.-Dec.).

The dietary staple in TS has traditionally been rice and fish, primarily freshwater fish. Consumption surveys show that nearly all meals involve eating rice, and fish is by far the most common food type after rice. Fish and other aquatic animals typically from inland water bodies, namely, paddy fields, rivers, streams, natural lakes and community ponds contribute more than 60% and often upwards of 75% of animal protein in Cambodian diets. The average animal protein intake per capita in Cambodia is the lowest in the Lower Mekong region, compared to neighboring Lao PDR, Thailand, and Vietnam. Households reported that they consume vegetables throughout the year, either grown in their backyards or bought. While chicken is consumed occasionally, pork and beef are consumed rarely (especially in the floating village).

Thirty-six percent of children are estimated to be underweight, and 26% of the population was malnourished in 2005. Cambodia has one of the highest under-five mortality rates in Asia, and malnutrition plays a role in more than half of all child deaths.

In addition, due to the lack of clean drinking water, sanitation and accessible health care, the disease incidence (particularly gastro-intestinal) is high leading to low productivity. Pre-natal and post-natal care is also very limited and not easily accessible.

Financial capital
The number of Microfinance Institutions (MFIs) in the Tonle Sap has increased rapidly over the last few years. Each village has 4-7 MFIs. The MFIs need collateral to lend money. A major proportion (40-50 %) of households are indebted. They take loans mostly to buy agricultural inputs and fishing gear. Households still borrow from private money lenders despite high interest rates, as these lenders do not demand collateral for loans.

A range of savings groups exist in the villages initiated by development organizations and programs. There have been mixed results with regard to the success and sustainability of these groups. Further understanding of this is needed.

Households in several villages visited, and young men and women in the floating village, mentioned that lack of financial capital is a major constraint for them if they wanted to engage in any value addition activities through new enterprises or if they wanted to relocate to a new place and start any enterprises. For example, most women mentioned that their aspiration was to engage in rice storage and trading (buy rice post-harvest, store and sell when the prices peak during the lean season). However, their major constraint is capital.

Human capital
National statistics reveal a big gender gap in literacy and education (enrolment) levels. However, in most villages we visited, the trend seems to be to send both male and female children to school without discriminating. Access to higher education is still a constraint in most of the villages visited due to their remoteness and because of affordability. This was particularly the case in floating villages. Most children also leave school to work to support their parents by earning an income. In places that see many tourists, boys aged about 13 give a tourists massages on boats.

Access to vocational education and other skills is missing. Hence, the livelihood choices available to men, women and youths are particularly limited. This also results in migration to take up unskilled and low-paid jobs. Most young men and women we spoke to aspire to leave their villages and go to cities in search of remunerative livelihood options. However, they also lack the capital and skills required to do so.

While there is a tendency for youths in villages close to cities or with easy access to roads/transportation to leave the villages in search of employment in non-farming sectors, most young men and women in remote villages enter farming after they graduate from school, as they cannot afford higher education.

Social capital
While savings groups are common, we did not come across many other types of groups. There appear to be youth organizations set up by the ruling political party, and the members engage in collective community-level work. Even though a number of programs and development organizations operate in the area, we did not hear about any active knowledge- or lesson-sharing activities going on among or between communities.

Cell phones, TVs, and radios are commonly used and have widened the opportunities for communication enormously.

Gender
Traditionally there is a gendered division of labor, roles and responsibilities within the household and in terms of the livelihood activities. However, these boundaries appear to be flexible, and women and men are able to engage in livelihood activities as needed. It was also mentioned that were men to take up household roles like cooking and caring for children, they would not be ridiculed but appreciated.

Cambodian women have a traditional "code of conduct" to follow. Women have access to and control over resources like land. Most women have the family land titles in their name or hold them jointly with their husbands. They can make decisions about the use of resources and income. The income women earn is mostly spent on food, education, clothing and medicines. Alcoholism is reported among many households and is perceived as the cause of Gender-Based Violence (GBV). It was also reported that as a result of increased livelihood opportunities and economic betterment due to the interventions of development programs/ organizations, men became busy and stopped consuming alcohol and reduced violence against women in the households.

Women in leadership positions are far and few between. Generally all village chiefs (selected by commune councilors) and commune chiefs are men. The deputy village chiefs and commune councilors could be men or women. This is based on the perception that "women have no knowledge and cannot lead". These are not necessarily the perceptions of men, but those of women themselves. We came across some good examples where through sustained engagement, capacity building and economic empowerment, women became more confident and are taking up leadership positions in the community. They did mention that the respect they receive from other men in the community increased after they took up these positions.

While this description paints a rather positive picture of gender equality in the TS area, we should treat this with caution as most villages and households we visited have been the focus of development efforts over long periods of time. So we do not know if this situation rings true for communities that have not been the subject of development interventions. In addition, given the short timeframes we had for FGDs, understanding social and gender norms in-depth and getting a true picture was also a challenge. We need to undertake a more in-depth social and gender analysis to validate and enhance this information.

Challenges and opportunities

Challenges	Opportunities
Livelihoods	
Low productivity of rice farming • flooding and droughts • lack of irrigation systems • low soil fertility • high chemical use leading to high input costs and deteriorating soil and water quality	• Water resources management • Development/rehabilitation and maintenance of irrigation infrastructure • Promoting techniques for nutrient recycling on farms
Vegetable cultivation	• Development of cropping patterns including vegetables to promote nutrition and income generation
Livestock husbandry • high disease incidence and mortality • high feed costs for pigs	• Promoting community-based animal health worker systems to make basic veterinary services more accessible and affordable • Developing poultry and pig value chains
Fisheries • declining catches	• Community management of fisheries • Development of fisheries value chains and value addition
Aquaculture • high investment costs • limited market access	• Development of aquaculture value chains
Enabling environment/support services	
Financial capital	• Understanding the factors influencing success of savings/self-help groups and scale out good practices/experiences • Promoting collective action in enterprise and value chain development
Human capital development	• Vocational training and skill development opportunities for youths • Improved access to technical knowledge and adequate extension/advisory/veterinary services provision
Multi-agency coalition building	• Enhanced co-ordination of research and development efforts for efficiency and impact • Linking community-based organizations (CBO) to the Commune Investment Plan (CIP) so these organizations can lobby the Commune Councils for commune funds in order to support livelihood development and other related things rather than only infrastructure
Food and nutrition security	
Promotion of nutritional security	• Understanding the current situation and develop strategies for diet diversification and addressing malnutrition • Promoting awareness regarding clean water and sanitation
Gender	
Enhancement of women's livelihood choices; access to and control of resources; and promotion of leadership	• Following a household approach and engaging men and boys to address social norms that could facilitate expansion of remunerative livelihood options for women and youths • Developing women's capacity to play an active role in developmental efforts and community leadership

Knowledge/data gaps

Area	Details	Who (potential)?
Provincial and district characterization	Profiles including secondary data on demography, poverty, livelihoods and other relevant socio-economic information	Provincial department of planning or National Committee for Decentralization and De-concentration (NCDD)
Community characterization	Demographic, economic, social and livelihood profiles; AAS dependency; poverty dynamics; farming/production systems and temporal and spatial patterns thereof; networks	GO-NGO-research partners with WF backstopping
Migration	Dynamics (who, where, how much, how long, changes over time) and social and economic impacts (positive and negative) using a Sustainable Rural Livelihoods (SRL) framework	NGO, Research
Food and nutrition security	Sample survey in different household types in different TS zones	NGO, Research
Social and gender analysis	Understanding in-depth the social context and the gender dynamics, including social relations, norms, attitudes and beliefs	WF, NGO, Research

Value chains and markets

Background

Cambodia is endowed with a wealth of aquatic agricultural resources, which has made it one of the region's major fish-producing countries and a net exporter of rice.

Cambodia's fisheries provide full-time, part-time and seasonal employment for up to 6 million people (FiA 2005)[6]. Fisheries production is estimated to be worth around US$200-300 million per year at the point of landing, and the value of fish exports has been estimated to be as high as US$100 million per year (FiA 2005). Fisheries hold the second largest share in the agriculture sector after crop production.

It is estimated that at least 2 million people are directly or indirectly associated with inland (freshwater) fishery activities (Rab *et al*., 2006)[7]. The freshwater fishery is considered the most productive in the world and contributes around 60% to the country's commercial fisheries production (Ahmed *et al*., 1998)[8]. Fish constitutes about 75% of the animal protein intake for Cambodian households with annual per capita consumption ranging between 30-40 kg. It is the second largest dietary component after rice, accounting for almost 20% of the daily food intake, and the highest consumption of inland fish is made by the populations of the Tonle Sap at 148 grams per day.

Cambodia is self-sufficient in rice and has recently become a rice exporter, supported by national policies that promote improved irrigation, mechanization and intensification to increase production. Rice production has increased by about 355,000 tonnes each year between 1999 and 2009 (Theng Vuthy & zKoy Ra 2011) and the production is growing by 7.4% per annum (MAFF 2010). The increase in rice production has seen a 26% expansion in land used and an increase in productivity from 1.31 tons per ha in 1993 to 2.49 in 2008 (Kem Sothorn *et al.* 2011).

In the Tonle Sap area, wet season rice production is the most prominent form of rice growing with an area exceeding 700,000 ha surrounding the lake. However, the total area of dry season production, estimated at 62,000 ha, is increasing due to government policies and provides up to two dry-season harvests per year for communities located at the high water line on the edge of the Tonle Sap.

The close relationship between fish and rice is typified by the Tonle Sap and its floodplains, which support a highly productive lake fishery, intensive rice crop (dry season), recession (wet season) rice and floating rice by the lakeside. For fish and rice, water and water management systems are critical and the natural flood pulses of the Tonle Sap means that for half the year the lake drains into the Mekong exposing the floodplain for rice cultivation, and during the monsoon the flood pulse expands to support fish production and the covers the area around the lake with up to 10 m of water.

The people of the Tonle Sap have developed different livelihood strategies to cope with the annual flood pulses. The majority of inhabitants on the edge of the high water line are more dependent on rice with up to three rice harvests a year, while fishing provides a dietary supplement rather than an income.

Situation analysis

During the scoping, 12 interviews were conducted with various stakeholders involved in the market chain including fishers, processors, traders, collectors/middlemen and wholesalers. Interviews were held in seven villages with at least two in each village type (water based, water-land-based and land-based; see the next table). The interviews were predominantly held with fishers, fish traders and processors, and the information on the rice market and vale chain is not complete. However, the reliance of the poor and in particular the landless and asset-less households on fisheries means that understanding and improving the fishery value chain is a high priority for AAS-dependent households in the Tonle Sap, particularly in light of the deregulation of the fishery lots.

Trading volumes

All respondents in all village types reported a decline in the amount of fish caught over the last 5 years. The volumes traded were characterized by a steady decline overall. There was a sharp increase in 2011/12 followed by a rapid drop in 2012/13.

According to interviewees, a combination of events is responsible for the decline in the volume of fish traded. Changing weather conditions have caused a drop in the lake water level. The deregulation of the fishery lot system had moved leasehold fishery areas back under government control as conservation areas or as open access areas, some of which are under community management regimes. As a result of deregulation there has been an increase in the number of fishers and traders, leading to more competition for existing traders and an erosion of their

[6] FiA (2005). Fisheries Administration Data Collection and Statistics. Phnom Penh, Cambodia.
[7] Rab, M. A., Hap, N., Ahmed, M., Keang, S. and Viner, K. (2006). Socioeconomics and values of resources in Great Lake-Tonle Sap and Mekong-Bassac area.
[8] Ahmed, M., Hap, N., Ly V., and M. Tiongco (1998). Socioeconomic assessment of freshwater capture fisheries of Cambodia. Report on household survey. Mekong River Commission (MRC). Phnom Penh. Cambodia.

Table 5. Market and value chain actors and village categories.

	Water-based	Water-land-based	Land-based	Totals
No. of villages	*2*	*3*	*2*	*7*
Farmer-fisher			1	1
Fish processor	1		1	2
Fish trader	2	2	2	6
Fish middleman		1		1
Rice miller			1	1
Fish wholesaler	1			1
Total no. of interviewees	4	3	5	12

established links with fishers and middlemen. Fishers reported increasing fishing effort to catch the same volumes as before, with the need to have larger boats and to travel longer distances. Traders also took several days to accumulate the same volumes that could be collected in a day about 5 years ago.

Looking across the three village types, the reported drop in traded fish was estimated as a 50-60% decline for land-based villages, a 75-80% drop in water-land-based villages, and an 80-100% decline in water-based villages. The impact of the decline in traded fish appears to be worse in communities that rely on fish than in land-based villages that have additional livelihood opportunities[9]. The composition of the catch was also reported as changing with traders observing that the proportion of larger fish presented for sale had dropped from 30% of the fish trade to less than 10%. This suggests that either the proportion of larger fish has declined or that they are traded using other channels.

Some differences in the peak season for fish trade are discernible between the different village types. The peak fish trade in land-based villages occurs over 6 months from October to March. For water-land-based villages, the peak season is extended by two months from September to April, and for water-based villages, the peak fish trade season is from August to April. The land-based traders appear able to trade in other commodities during the low season for fish. These commodities included rat and chicken. Gaining entry into the rice-selling networks appears to be difficult.

Larger wholesalers noted a decline in the traded catch although some were still able to maintain their overall volumes by purchasing from more fishers and from a greater distance from their normal purchasing territory. Navy *et al.* (2012)[10] also reported a drop in traded fish between 2005 and 2010 with almost a 60% drop for Pangasius, Snakehead and Reddish, and a 40% decline for Croaker and Henicorhynchus.

Although the majority of the fish traded is wild capture fish, there is a market chain for aquaculture (cage and pond) and rice field fish, and fish from natural and man-made ponds and lakes. Village traders reported that the majority of the fish traded was from the capture fishery (65%) with 5% from rice field fisheries, 20% from aquaculture ponds and 10% from natural ponds or "beers". The beers are shallow ponds often dug next to streams, and each family has 3-4 in the floodplain for additional storage for fish as the lake's waters recede. In some locations, the size of the natural ponds is quite substantive (several hectares) and community fish refuge committees have been set-up to oversee and protect the fish in the natural ponds. The ponds are also supported through additional stocking of wild-caught seed. The significance of the ponds both as a fishery and as a source of water for irrigation needs further investigation.

Markets and supply chains

The supply chain and distribution of inland fish in Cambodia is complex and diverse with numerous transactions taking place before fish and fish products reach the consumer or export markets (Navy *et al*. 2012). Despite poor marketing infrastructure in terms of landing, storage, preservation, transport and retail facilities, the market chain and networks are relatively well managed and based on long-term relationships. These relations are often formalized through traditional credit arrangements between fisher, collector, processor, trader, wholesaler and exporter, which maintain as well as sustain the networks. The traditional market and supply chain for fish and fish products appear quite resilient to changes, though there is evidence that the deregulation of the fishing lots in the Tonle Sap and the opening up of the microfinance markets are beginning to uncouple the historical linkages between traders and fishers within the chain.

The trading system would not function without entrepreneurial individuals and this is observable throughout the market and supply chain. Rab *el al*. (2006)[11] produced a diagram to illustrate the freshwater fishery and stakeholders in the chain (see Figure 3).

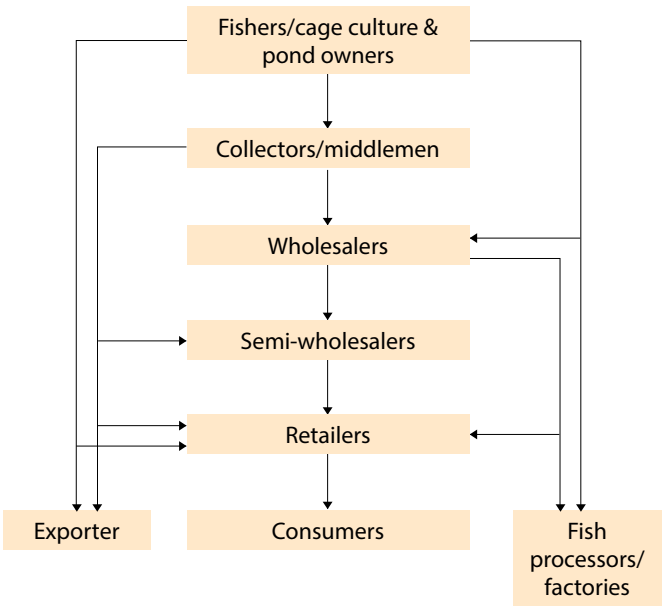


Figure 3. Supply & market chain of freshwater fish with stakeholders in Cambodia (Source: Rab *et al.* 2006).

[9] In land-based and water-land-based villages 7 and 6 livelihood options were identified, while in the water-based villages only three livelihood options were identified (i.e. fish, rivers and home gardens).
[10] Navy, H., Sophea, U., Yagi, N., Nakajima T., and Matsui T. (2012), Value chain analysis of five key fish species: Inland Fisheries Research and 2012.
[11] Rab, M. A., Hap, N., Seng, L., Ahmed, M., and Viner, K. (2006). Marketing Infrastructure, Distribution Channels and Trade Pattern of Inland Fisheries Resources in Cambodia: An Exploratory Study. WorldFish Center, Buta Maung Penang, Malaysia.

The fish market chain observed during the scoping included:

- Fishers – local collectors/middlemen – export/domestic market
- Fishers – wholesalers – processors – domestic market
- Farmers – collectors – processors - wholesalers – retailers – domestic market
- Farmers/fishers – export/domestic market

During the scoping visit it was observed that the market chains have long been well established and the chains operate based on trust and long-term relationships. Entry of fishers and traders into the chain is determined by their social networks. In addition, women are involved throughout the chain with 80% involved in the buying, selling, processing and marketing at small, medium and larger scales. Women have traditionally played the role of collectors.

Arrival of mobile phones and 3G networks has made communication between fishers, collectors and traders easier, and there is evidence that this is the favored mode of communication between collectors and traders for fish collection.

Large-scale fish operators were not in evidence as the fishery reforms have restricted industrial fishing. Only large empty sheds were left in places like Phat Sundae where lot owners collected, sorted and arranged transport for export. Some larger operators do still exist for the dai fishery and they integrate a number of functions and roles in the chain.

Small traders collect fish from fishers and sell to wholesalers who distribute to domestic and international markets. There is high national demand for fish and fish products, ranging from live to processed forms (i.e. fish paste, fermented fish, salted-dried fish, steamed fish, smoked fish and fish sauce). Poorer households rely predominately on processed fish as they have limited cold storage capacity and as larger high-value species are sold to traders to be sold in Phnom Penh or exported.

The high domestic demand for preserved fish relies on many business transactions at many locations and involves many types of stakeholders and beneficiaries. Fish processing and trade are often conducted as an additional source of income by many households, and this offers one of the few opportunities for women and poor households who live in and near the Tonle Sap Lake to increase their incomes.

In addition to those directly involved in the marketing system, there are also others that are indirectly involved as transporters, fish handlers/workers at landing sites and markets, fishing equipment producers and sellers, boat makers, money lenders, ice suppliers, salt suppliers, boat and motor-taxi drivers, fisheries officers, police and local authorities, basket producers and sellers, landing place owners, and market managers (Rab *et al.* 2006).

Fish export consists mainly of processed fish products from industrial-scale processing plants (mainly in Phnom Penh) and high-value species sold as fresh fish to neighboring and other countries (Rab *et al*. 2006). There are three types of exports in freshwater fisheries products in Cambodia: (1) export of chilled fish by land using big trucks and cars (to Thailand); (2) export of live freshwater species and catfish fingerlings by waterways using cages with big boats (to Vietnam); and (3) export of high-value live fish and some fish products by air (to Asian countries, namely Singapore, Malaysia, Hong Kong, and China). Taiwan, Japan, Australia and the USA are markets for frozen fish, fish fillets and balls, and salted dried fish.

Navy *et al.* (2012) identified five (5) main species that are traded by all fishers, collectors and wholesalers and are in high demand by retailers and consumers. These are the Giant Snakehead (*Channa Micropeltes*), Pangasius, (*Pangasianodon sp.*), Croaker, (*Boesemania microlepis*), Reddish (*Micronema apogon sp.*) and *Henicorhynchus sp*. Giant snakehead is a highly profitable species caught in the wild and also raised in cages and natural pond culture. Pangasius is predominantly a culture fishery, and Croaker and Reddish are high-value species that are predominantly wild capture species. In contrast, *Henicorhynchus* is a small low-value fish that provides a staple supply of vital protein to fishers not only in Cambodia but also in all riparian countries. *Henicorhynchus* is traded extensively in local markets either in fresh, salted-dried or fermented form. It is also traded from Cambodia to Vietnam as feed for *Pangasius sp.* (Seng 2006). *Henicorhynchus* represents the highest percentage (40%) among the 62 low-value fresh water fish species used as feed for fish culture (So *et al*. 2005).

Wholesalers play an important role in delivering these species from fishers and fish farmers to markets and consumers with fish prices having dramatically increased from 50-135% depending on the species over the last 6 years. The price increase is as a result of fish scarcity and consumer's preference for wild capture fish. The main difficulty for consumers is the availability of fish, especially wild fish, to satisfy market demand.

Price and sale

The price of fish has increased dramatically over the last five years, which is in accordance with the findings of a market chain study carried out in 2012 by IFReDI (Navy *et al*. 2012). They reported a 70% increase in fish prices for all species from 2005 to 2010. Of the five species studied the biggest price increase was for Reddish at 130% and lowest was for Pangasius with a 48% increase. During the scoping, fishers reported that they now need to purchase fish from the market to supplement their declining catches and fish had become expensive. The price of fish also corresponds with an increase in wage labor in the sector from 2,000 riel per person per day in the past to 5,000 riel per day today.

Prices are determined by the (domestic and export) wholesalers in Phnom Penh and also by the export wholesalers working on the Thai border. Traders reported fresh fish sales for small fish used in processing at about 800 riel/kg and were relatively constant, while for larger fresh fish the price varied between 1,500 to 12,000 riel/kg depending on the type and size of fish. This observation is consistent with Navy *et al.* (2012) whose analysis identified the wholesalers of Snakehead and Croaker as havingless power over prices than retailers, while wholesalers of the smaller fish Henicorhynchus have more power than retailers. In addition, that study found a positive asymmetry in the relationship between sellers and wholesalers of Pangasius and Croaker, whereas no asymmetry was found for those dealing with Henicorhynchus. As such, retailers of Henicorhynchus may not enjoy excess profits.

Processing and marketing

Small low-value fish (*Henicorhynchus* sp) are sold locally (in local, provincial and national markets), and used either for consumption or are processed by salting, drying, fermenting (*prahoc*) or sold to the fish feed industries as trash fish. *Henicorhynchus* sp. is sold to domestic markets with about 50% sold to retailers, 25% to collectors and onto wholesalers and processors, and 35% processed by small-scale, household level units which produce salted/dried fish or fermented fish sauce from the surplus catch.Fresh fish is preferred in some markets rather than processed fish and this is observed for the Snakehead collected from the natural ponds and cage culture. Snakehead is often used to celebrate and for special occasions with high demands around Khmer New Year. According to Navy *et al*. (2012) about 70% of Snakehead is distributed through different chain actors to Phnom Penh with about 25% kept for household consumption and the rest sold directly to consumers.

Many of the smaller traders, particularly those without transport, will process fish themselves and this is an important value addition activity for households. However, the profit margin is small with prahoc sold at retail price for 4,000 riel/kg (with bones) and 12,000 riel/kg without bones. It takes almost 4 kg of fresh fish to make 1 kg of *prahoc*. The value added for the export market to Thailand was mainly limited to salting and drying and the addition to value was low.

It was not clear during the scoping whether poorer segments of the communities were engaged in small-scale value adding enterprises such as fermenting and preserving fish. There are NGO activities in fisheries there that had tried to develop self-help groups (SHG) and to support saving schemes. This had focused on women and women's networks and resulted in some horizontal coordination among traders and processors to purchase larger volumes of fish and increase profits through scale.

The main products supported by many NGOs are prahoc (fermented fish paste) and fish sauce where investment costs are relatively low. New opportunities to diversify the processed products need to be considered, based on an assessment of the market demand (both domestic and export). There may be several opportunities to enhance the efficiency and performance of the chain and make it pro-poor. Fermented fish, although relatively easy to make, has a low profit margin and may not be enhanced sufficiently through branding and targeting higher-end markets in Phnom Penh and overseas.

Loans and regulations

The majority of traders provided loans to fishers and middlemen to secure the rights to purchase fish and fish products from them. Many traders took bank loans of up to $1,000 for small traders, and larger wholesalers used their own funds to provide loans. Typical loans to fishers are about $50 and to middlemen are up to $250. Many traders reported informal fees or artificially low prices when selling fish and there appears to be a predominance of informal rules and fees in the supply and market chain that reduces profits for fishers.

Limited information on business development services to support the chains and various segments could be gathered during the visit.

Challenges and opportunities

The challenges and opportunities as highlighted by the respondents are listed below with the number of challenges far outweighing the opportunities. Most respondents did not see a bright future for the fish trade business and saw rice as a better option, though the ability to enter the rice trade is limited as the network appears closed. Many fish traders do not know anything else, particularly those from water-based villages and those from landless and asset-less households.

A significant proportion of the poor and women are dependent on fisheries in the Tonle Sap and the floodplain. These people are therefore dependent on fish value chains for their livelihoods and food security. The fish value chains are well established and are based on strong social networks and trust-based relationships but there are limited opportunities to develop new networks for marketing and distribution.

Most of the landless and asset-less poor are engaged as wage labor or have migrated to the cities or other countries. Opportunities in different parts of the value chains, especially in the post-harvest segments, are possible but new products and markets are needed.

Despite the liberalization of the credit market and deregulation of the lot fishery, the poor and particularly those living in marginalized areas such as the floating villages and floodplains continue to have limited access to well-managed fishery resources, technologies, capital markets, marketing and transport infrastructure, and have low levels of skills. The deregulation of the fishing lots has appeared to reduce the traded volumes through competition. The ability of poor households to accumulate assets (social, human, financial, physical and natural capitals) is critical for them to participate in and benefit from the value chains. Easy access to technology, inputs and services is crucial to the improvement of fish value chains, but resource-poor households lack access to one or more of these resources, which restricts their ability to benefit from improved value chains.

Table 6. Challenges and Opportunities in Fish Value Chain.

Challenges	Opportunities
Technical skills and knowledge	
• Lack of technical skill on fish processing–many processors have been taught by their parents • Equipment–lack of storage facilities, containers for producing quality product • Limited idea about how to build new business opportunities • Fully dependent on fish and fish trade	• Improve the network links between the different segments of the value chain and particularly among women's groups • Improve business development capacity building, networks and extension
Marketing, supply and demand	
• Demand is high but supply is low • No space or storage at the market to sell the community products and no branding to compete with other products • Lots of new competition from new traders and fishers since the deregulation of the fishing lots	• Improve knowledge and information on appropriate technologies for fish raising and marketing • Improve management of fish trade to make information about fish prices clearer and more accessible to all chain actors
Resource management	
• Management of fish and natural ponds as fish is still an important livelihood resource • Water management critical for the right balance between rice and fish in natural ponds • Many government agencies involved in fisheries protection	• Improve management of wild fish stock and other aquatic resources • Promote integrated land and water management • Improve coordination between government agencies, communities and stakeholders

Challenges	Opportunities
Value adding	
• Small amount of profit in fish processing • High labor cost because of migration to Phnom Penh, Thailand and provinces • Limited alternative livelihood opportunities. • Fishers face poverty because they take loan from MFIs to support business and get small amount from their business	• Improve management of the quality of fish and fish products • Provide opportunities to establish financial organizations that support pro-poor business development
Regulation and informal rules	
• Commissions paid to middlemen and uniform sale prices for all fish quality types reducing profits	• Provide clearer guidelines on regulations to limit/restrict unnecessary and informal-fee payment

Knowledge gaps

Developing a clear understanding of how value chains (for both rice and fish) is important to address the constraints and opportunities in value chain and markets for poor households. This includes an understanding of demand and supply, price dynamics and markets operating in the Tonle Sap. Some initial work on this has begun through IFReDI (Navy *et al*. 2012) but this needs to be expanded to focus on value adding opportunities in poorer households and improving the networks and networking potentials of the poor.

Some key questions based on the scoping visits and consultations with local stakeholders are:

- How do various value chains operating for rice and fish products from the Tonle Sap work?
- How do demand-supply dynamics affect the way resources are exploited?
- How can the lower (poorer) segments benefit from improved value chains?

Focussing on 2-3 chains (e.g. fish and rice) in which poor households are significantly involved in different segments (production, processing, marketing), a value chain analysis can identify opportunities for improved performance and greater involvement of the poor. This should aim to contribute to income security and stability, increase productivity, and reduce vulnerability and risk. This undertaking will be important to understand the functioning, efficiency and performance of the value chains in the Tonle Sap and to identify opportunities for upgrading the chains to improve their performance, to distribute benefits more equitably along the chain, and to make chains more pro-poor.

This will involve a combination of economic analysis of enterprises in the chain, networks analysis, and case studies. This may include an analysis that focuses on the following aspects:

- understanding the economics of rice in poor households and processed and fresh fish trade;
- developing viable small-scale input and services delivery systems which are accessible to poor men and women;
- understanding the opportunities for setting up and scaling out small-scale value addition enterprises (including diversifying the products) to the village level (individual or group based) and the role government and other agencies can play in supporting these enterprises;
- understanding the opportunities to create enabling and supporting conditions (formal and informal institutions) for asset-poor households which might not have the requisite social networks to enter and benefit from the chains;
- identifying the potential role of business groups to support poor operators and the related implications for government extension capabilities, skills and capacity;
- analyzing demand and supply of fish and rice products from the Tonle Sap and better understanding the trading relationships between rice and fish markets across the ecological zones.

This will involve a combination of economic analysis of enterprises in the chain, networks analysis, and case studies. This may include an analysis that focuses on the following aspects:

- understanding the economics of rice in poor households and processed and fresh fish trade;
- developing viable small-scale input and services delivery systems which are accessible to poor men and women;
- understanding the opportunities for setting up and scaling out small-scale value addition enterprises (including diversifying the products) to the village level (individual or group based) and the role government and other agencies can play in supporting these enterprises;
- understanding the opportunities to create enabling and supporting conditions (formal and informal institutions) for asset-poor households which might not have the requisite social networks to enter and benefit from the chains;
- identifying the potential role of business groups to support poor operators and the related implications for government extension capabilities, skills and capacity;
- analyzing demand and supply of fish and rice products from the Tonle Sap and better understanding the trading relationships between rice and fish markets across the ecological zones.

Institutions and governance

Background

The people living around the Tonle Sap have adapted to the seasonal rise and fall of the lake's water level. The lake has been a source of livelihoods for millions for many generations, and fishing and farming have shaped the culture and practices of these people.

After the French Protectorate was established in 1863, the fishing lot system was used to manage the Tonle Sap Lake, but the system was not used by either the Khmer Rouge between 1975 and 1979 or the post-Khmer Rouge government from 1980 to 1990. In the 1990s, the fishing lot system was reintroduced by the government. However, in 2012, this system was abolished and the lake was returned to an "open access" system. These changes have affected the governance of the Tonle Sap. The cancellation of fishing lot system in early 2012 has raised alarms for the lake's management.

This section of the scoping report examines the governance of the Tonle Sap and identifies the challenges and opportunities for improving governance. It is based on visits between April 28 and May 05 to various communities for the scoping study.

Situation analysis

The governance of the Tonle Sap Lake and its floodplain

Prior to 2000, the management of fisheries in the Tonle Sap area was equated with management of the Tonle Sap Lake itself. The Fisheries Administration (FiA) under the Ministry of Agriculture, Forestry and Fisheries (MAFF) was the key actor in managing fisheries around the lake, and the whole lake was managed based on the fishing lots, open access, and the conservation areas. The MAFF had a mandate to manage not only the Tonle Sap's fisheries but also the area's agriculture. However, fisheries management in the Tonle Sap was viewed as a key responsibility where the role of the FiA in governance issues was critical.

The designation of the Tonle Sap Lake as a Biosphere Reserve in 1997, with the establishment of the Tonle Sap Biosphere Reserves (TSBR) Secretariat within the Cambodian National Mekong Committee (CNMC) in 2001 raised standards for the environmental governance of the lake, leading to a focus on issues beyond just fisheries management. This led to the creation of the three zones around the lake: the (I) transitional zone; (ii) buffer zone; and (iii) core zone. These zones were established for biodiversity conservation and to create a new governance structure for biodiversity conservation.

In 2000, the government's first reform in fisheries management was the release of 56.46% of the commercial fishing lot area representing 538,522 ha into open access. In 2001, about 47% of the total commercial fishing lot area was cancelled in the Tonle Sap and reserved for local community use. This changed the management system so that the FiA was not the only actor responsible for the management but had to share responsibility with the MoE and MoWRAM. However, this reform did not stop fishery conflicts, and the government made a second attempt to reform the fisheries sector. By February 2012, the Head of the State finally decided to completely cancel the fishing lots in the Tonle Sap. A total of 38 fishing lots were converted into conservation areas and some placed under the "open access" system. A new form of governance involving local fishing communities emerged whereby about 175 community fisheries comprised of a total of 61,613 households in 361 villages across the Tonle Sap Lake were established in 2007 (Sithirith 2011).

After the fishing lot system was abolished, fisheries were converted into a mixture of community fisheries, "open access" areas and some conservation areas. However, the exact size of the "open access" and "conservation" areas is not known, and how they are to be managed is not well understood. As a consequence, there are media reports that the situation in the area formerly reserved for fishing lots is now chaotic, villagers clearing flooded forest for farmland and private individuals building irrigation schemes around the lake.

Institutional arrangements for governance of the Tonle Sap—the Tonle Sap Authority (TSA)

Coordination of the management, conservation and development of the Tonle Sap Basin areas is still a major issue in the management of the Tonle Sap. The CNMC is the coordinating body for all types of issues related to the Mekong's development. Coordination of issues related to the Tonle Sap falls to the CNMC. However, in 2007, The Tonle Sap Authority (TSA) was established by a Royal Decree in September 2007 (RGC 2007), aiming to improve the coordination, conservation and development in the Tonle Sap and to address the pressing governance issues outlined above.

The Tonle Sap Authority (TSA) was established and is chaired by the Ministry of Water Resources and Metrology (MOWRAM) to coordinate government and non-government agency activities in relation to the Tonle Sap. A number of representatives of various government agencies are included as members of the Tonle Sap Authority. About 31 high-level representatives from different government ministries and institutions are appointed as Members of the Tonle Sap Authority (July 1, 2009)[12]. However, the representation of stakeholders does not take into account the community and civil society. In other words, the members of the TSA only represent government agencies.

The distribution of authority determines the degree to which there is polycentric and multi-layered institutional agreement. At present, many institutions are involved in the management of the Tonle Sap. Apart from the Tonle Sap Authority, the Tonle Sap Inter-Ministerial Committee was formed to combat illegal fishing. At the provincial level, the Provincial Committees were formed to act with the Inter-Ministerial Committee to combat illegal fishing. The TSA conducted a campaign to crackdown illegal fishing. However, the crackdown used heavy equipment transported by ferry and controlled by helicopter. About 75-85% of illegal fishing equipment was removed following an ultimatum delivered by 8 provincial vice governors (TSA Report 2013)[13]. However, communities and civil society organizations have not been involved in resolving fishing conflicts or determining access to fisheries in the lake. All decisions are top-down.

The government has taken action to combat illegal fishing and to improve governance in the Tonle Sap. Lower-level government institutions face pressure from and are held accountable to higher-level ones. This form of accountability produces results when the Head of State demands action, but it was doubtful whether the results from this form of governing can be sustained. With regards to the mechanism for ensuring accountability, the government has used the court system to combat illegal fishing. Some illegal fishers have been arrested for crimes against the Fishery Law, and those found guilty have been imprisoned, but only small fishing operators have faced prosecution (Scoping Study 2013; Open Development Institute 2013).[14]

Table 7. The reduction of the fishing lot area in 2001 for local people to use.

Province	Total fishing area before 2000		Fishing Lot areas cancelled in 2001		Fishing lot areas cancelled in 2012	
	No. of lots	Lot area (ha)	No. of lots	Area	No. of lots	Lot area (ha)
Banteay Meanchey	4	32756	2	26,358	2	6,398
Battambang	12	146,532	3	43,814	9	102,718
Kampong Chhnang	19	62,256	7	17,171	12	45,085
Kampong Thom	7	127,126	0	57,773	7	69,353
Pursat	7	55,120	2	30,272	5	24,848
Siem Reap	7	83,941	4	61,216	3	22,725
Total	56	507731	18	236,604	38	271,127

Source: DoF, 2001. Sub-decrees of the fishing lot released for local people uses; FiA, 2012.

[12]DFDL Mekong: Legal & Tax Advisers: Weekly Law Update July 07, 2009.
[13] Website of the Tonle Sap Authority: http://www.tonlesap.gov.kh/index.
[14]http://www.opendevelopmentcambodia.net/tag/flooded-forest/accessed on 21 May 2013.

Compliance with and enforcement of laws in the Tonle Sap by the Inter-Ministerial and Inter-Provincial Committee around the Tonle Sap varies from province to province, and it is biased by the interests of government agencies. Various institutions are involved in cracking down on illegal fishing, but they can interpret the relevant legal framework in different ways (Scoping Study 2013).

Local governance practices at the community level
Governance reform and new institutional arrangements for the Tonle Sap are happening rapidly at the national level. Local people in land-based, water-based and land-water-based villages are aware of what is happening at the national level and welcome the reforms. Yet they have not experienced the intended impacts of the reforms; for instance, increased fish catches and improved incomes. Instead, they face increased competition between small fishers and large fishers and between fishers from water-based and land-water-based villages. The changes have not been consistently applied across institutional and sectoral lines. The major difference is simply that communities have larger fishing areas than before and have greater access to fishing areas. The lack of clarity about where to fish and where to use water remains among villagers in different geographical areas, causing tension and conflicts within and between land-based, water-based and land-water-based communities.

- **Governance practices of land-based and land-water-based communities**

Land-based communities are located on land but influenced by water from the Tonle Sap. In the wet season, the water level in the Tonle Sap rises to a level that almost submerges land-based villages. The area around villages is occupied by water that submerges farmland and floods forest areas. These flooded areas are considered fishing areas and used to be managed as commercial fishing areas under the FiA's authority. However, fishing is not economically feasible during the peak flood in these areas as water is deep and covers a large area, allowing fish to spread out. At the same time, as a fishing area, any activity leading to the destruction of fish habitats, such as digging ponds and canals, is prohibited. Villagers during this period cultivate wet season rice in a different location in the floodplain. These rice varieties include *sreleu*, *srekrom* and *srechamrov.* This is true for villagers in Santey, where some villagers stay in the floodplain to farm these rice varieties However, in Rohal Suong, villagers practise rice farming only in *sreleu and srekrom*.

Sreleu is cultivated as wet season rice, while *srekrom* and *srechamrov* are cultivated as floating rice, indigenous rice varieties that can stand and float in the deep water of the floodplain. The planting of floating rice is not productive at present as the hydrological regime of the lake is not regular. Thus, villagers do one rice crop a year, which is wet season rice.

However, in the dry season, the water recedes, leaving the area dry. Many people from land-based villages move down to the Tonle Sap Lake to do fishing deep in the lake. Many villagers from Santey move down to stay and fish in Kanthou. In Tramper, many villagers move down and organize a fishing camp for 3-4 months. They return to their villages when the water level in the lake rises. However, villagers in Santey did not move up, but settled in Kanthou as a village. These practices remain valid so far, although none of these are covered in the legal framework.

As fishing has declined and wet season rice has low yields, roughly 1.2 tonnes/ha, villagers in land-based villages practice a new rice farming method. In the dry season, when the water recedes in the floodplain, farmers cultivate receding rice, *srekrom*, which is a short-term rice variety. This variety takes about 3 months to grow, and is planted in November or December. In January or February, villagers move down into the lake and do the dry season rice *srechamrov*, using the water from the lake or from canals to irrigate the rice.

Thus, at present, farmers from land-based villages in the Tonle Sap can do three rice crops a years: wet season rice, receding rice and dry season rice. By planting three crops per year rather than just one, farmers are able to increase their annual harvest. For instance, the wet season rice yield is about 2-2.5 tonnes/ha and the dry season rice is 3-5 tonnes/ha. For some villages, like Rohal Suong, dependence on fishing has dropped as rice yields have increased.

However, farming is legally prohibited in the floodplain by the Fishery Law. Farming in the deep water field of the lake leads to clearance of flooded forest which is banned under the Fishery Law. Farming often conflicts with fishing in this area. There was a case of conflict between farmers and fishing lot owners in Kampong Chhnang in 1997 where the fishing lot owners wanted to pump water out in order to catch fish. This negatively affected the farmers, who needed water to keep their rice growing. This is still the case in Santey, where fishers want to pump water out to catch fish while other groups want to leave the water for their fields. In Rohal Suong, villagers keep one deep pool as a fish sanctuary, while the rest of the village wants to use pond water to irrigate their crops in the dry season. This has led to the formation of a community fish sanctuary.

Ownership of this land has been designated under three zones. Ownership is legally given if the land is located in zone 1, while in zone 2 ownership is subject to approval from the provincial administration. In zone 3, ownership is not granted as the land is used for conservation. This is a new form of governance in the Tonle Sap, instituted after 2012. About 15 reservoirs, covering 3,600 ha in the Tonle Sap floodplain have been dug privately, affecting the Tonle Sap.[15] Illegal fishing on the lake had increased substantially since Prime Minister Hun Sen cancelled the commercial fishing lots and urged authorities to crack down on violators.[16] Ownership over the areas formerly considered fishing areas is now allowed, and this has led to conflict between farmers and fishers. However, Rohal Suong, Santey and Tramper villages have irrigation schemes. Water management in these areas is done independently according to the community's needs. The government tends to come up with large-scale plans that do not always meet the needs of villages, while villagers work on a small-scale level based on needs that do not meet technical requirements.

In Santey, the community fishery is managed by the villagers in coordination with the FiA. The Commune Councils generally have a smaller role to play with the community fisheries, but they have worked closely with community to initiate an irrigation committee to manage water. As a result, the community has managed to start cultivating three crops a year rather than just one crop. However, many villages are members of the community fishery and the governance structure is hierarchichal, the decision-making process bureaucratic. Only a few villagers are active members of the community fishery, while many do not contribute to themanagement of fishing areas. Leaders of community fisheries are not empowered to stand for their communities, as they do not benefit from being leaders but are confronted by illegal fishers if they attempt to enforce the law. At the same time, community fishery committees do not have power to enforce the law, but have to rely on the FiA for the task.

[15]http://www.opendevelopmentcambodia.net/tag/tonle-sap/
[16]http://www.opendevelopmentcambodia.net/tag/tonle-sap/

In Rohal Suong village in Battambang, the community has played an active role in managing the community fishery and rice farming. Villagers now have two to three rice crops whereas in the past they only had one. This has made the community more independent in terms of decision-making. Local authorities and technical agencies like the FiA have acted to support communities while communities take the lead on developments that they believe could benefit them. However, the decision-making power is still in the hands of the FiA. Community fishery members do not always do their roles and tasks to contribute to the management of fisheries. The management of community fisheries is left in the hands of the community fishery committee. Sometime, the members of community fishery committee are discouraged from doing their tasks as they do not receive the full support of other members.

- **Governance practices in water-based communities—Community Fisheries versus Open Access**

Water-based communities rely primarily on fishing. The cancellation of fishing lots created more fishing areas. Some fishing areas have been established and managed as community fisheries and other areas have been reserved for open access or conservation. All villages the scoping team visited have organized their fishing areas as community fisheries except for Chhnoc Tru. The return of fishing lot areas to open access and the change of the management system from private management to state management raises the question of the sustainability of fisheries management.

Chnok Tru has not gained or lost from the cancellation of fishing lots areas. The whole community lives on water and fishing is the primary occupation, but the community has established no community fishery. Given the increase in population, the fishing area is getting smaller for the community and, therefore, many fishing households from Chnok Tru fish in Phat Sanday. This is a neighboring community where a community fishery is active and has taken strong control over their fishing areas. Conflicts often occur between Phat Sanday and Chhnok Tru. As a result, illegal fishing is still an issue and governance of fishing area is still weak. As this community is floating, water management is central to the development of Chhnoc Tru. There is no ownership over water, though in practice some forms of informal ownership are recognized by villagers. However, as the community is located over the lake, human waste is discharged into the water, polluting the lake and causing and health and environmental problems. The FiA is active and influential in this area.

A large part of the old fishing lots (though no part of the fishing area in Chnoc Tru) was transformed into conservation areas. The main conflict is that fishers from Chhnoc Tru fish inside the fish conservation and former fishing lot no. 2, which was transformed into a fish conservation area in Phat Sanday commune. Two fishing areas (located closed to the Kampong Chhnang administrative boundary and Chhnoc Tru village) have been transformed into conservation areas where there is conflict with fishing communities. Fishing conflict is still intense and this affects the governance of fishery in Chhnoc Tru. For the villagers, the cancellation of fishing lots made their lives harder. Before the cancellation, fishers from Chhnoc Tru made a deal with fishing lot owners and could fish inside the fishing lots, and they caught more while fishing. The cancellation of the fishing lots resulted to these people losing fishing grounds. Having no specific fishing grounds, the villagers from Chhnoc Tru have ended up fishing anywhere they can. As a result, they are blamed for illegal fishing or encroaching on the fishing areas of others, including community fisheries and conservation areas.

In Phat Sanday, villagers benefited from the cancellation of fishing lots. The first and second fishery reforms provided communities a large fishing area. The community fishery was established and run by community members. At present, they are managing the community fishery, plus the newly cancelled fishing lot areas. However, they have difficulties managing the old fishing areas plus the new fishing areas. The cancelled fishing lot areas are managed as open access for different types of fishers, leading to concern and conflicts. Illegal fishing is taking place, but the villagers from this community cannot stop the illegal fishers. At the same time, there are no tools or systems to manage the open access areas.

In Chong Kneas, the floating environment has been greatly modified by reclaiming the flooded land and developing it into a tourist area. Some floating households were relocated and new buildings were developed with new infrastructure. Communities in Chong Kneas do not have much control lover the development of their area, but they are affected by the process. The whole area is controlled by the Sou Ching Company, and activities inside the communities are subject to the approval of the company. Most of the land in the area is under the control of the company and people from outside. Local people sold their land and became landless, but more dependent on fishing, while fishing is no longer lucrative. A community fishery was established, but it does not function well because members do not rely on it and because the livelihoods of community members derive from other activities such as boat service tours. An association of boat service providers has been established and it is closely linked with the Sou Ching Company. The Commune Administration is active, but does not have power over the place and, therefore, it has to coordinate with the company rather than confronting them. At the same time, there are other agencies working in the area including the MoE, FiA, NGOs, banks, and private actors, but the coordination and cooperation is complex. Thus, these affect the governance and it is very complex.

Challenges and opportunities

Coordination is the main challenge facing the governance of the Tonle Sap Lake. Despite the establishment of the Tonle Sap Authority, coordination is still inadequate. Coordination within intra- and inter-institutions requires more effort if governance is to be improved. The intra-institutional coordination within the TSA is still being worked out and some roles and responsibilities are not well established. At the same time, inter-institutional coordination needs time to improve. The existing multi-lateral institutions and structures relating to the Tonle Sap governance are inadequate to meet the environmental challenges facing the Tonle Sap.

The cancellation of fishing lots was too sudden. An alternative mechanism for fisheries management should have been prepared before the decision was made to cancel the fishing lot system. The turning of the fishing lot areas into the open access and conservation areas has raised many questions about how these areas will be managed. At the same time, the turning of fishing areas into the open access ones will lead to what Gareth Hardin (1968) called a "tragedy of the commons" of fisheries in the Tonle Sap. The question is whether there is a management system that can manage the open access areas and prevent a tragedy.

In the context of conservation, fisheries are a state property. State property means everybody's property and everybody's property means nobody's property. This contributes to the degradation of fisheries. In addition, the conservation area is managed by the state, and the state uses the state property resource management regime to manage conservation. So far, in Cambodia, experience shows that the state property resource management regime was abandoned as it manages resources poorly. Instead, the state has chosen the private property resource management regime to manage resources. The cancellation of the fishing lot system and the resulting state property resource management regime raises questions about the possibility of effectively managing the resources.

More importantly, governance mechanisms at the local level are not clear, though major initiatives have taken place at a higher level. Although local action such as improving water management has been initiated by local communities, challenges are still ahead of them. At the same time, many communities around the Tonle Sap Lake have changed from farming one crop a year to 3 crops a year, though the government is still slow in supporting farmers to do. However, farming and other livelihoods activities have been constrained by an excess of water in the wet season where the whole area is flooded, and too little water in the dry season where the whole area is dry.

The Tonle Sap has been zoned. The zoning requires different modes of governance for each zone, and communities around the Tonle Sap have been in conflict over the management of different zones. The floating community needs to catch fish to feed their families. Therefore, they reduce the water level as much as possible by pumping water out to catch fish. However, farming communities need to keep water to irrigate rice fields. Any effort that causes water to flow out of their fields would affect the rice harvest. These conflicts have occurred between different communities over the use of resources.
The management of water is an essential element in the governance system at the local level.

Moreover, these challenges could be addressed given the fact that the Government of Cambodia has made efforts to manage the Tonle Sap sustainably. The Tonle Sap Authority (TSA) is a national body established to promote the development in the Tonle Sap. Our program to manage aquatic agricultural systems in the Tonle Sap coincides with the work of TSA, and this is a great opportunity for the AAS Program to work with the TSA on activities that can improve AAS for the benefit of AAS-dependent communities.

Knowledge gaps

Information on the governance aspect of the Tonle Sap is available at the national level. The cancellation of the fishing lots, the establishment of the TSA, and the zoning of flooded forests and so on are well-known aspects of the governance in the Tonle Sap. It seems that we have more knowledge about the governance at the macro level.

However, knowledge about governance at the local level is inadequate. There is a gap in our knowledge of local governance practices. There has not been much study of how local communities manage their resources outside the scope of the government's practices. The scoping study suggests that more studies could be conducted to generate knowledge on the ways communities use resources.

Different fishing communities around the lake—land-based, water-based, and land-water-based villages—are still practicing informal governance of resources from the lake. These practices have not been documented and, therefore, information on these practices has not been integrated into formal legal and institutional system of resource governance in the Tonle Sap. Nevertheless, communities keep these practices even when they conflict with the formal system. The two systems view each other as inadequate, which leads to weak governance.

Some laws and policies, such as Land Law, Water Law, Fishery Law and others do not adequately address the needs of communities around the Tonle Sap. For instance, floating communities exist on water year round, but there is no law that reflects this practice. According to the laws, they are acting illegally, but their practices have been in place before the law was created. The question is whether we should adjust the law to include this practice or whether these communities should live in a way that is beyond the scope of the law. Thus, there is a need to examine the existing legal and institutional framework aiming at understanding formal and informal practices to improve the governance of the Tonle Sap.

The Fishery Law limits fishing communities to small-scale fishing. At present, small-scale fishing is not able to provide for people and, therefore, fishing communities around the Tonle Sap do not follow the law, but fish to secure their living while the resource is in decline. Local fishers from different fishing communities will not be reluctant to fish illegally if they cannot live by fishing legally. Should people be blamed for not respecting the law or should the law be changed? However, small-scale fishing means different things to different fishing communities. Small-scale fishing for a floating village might be different from small-scale fishing for a land-based village or a land-water-based village. Floating villagers depend entirely on fishing and, therefore, fishing for them is more significant than small-scale fishing in land-based villages, who can rely on farming if they cannot fish. There is a need to consider how these differences affects the governance of the Tonle Sap.

The governance of the Tonle Sap has changed from a focus on fisheries management in the Tonle Sap, which was based on management of the commercial exploitation of fishery resources by FiA alone, to community-based fisheries management and to conservation of biodiversity involving many institutions. While this is a new approach, there is also concern about how many institutions will work together under complex institutional and legal arrangements and in the context of institutional conflicts. More studies should be undertaken on the institutional and legal arrangements for the Tonle Sap.

Knowledge management and partnerships

Background

This section on knowledge management (KM) and partnerships looks at how and what type of information is generated and shared among the stakeholders, and particularlyat the networks and relationships between the different stakeholders and donors. In addition, we highlight issues where new knowledge networks and information could be further developed in order to share information and improve agricultural productivity.

We visited seven villages across three different types of ecological zones—water-based, land-based, and land-water-based villages. Rice cultivation and fishing are the primary occupations of a large majority of villagers. In the visited villages, there are existing groups, communities and associations. However, they are not well-organized in terms of knowledge learning and sharing and many of the community networks have been established based on the interests of outsiders, and this has led in many instances to fragmentation of organisations, groups and networks.

Current situation analysis

Existing networks
In the visited villages, networks and groups exist, but they are fragmented. There is no mechanism for coordinating existing networks and groups to share their knowledge and experiences with regards to fish processing, fish culture, rice cultivation and so on. Some of groups or communities were established based on interests of NGOs or government institutions, and these do not always reflect the genuine interests of the villagers. There were some cases of successful groups, while others were still struggling to achieve success. A savings group in Rohasuong which was formed in 1998 has now expanded into the Ek Phnom district Savings Federation and is one successful case. Yet it is not clear what factors led this group to become successful and how it incorporated the genuinely poor in the community. Savings groups in Pursat and Siem Reap did not run well, with members expressing scepticism about the groups' functions.

Knowledge and information sharing
Information has not been widely shared among farmers and fishermen. Many fishermen and farmers mentioned learning new skills by word of mouth or by conducting their own experiments through trial and error. In one village in Siem Reap province, villagers mentioned that a local NGO trained them in the use of methods to cultivate dry season rice and to raise livestock. Yet, the skills were not widely practiced because there is lack of water for dry season rice cultivation. A community member in Rohal Suong village in Battambang mentioned his individual attempts to cultivate a fast-growing rice variety (IR 74). In addition, some people in his village learned from radio and TV programs.

Radio and TV programs are effective channels to improve farmers' knowledge about rice cultivation and in some cases about fish processing techniques. The youth in Tramper commune referred to a radio station to get updates on the market price of vegetables and rice.

There is limited space for knowledge and information sharing. These activities rely on training from NGOs, but there is limited information sharing between farmers themselves. Some farmers who were trained in techniques for rice cultivation did not share this knowledge with other villagers.

Villagers struggled with the lack of market price information. There is no mechanism for traders to share information about the market price of fish and fish products that traders give to fishermen. In many cases, villagers complained of competition with other fishermen, claiming they sometimes had to reduce their prices in order to sell their products. The reduction in sale prices sometimes caused fishers to get lower profits.

Community fisheries (CFi)
In this report, the term community fishery (CFi) refers to a body of water that is under joint management of the community and the Fisheries Administration. A community fishery (CFi) is one element to ensure community participation in managing sustainable fish resources. Often the CFi involves more than one village in working on fisheries management projects. For instance, in Chong Khneas commune, there are 7 administrative villages which form one community fishery. The CFi management committee has a 5 year mandate and its leaders are elected by members. However, almost none of the CFis that we came across in the scoping have been re-elected, and the mandate of some CFis has already expired. Many CFi management committee members expressed exhaustion at the lack of incentives.

CFis were established in 2009. In Battambang, there are 42 CFis, while Siem Reap has 22 and Pursat has 34 CFis. There is a pressing need to revive the existing CFi structure as well as reconsider the incentive scheme. The following section highlights issues where new knowledge networks could be further developed in order to share information and have an impact on agricultural productivity, livelihoods and natural resources.

Water management: Water management is one of the serious issues mentioned by most participants. When talking about water management, the irrigation system is the key element. Irrigation systems were built during Khmer Rouge time and there are a few irrigation systems that have been properly renovated. Many villagers in Pursat complained about water shortages for their dry season rice and other cash crop activities. There is a large difference between upstream farmers and downstream farmers with regard to water distribution. The downstream farmers in the previous year were affected by the drought. As indicated by the commune chief in Metuk commune, villagers know about benefits of cultivating dry season rice. Yet without water, they are not able to cultivate dry season rice. Many of the villages in Metuk commune were affected by excess water during rainy season and by drought during dry season. There has also been conflict with regard to request for water from upstream villages (Damnak Ampil village). There is currently no mechanism to solve the problem.

Agro-chemical products: The use of agro-chemical products such as chemical fertilizers and pesticides has caused harmful effects on water and the natural ecological system. Farmers have not been properly trained about techniques to use chemical fertilizers and pesticides. They learned by word of mouth from other villagers. The Deputy Director of the Provincial Department of Agriculture, Forestry and Fisheries complained about the lack of capacity building to farmers about new farming technology and about the lack of soil experiments. She added that there is a lack of equipment to diagnose land use and that there has been no advice on use of chemicals.

Farmers in Pursat showed that in one hectare of dry season rice, they use about 200 kilograms of chemical fertilizers. In one year, they can cultivate rice a maximum of 3 times (for upstream villagers). They harvest rice for family consumption and sell the surplus. Some of them mentioned the low price of dry season rice this year. The three rice harvests are the receding rice crop and two dry season rice crops. The locations of receding rice fields and dry season rice fields are different.

Representatives from CFis in Battambang and Pursat raised similar concerns about extensive use of chemical fertilizers causing damage to fish resources in the conservation ponds after the flooded season (i.e. after the water had receded).

Indebtedness: Many villagers, except those from some villages in Sdei and Rohasuong, mentioned indebtedness as a cause of increased migration and wage work. According to a rough estimate by a female villager in Chambak village, about 50 percent of the villagers have debts which have not been repaid. Similarly, the commune chief in Metuk commune mentioned that about 30 percent of his commune is in debt. The reason they are in debt is mainly that yields from the last dry season was not very profitable. They did dry season rice cultivation, but they did not have water for their rice fields. A woman in Metuk commune, in addition, said that if the villagers could earn enough from rice cultivation and fishing, they would not take the risk of migrating away from their villages.

Lack of knowledge about fish processing techniques: The most common type of fish traded is fresh fish. Fishermen and fish traders do not have capacity to process fish according to market demand. Of the 9 villages visited, there was only one, which was in Kampong Thom province, where fishermen and fish traders mentioned processing fish and fish paste to sell at the nearby market and at a market supported by a local NGO, COWS. However, fishermen and traders said that they first sold fresh fish and processed any unsold fish.

Fish export market and price: Generally, the price of fresh fish is volatile and depends on the size of the fish catch and the time it takes to get the fish to the market. Some fishermen talked about losing profits because of the decline of fish resources forcing them to travel long distances in the river in order to catch fishes.

Fish trading is mainly a small-scale operation. Many fish traders have been affected by the decline of fish resources. There are several reasons for this decline. Some villagers stated that it is due to low water levels. Others blamed the impact of abolishing fishing lots. Now their catch varies, but it is getting progressively smaller.

The fish trade is mainly to supply domestic consumption and a few high-quality fish are exported. Normally the fish are sold fresh. Fish traders in Battambang mentioned that fish is imported from Thailand at a much lower price (around 3,000 riel per kilogram compared to the domestic fish price of 6,000 riel per kilogram). The import of cheap fish will erode motivation of villagers to engage in fish culture and will have a negative impact on fish traders because of price competition. Although there was processed fish for export, there is still a lack of capacity in fish processing and preservation. This is an opportunity for AAS to work on Action Research in this area.

Fishery Law: Awareness raising pertinent to the Fishery Law and other natural resource management laws is limited. Not many villagers in the study area were aware of the existing legal framework. Some fishermen complained about fraud with the law and said that the law is too restrictive.

Many fishermen shared their frustration at the cancellation of the fishing lots. Yet some people were happy with the decision to cancel the fishing lots because the CFis were to be given control over the fishing areas. Also, some people, especially poor fishermen, said that they could not go fishing far inside the lake because they lacked big motor boats and good fishing gear. Other fishermen complained about restrictions in the fishery law on using certain fishing gear. At present, they have to pay more informal fees to government officials including journalists in order to use illegal fishing gear. In the end, fishermen asked that the fishery law be modified so as to be less restrictive in terms of fishing gear.

Livestock raising: Livestock raising skills were shared by NGO programs in collaboration with relevant provincial departments. These were shared only with villagers in land-based and land-water-based villages. However, many villagers in Pursat talked about the failure of raising livestock because of diseases. There is no treatment provided for sick livestock. Thus, in the past year, many villages lost a lot of profit. There are veterinarians in each commune, but since the disease outbreaks occurred quickly and affected many animals, they were beyond the capacity of veterinarians to handle.

Challenges and opportunities

Local people are facing many problems but also find opportunities in the process of establishing relationships and networks for income-generating activities and for the emerging changes that affect their daily lives. What are the main development challenges influencing knowledge sharing, information management and partnership development in the Tonle Sap? The general challenges involve limited access to wider networks, scaling up issues, access to capital, sharing experience and creativity, and role of CFis and conservation efforts. Each one of these issues is explored further below.

Limited access to wider networks that could increase and sustain income-earning activities was observed in visited areas. For example, a trader in Chambak village of Kampong Thom has the ability to produce a certain quantity of fish products for sale and have access to a few middle men who would come over to her place, and she seems to have trouble expanding her network. She also lacks information about various links that existed beyond her locality that would perhaps provide her products with more competitive prices. But there were also issues related to the quality and quantity of products produced. Another case was from Chong Khneas in Siem Reap, where the fisher was locked into existing links with middlemen who set the price of products but who also provided loans when fishers needed them.

Scaling up is an issue but it also appears to be an opportunity for what the community people are doing right now. The issue is that community people have not been able to produce enough for supplying market demand. Perhaps, the lack of information related to existing markets for the kinds and quality of products that they are making has constrained people's creativity to produce more and engage in something new. The challenge for the community is that they tend to produce for local consumption with projects like home gardening and environmental promotion/sanitation practices by setting up biogas production in Kampong Thom and Kampong Chhnang provinces. At the same time, some of these activities are generally seen as outsiders' interventions rather than an exploration of the potential within.

Important opportunities are found in people's access to capital as information and services are readily available at their door steps. While many have said that they lack capital, the issue may be the inability to stick to deadlines when repaying and this may be attributable to the performance of their income-generating activities. However, there seems to be no supply of skills available to local people to help them find access to markets. Such assistance, including in relation to fish and fish processing, would allow villagers to generate income on a regular basis, which would in turn sustain links with MFIs. An emerging pattern is that borrowers invest in prohibited fishing gear even as they watch fish resource declines. They do so to be able to repay MFIs and also law enforcement officials. As fish resources become scare, alternative livelihood sources (e.g. aquaculture, livestock, etc.) need to be explored and supported. Although people in some areas complained of limited access to capital, the role of MFIs has been instrumental in providing access to the people in most visited areas. So, the issue is how to bridge the gap between access to resources from MFIs and the ability to generate a regular income by investing these resources.

Effective sharing of new techniques is found most in villagers' own locality. Sharing locally allows villagers to adapt to changes affecting their communities, especially regular food shortages and droughts. For example, in Rohal Soung community, someone experimented with a more resilient type of rice variety and the result has spread in the commune in recent years. This locally-adapted initiative by people themselves seems to provide an important lesson for future AAS works. The more the mission team probed deeper during the discussion, it seemed that relevant agencies have not kept pace with changes in communities. For example, FGD participants said that outsiders were still teaching SRI techniques that are not suitable to the area. However, they acknowledged that their learning to adapt to change has come in part from various advices—the government, commune councils and NGOs. As a result, the community people feel that they are less reliant on fishery resources. This creates a good opportunity for sharing knowledge in other areas where people may try something similar.

People have knowledge about the recent reforms for conservation and for family-scale fishing. However, in some areas people complained about not being aware of the boundary between conservation zones and public fishing areas, while many others feel that those who enter into the conservation areas do so because they know that is where fish gather. An important issue we need to understand is the changes created by the cancellation of the fishing lots. It will be a challenge to maintain the motivation of the CFi committee members, especially when the CFi structure is not adequately supported. There is already recognition that about half of CFis are not functioning and that their leaders' terms of office have already ended. The future remains doubtful even if, for example, the CFi committee in Rohal Soung expressed a strong commitment to combating illegal fishing and to patrolling and guarding the community conservation areas.

Knowledge gaps

Gaps in our current knowledge exist in terms of the issue of upstream and downstream coordination, the potential for all institutions to come together, land sales and their effects on former owners, and the process of engaging people in conservation efforts.

The situation between upstream and downstream communities, where those downstream suffer from acute floods and droughts, appears to have either promoted or inhibited AAS activities depending on how the situation is handled. We know that this is an issue in Siem Reap's Santey village and Pursat's Metuk commune. We still do not have sufficient information about many aspects including the decision-making process or the challenges or benefits that each area faces. This is an opportunity to increase dialogue and share information so that villages have equitable access to resources. If this situation is not resolved, constructing or renovating systems to support AAS activities could not realize its objectives.

It is good to hear stories about **communities working together** with the support of local authorities such as the commune council. This is the case in Rohal Soung and Santey, where villagers have worked on agriculture/rice farming and fishery management in the own communities. They are proud of the work they have done so far because they were able to create rules and manage their differences. Moreover, we have heard about many institutions entering the community including some NGOs, many MFIs, and some government agencies. This leads to a question about the extent to which these groups contribute to the health and wealth of the community. It would be worth exploring the potential synergy that that these institutions could bring to the community, which has so far worked mostly in relative isolation.

Incidence of **land sales may lead to landlessness** or force people to become tenants. Although we have not heard much about land sales in most visited areas, large land areas (by about 70% of village households) in Santey village in Siem Reap have been sold to outsiders. While some said that they can still work on land, would they be allowed to continue when the areas become more attractive for new investment opportunities in the future? The people who sold their land could become vulnerable and may be forced to migrate to other areas for work. Therefore, it would good to further investigate what they have been doing to support their households now that land ownership is in the hands of others.

It is important for **community people to have sufficient information about the conservation areas** and know how they can get engaged in the process of conservation. Right now, the role of managing areas seems to be confined to the enforcement agencies, but communities seem to be excluded from the process. Perhaps, we need to gain more insight into the extent of people's encroachment into conservation areas and the benefits they get and their perceptions. An understanding of this would form the basis for a broad-based discussion and lay out all possible options. If the situation continues the way it is now, the tensions will remain and negative effects on their lives may be inevitable.

Some of the research questions that we feel would help in developing and strengthening existing and emerging knowledge networks and partnerships are as follows:

- How can better technologies and management practices be disseminated most effectively for the benefit of smallholder fishers and farmers in Cambodia?
- How can we best harness learning that can be scaled out to other similar parts of the country?
- What precise actions and mechanisms are needed to transform research into developmental outcomes?
- How can networking, in the form of engagement in multi-stakeholder platforms and other modalities, work to link research to generation of outcomes?
- How can dialogue and negotiation in stakeholder platforms be most effectively informed to deliver the best development outcomes?
- How can effective networking and community voices be expanded and sustained?
- How is it best to link with local NGOs and their grassroots networks to create geographical spread, long-term committed presence, organizational development skills and local credibility?

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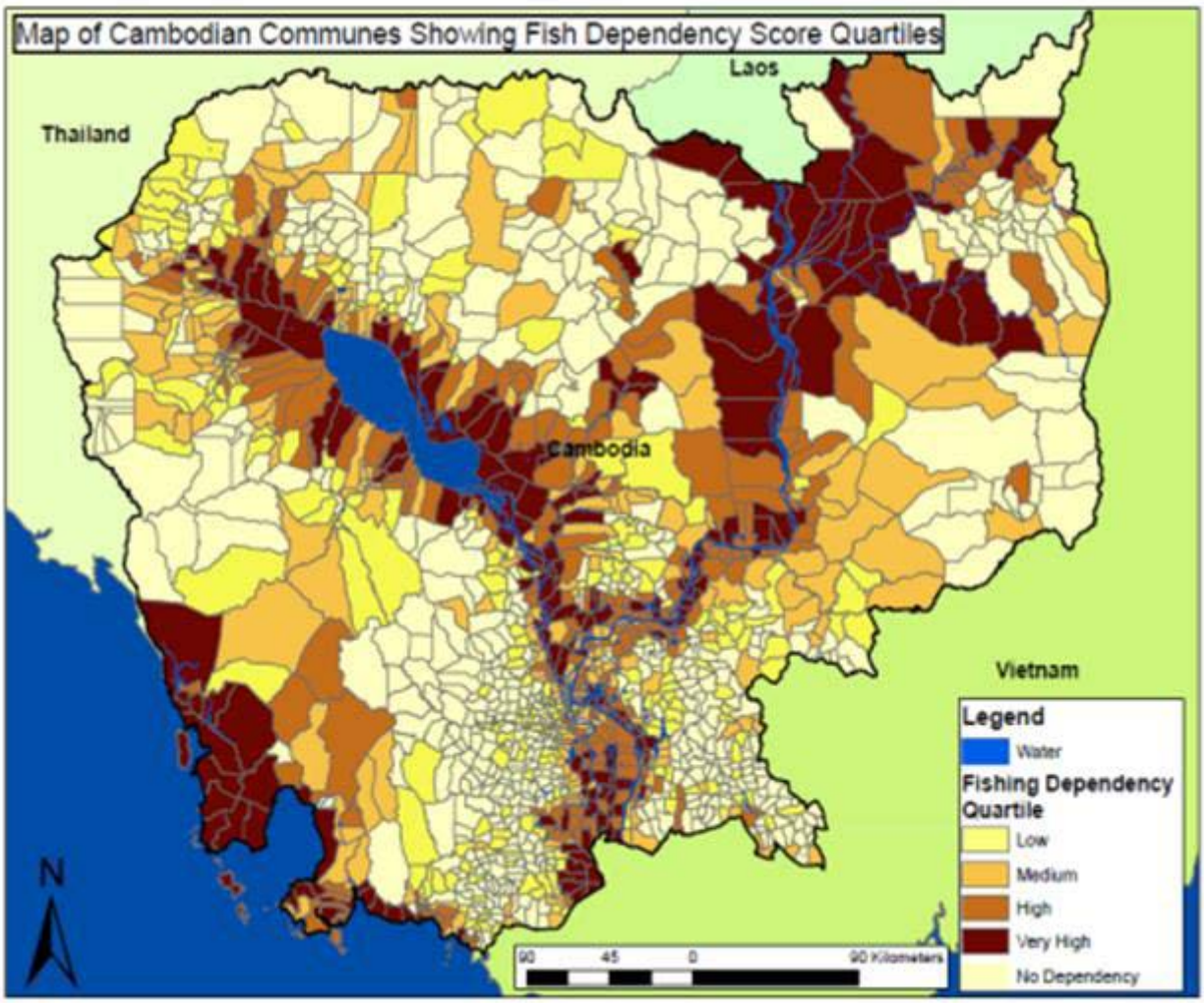
Annex 1. People interviewed

Day/Site	Name	Organization
28 April 2013/Chambak village	Oeu Sok Mean	Fish trader
	Seng Nheung	Fish trader
30 April 2013/Santey village	Sem Sea	Danrun Commune Vice Chief
	Oung Chhang	Chief of Santey village
	Srey Ky	Vice Chief of Santey village
	Chea Tak	Farmer
	Hong Sothy	Chief of Dam Dek agriculture District
	Chhun Vong	Member of commune councilor
	Sum Sam Ath	Member of commune councilor
	Sun Phum	villager in Santey village
	Neum Tis	villager in Santey village
	Ork Tum	villager in Santey village
	Sam Meas	villager in Santey village
	Matt Meu	villager in Santey village
	Se Han	villager in Santey village
	Keh Tun	villager in Santey village
	Chuch Tho	villager in Santey village
	Noeun Norn	Farmer
	Keo Phat	Fisher
	Sam Meas	Housewife
	Oeur Dam	Danrun commune Chief
	Choeur Hong	Fish trader
	Sem Sea	Danrun Commune Vice Chief
	Chung Mean	Chief of Santey village
	Srey Ky	Vice Chief of Santey village
	Chea Tak	Farmer
	Hong Sothy	Chief of Dam Dek agriculture District
30 April 2013/Kantou village	Chao Sokhun	Fish trader
	Hang Sar	Farmer
	Huon Hai	Fisher
30 April 2013/Chong Kneas CFi	Um Navy	Chong Khneas Commune vice Chief and Chong Kheas CFi Chief
	Em Marn	Village number 2 Chief of Chong Kheas Commune
	Som Seut	Village number 2 Chief of Chong Kheas Commune
	Sgoun Sarum	Village number 3 Chief of Chong Kheas Commune
	Khun Leang	Village number 4 Chief of Chong Kheas Commune
	Duong Reun	villager
	Em Samai	villager
	Kroch Yat	villager
	Cheng Navy	villager
01 May 2013/Rohal Soung village	Khim Sarith	Chief of Rohal Soung CFi
	Seng Yi	Rohal Soung Commune Council Chief
	Eur Chheut	Vice Chief of Rohal Soung CFi
	Rey Keng	Vice Chief of Rohal Soung CFi
	Chuy Chem	Vice Chief of Rohal Soung CFi

Day/Site	Name	Organization
01 May 2013/Rohal Soung village	Tat Heung	Rohal Soung CFi member
	Veun Sareun	Rohal Soung CFi member
	Khun Sambath	Farmer
	Lam Han	Farmer
	Chet Sareun	Farmer
01 May 2013/Sdei village	Ang Mom	saving group leader
	Chhan Chhum	saving group sub leader
	Pun Ving	villager
	Pheu Sarum	villager
	Lai Y san	villager
	Bo Voeut	villager
	Pun Dak	villager
	Mom La	villager
	Ho Sea	villager
02 May 2013/Meteuk commune	Oun Kheun	Meteuk Commune Council Chief
	Chiel Vanny	Meteuk Commune Council member
	Tain Meo	Meteuk Commune Council Vice Chief
	Sok He	Snam Prah village Vice Chief
	Um Lang	Snam Prah village Vice Chief
	Chiel Sokny	Fisher
	Yeung Khoun	Fisher
	Chhun Ren	Fisher
	San Bun	Fisher
	Tun Kang	Fisher
	Nheup Kiatha	Farmer
	Chan Noun	Farmer
	Chea Sreymuch	Farmer
	Oun Sam Eun	Farmer
	Kim Kuim	Farmer
	HAK Kiri	director of AARR (NGO in PS)
	Chheav Kuch	commune chief
	Nhuk Sophal	commune councilor (CC)
	Horm Ly	Assistant
	Neang Soviet	commune councilor (CC)
	Em Oeun	Community Leader
	Chea Sok	Demo Farmer
	Pheng Phorn	Cashier (Commune)
	Art Yong	Patrol team
	Mae Mut	Patrol team
	Pon Han	Program Coordinator AARR
	Morn Ravy	Officer of AARR
03 May 2013/Tram Paer village	Uon Sam Oeun	Youth Group
	Chan Nol	Farmer
	Nheub Kiet Tha	Farmer
	Chea Sreimoch	Village Health Support Group
	Chea Vannei	Commune Councilor
	Kim Ky	Demo Farmer
04 May 2013/Phat Sanday commune	Sok Seung	Neang Sao village Chief
	Peuv Rum	Kampong Chamlang village Vice Chief

Day/Site	Name	Organization
04 May 2013/Phat Sanday commune	Yem Youn	Phat Sanday village Vice Chief
	Tum Chhien	Kampong Chamlang village CFi member
	So Pek	Kampong Chamlang village CFi member
	Hou Trik	Kampong Chamlang village CFi member
	Heun Chi	Phat Sanday Commune Secretary
	Thoung Hey	Kampong Chamlang village Chief
	Sien Kim Heu	Fisher
	Siek Sokien	Fisher
	Yun Sreimom	Fisher
	Long Chea	Fisher
	San Phalla	Fisher
	Phork Kea	Fisher
	Orn Lai Im	Fisher
	Eng Sopheak	Fisher
	Hor Chanthy	Fisher
	Leng Kim Chheang	Fisher
	Reun Chamroeun	Fisher
	Thorn Savy	Fisher
	Horm Heng	Fisher
	Chhai Ry	Fisher
	Oum Meng	Community Fishery
	Sok Sing	Village Chief
	Pov Rom	Vice Village Chief
	Yem Yorn	Vice Village Chief
	Tum Chhean	Community Fishery
	So Perk	Community Fishery
	Hor Trik	Phan Sandai Community
	Heun Thy	Commune Clerk
	Phorng Hai	village chief of Kampong Chamlong village
	Kang Kiem	Fish Trader
04 May 2013/Chnoc Trou commune	Ms. Phat Phalla	Fisher
	Mr. Yong Kim Seng	Teacher
	Ms. Sam Somearith	Village chief of Chnok Trou village

Annex 2. Fish dependency score and map



The FDS is a village-level variable which equals the probability that a randomly selected household engages in some level of fishing activity. The FDS can be interpreted as a predictor of the intensity of fishing activity in a village since the higher the FDS score is, the more likely it is that a random household engages in fishing activity. It is based on the number of self-identified fishers (2008 national census), the number of boats used for fishing (2010 Commune Database) and a small poverty modifier that increases the FDS if the village is poorer than the average Cambodian village.

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Annex 3. Schedule of scoping trip

Day	Date	Travel	Location	Development challenge	Production system
1	Sun 28th April	Arrive Siem Reap	Travel by bus to Siem Reap - Departure at 8:30 am **Visiting Chambak village/Taing Krasang Communities** in Kampong Thom Province on the		
2	Mon 29th April	Morning	**Scoping Team Introduction Meeting and Planning** Topic: Introduction to scoping trip, planning, team-up, and information to be gathered Participant: Scoping team		
		Afternoon	**Tonle Sap Scoping Seminar in Siem Reap** Participant: Scoping Team; NGOs, FiA, MAFF, Government. fish processors and fish traders Organizer: TCO and WorldFish		
3	Tues 30th April	Morning—Visiting Santey village, Dan Run, SotrNikum District, Siem Reap	Stand-Stilt Community	• Farming vs Fishing • Flooding and drought vs Irrigation • Land for agriculture and inland fisheries.	• Capture fisheries and aquaculture • Farming
		Afternoon—Travel to Chong Kneas in Siem Reap	Floating community	• Livelihoods of floating villagers depending on fishing. • Impacts of development on fisheries and floating livelihoods. • Lack of alternative livelihoods	• Fish productivity in the Tonle Sap • Fish catch
4	Wed 1st May	Morning— Depart from SiemReap for Battambang	Travel by bus to Battambang Departure at 8:30 am		
		Afternoon— Battambang: Visiting the RohalSoung Commune, Ek Phnom District	Farming—Fishing Community	• Farming challenges • Fishing limitation • Land issue—farming versus fishing	• Capture fisheries • Farming
5	Thurs 2nd May	Battambang—Morning	Tonle Sap Scoping Seminar in Battambang Venue: Sangker Hotel Participant: Scoping Team; NGOs, FiA, MAFF, Government. fish processors and fish traders Organizer: AS, VSG and WorldFish		
		Battambang—Afternoon	Travel to Pursat Departure at 1:30 pm Visiting **Me Teuk Community** in Bakan District, Pursat Province on the way from		
6	Fri 3rd May	Pursat—Morning	**Tonle Sap Scoping Seminar in Pursat** Venue: Pursat Century Hotel Participant: Scoping Team; NGOs, FiA, MAFF, Government. fish processors and fish traders Organizer: ANKO, AARR and WorldFish		
		Pursat— Afternoon Visiting Tram Per Community in Bakan district	Farming- fishing community	• Drought and flood, • Agriculture and fisheries • landlessness and migration	• Farming • fishing
7	Saturday 4th May	Breaking in two groups (Whole day): 1. Group one—Visiting PhatSanday in Kampon Thom Province; 2. Group 2—Visiting Chnoc Truin Kampong Chang Province	Floating communities	• Capture fisheries • fishing is the primary source of livelihoods • Fishing degradation • Increased population. • Landlessness • Fishing conflicts	• Fishing and aquaculture
8	Sunday 5th May	Return to Phnom Penh Departure at 8:30 am			
9	Tues 7th May	Phnom Penh	**Tonle Sap Scoping Study Debriefing Seminar with Stakeholders in Phnom Penh** Venue: Cambodiana Hotel (tbc) Topic: To be developed		

	Livelihoods FSN, and gender	Governance and institutions	Value chain and markets	Partners & stakeholders	Overnight
way from Kampong Thom to Siem Reap, facilitated by **COWS**, an NGO based in Kampong Thom Province					Siem Reap **(Paraidise Angkor Hotel**
					Siem Reap
					Siem Reap **(Apasara Angkor Hotel**
	• Farming and fishing • Poverty • Landlessness. • migration and lack of alternatives	• Community fisheries • Community refuges	Fish selling	TCO (Site under the Rice Field Fisheries Project of WorldFish in partnership with TCO)	Siem Reap **(Apasara Angkor Hotel (tbc))**
	• Fishing for food and living. • Poverty • Indebtedness • Lack of alternative income-generating activities for floating communities. • Fishing conflict	• Community fisheries • Open access in fishing in the Tonle Sap • Conservation • Illegal fishing	Fish marketing	HURREDO	Siem Reap (**Apasara Angkor Hotel** (tbc))
					Battambang (propose a Sangker River Hotel)
	• Farming degradation • Fishing degradation • Increased population • Landlessness. • Fishing conflicts	Community fisheries	Fish trading	AkphiwatStrey (AS) and VSG	Battambang (propose a Sangker River Hotel)
				AS will work with VSG and WorldFish to organize the seminar	Battambang (propose a Sangker River Hotel)
Battambang to Pursat, facilitated by AARR, an NGO based in Pursat Province.					Pursat (Proposed in Pursat Century)
				We will work with ANKO and AARR to organize this seminar	Pursat (Proposed in Pursat Century)
	• Livelihoods and flood security	• Community fisheries, • community refuges and • community irrigation		ANKO will facilitate the trip	Pursat (Proposed in Pursat Century)
	• Poverty and indebtedness • no land for farming	• Community fisheries, • the cancelled fishing lots and the open access	Traders Collectors	ADIC will facilitate the trip	Kampong Chnnang (Proposed Hotel—Sovann Phum)
					Phnom Penh
					Phnom Penh

Annex 4. Seasonal calendar

Seasonal Calendar in Santey Village, Dan Run commune, Sot Nikum district, Siem Reap province.

No	Occupation	Calendar												Notes
		1	2	3	4	5	6	7	8	9	10	11	12	
1	Rainy season rice farming													Flooding is the main barrier during rainy season
2	Dry season rice farming													Drought is a challenge during dry season as there is no irrigation system
3	Vegetable cultivation													Mostly for home consumption
4	Livestock raising (Pig, Chicken, Duck, Cattle)													Small scale/backyard throughout the year. High incidence of diseases and pig and chicken mortality in March and April
5	Fishing													Throughout the year (small scale) at the river/lake and increases in rainy season (August-December) when the water approaches the village
6	Workers (labor selling)													Throughout the year and migration to other provinces and Thailand
7	Small business (selling goods in village)													

Seasonal Calendar in Santey Village, Dan Run commune, Sot Nikum district, Siem Reap province.

No	Occupation	Calendar												Notes
		1	2	3	4	5	6	7	8	9	10	11	12	
1	Fishing													Throughout the year. Mostly, the husband and the son are responsible for fishing, except in some households where both husband and wife are involved. Fishing is the main source of income and there is no land for rice farming available in the village.
2	Tourist boat													This also runs throughout the year, but there are fewer tourists between April to July. This is a major job for the males in this village after fishing.
3	Worker (labor selling to carry fish at fish import/export depo)													Higher fish catches from Nov to Apr (as there are many fishes during this season),therefore the demand for labor is high during this period. It is mainly men who are engaged in this work and some women work as construction workers.
4	Small trader farmers (trading on fish, vegetable)													Usually, both men and women (husband and wife) go together for trading. While the wife negotiates the price with seller and middlemen, the husband carries and transports the products from seller to middlemen at the market.
5	Small business in the village (selling goods)													Throughout the year
6	Production of tourist boats													Throughout the year and only men
7	Handicraft (made from water hyacinth)													Mainly by women throughout the year, most busy from July to December
8	Livestock raising and fish raising													Throughout the year and mostly women take care of livestock

Seasonal Calendar in Sdey Village, PrekNorin Commune, Ek Phnom district, Battambang Province

No	Occupation	Calendar												Notes
		1	2	3	4	5	6	7	8	9	10	11	12	
1	Rainy reason rice farming													Braodcasting rice seed.
2	Dry season rice farming													Mostly done in two cycles from May to August and November to February
3	Crop production (Water melon, peanut, corn, etc.)													
4	Small business in the village (selling goods and some processed food products)													Throughout the year, there are five or six families who produce the processed tamarind candy.
5	Livestock raising (family scale)													Chicken, pig, cow/buffalo were raised by almost all households and are mainly taken care of by women, except cow/buffalo
6	Fishing (along the lake or rice field)													
7	Worker (construction and transplanting)													The construction workers are employed throughout the year (depending on work available in village or nearby),the agrioculture wage labor is mainly available from July to September for rice transplanting and in November or December for crop production (peanut, water melon, etc.)

Seasonal Calendar in Sdey Village, PrekNorin Commune, Ek Phnom district, Battambang Province.

No	Occupation	Calendar												Notes
		1	2	3	4	5	6	7	8	9	10	11	12	
1	Rainy season rice farming													The rice yield in this season is around 1.5-2 tons/ha only. Flooding is main challenges here.
2	Dry season rice farming													Main challenge is lack of water and irrigation system in the village.
3	Fishing													Mostly, the villagers are fishing in rainy season because the river/lake expands near the village. Generally, they catch around 1-5Kg fish per day.
4	Migrate outside village (for potato planting/harvesting, corn harvesting, and construction work)													The workers are mostly under 40 years old and earn around 5$ per day.
5	Livestock raising (family scale)													Villagers rear livestock in small scale throughout the year. Chicken mortality due to disease is high around March or April.
6	Vegetable cultivation													Villagers grow vegetables in small scale throughout the year such as pumpkin, morning glory, and gourd.
7	Food shortage (rice)													Due to low rice production, the villagers face food shortages for about 4 months on average between September and December.

Annex 5. Governance practices at local villages around the Tonle Sap

Village	Village characteristics	Governance			Actors involved		
		Water	Agriculture	Fisheries	State	Non-State	Private
Santey	Santey is an official village. Geographically, this village is divided into three main areas. The upland below national road no.6, the floodplain, and lowland areas. Villagers in Santey live in two main areas (i) land based village and (ii) floodplain area land-water based village. The upland area is called Santey village, and the floodplain area is called Kanthou.	• There is too much water in the wet season, and there is little water in the dry season. • Governance of water is key for both agriculture and fishery. However, Provincial MOWRAM has not been active in water governance in Santey. • Commune Councils have led activities in the governance of water for farming.	With supports from Commune Councils, a water user group is established to manage and use water for rice farming. At present, villagers could do 3 rice crops a year given the presence of irrigation system. Rice farming: 3 crops of rice a year: • Early season rice June and July. The rice yield is 3-5 tons/ha Sreleu. • Recessing rice—cultivation in Oct and Nov Srekandal. • Dry season rice—This is in Srekrom.	Fishing is a supplementary job, but of the total population, about 61 households are full-time fishers. Two types of fishing exist: 1) collecting the fish fingerlings from nature in the wet seasons cage culture fish; and 2) when water affairs Community fishery is established by FiA, covering some part of commune. Santey land base is outside the CFi area and Kanthou in floodplain area is inside CFiarea of Thna lDachCFi	FiA cantonment is responsible for fishery management and CFi. Provincial MAFF is esponsible for agriculture development, but often villagers do not meet them. Provincial MOWRAMS have not been active inwater management. District Administration has not met villagers about the management of water, fisheries and agriculture, but are in charge of administrative affairs. Commune Councils are more active in Santey, particularly in water management.	• A number of NGOs TCO, CEDAC, WorldFish, FAO, TSSLP. • Community based organization Saving group; self-help group; rice-bank. • Community fishery • Water user group	• 9 Banks operate in the village.
Chong Kneas	Floating village. It is home to about 1253 households in 2010. Five villages are under the administration of Chong Kneas commune. The socio-economic and political set-up is complex. SouChing seems to manage the whole Chong Kneas and all developments need to be discussed with the company. Sou Ching Company is powerful. Any development is under their control.	It is located on water. Water pollution is a concern and is affecting people's health. The ADB/TSSLP developed the water sanitation. The whole landscape of Chong Kneas has been changed following the land refill and tourist development. Floating communities have been affected by the development.	There is no farmland. All lands around Chong Kneas belong to highlanders. SouChing Company is now developing a tourist area in Chong Kneas where the agricultural land is converted into township	All households are engaging in fishing. Fishing is a primary occupation. Flooded forest areas are under the state control. A community has been established but it does not function well. In 2010, about 156 households raised fish, mostly fish cage culture. There are about 232 fish cages.	• FiA used to be active in Chong Kneas, but now, it is less active. • APSARA Authority is more active in tourist development, but management is under Sou Ching Company.	Many NGOs are working in Chong Kneas, but they are not coordinated. NGOs do not work well with private actors such as SouChing. SouChing is doing different types of activities.	There are many banks operating in Chong Kneas including ACLEDA, Hatha Kasekor, Amrith, and others. They are not coordinating, but competing to provide bank services to villagers.

Village	Village characteristics	Governance			Actors involved		
		Water	Agriculture	Fisheries	State	Non-State	Private
RohalSuong	It is a land-based village, but farming and fishing are the main livelihood activities. It is home to about 306 households. People migrate to earn more income, creating more wealth but causing labor shortages. Labor is very expensive. Farmer uses Vietnamese rice varieties, namely IR504 to experiment and expand production. They have 3 farming activities—Early season rice; receding rice and floating rice.	This village is surrounded by water during the wet season, but it is dryduring the dry season. Management of water is observed as a key trigger for the developmentof agriculture and fishery. Water management is undertaken by the community, but this is still not well organized. There is still lack of initiatives from government to support communities. There is a need from MoWRAM to supportthis initiatives with RohalSuong village.	They formed the dry season rice association where they put their savings to buy the water pump to irrigate the dry season rice. The commune councils has supplied the pump machine to the community. The adaptation capacity is very high—the independence, the ability to take risk, the experimentation.	Fishing is considered as secondary fishing. RohalSuong village together with Sdei and Duong Mea has established the community fisheries over the fishing areas of 1814 ha. This community fishery is managed under the steering committee of 13 people from three villages, of which 4 people are women. The Community Fishery has a total member of 858 people, of which 296 are women. The community is able to mobilize itself to take action on illegal fishing.	FiA is working with villagers to organize the community fishery (CFi). However, the support to the CFi is still limited, but more actions were taken by the community with supports from NGOs. Farming is undertaken through the initiatives of farmers than the Provincial MAFF in a small scale and adhoc. Farmers learn from other farmers via informal interaction and then applied what they learn with no clear extension services from MAFF.	Many NGOs including AS, HARVEST, UNDP, and others are working in this village. They are not far from town and they could learn. The dependence on NRM is reduced as they could cultivate more rice.	There is no private actor involved with villagers, but buying and selling fish and rice paddy take place everyday. There is a close link between villagers with traders, but villagers organize themselves as a group to interact with traders. Villagers approach many private banks for the loans.
Tramper	Land-water based village. It is home to 223 families. Farming and fishing are main sources of living. Tram Per is also a fishing village. Almost all families in this village do fishing, but only in small scale. The livelihoods of villagers seem poor and they do not have alternative livelihoods in place.	In the wet season, the flood sometimes submerges/surrounds surrounds the villages. With support from JICA, the irrigation system was developed to store water to irrigate ricefield. The water user group was established to manage the use of water. However, the water level was so low in May 2013. Some areas inside the irrigation scheme were used for farming. Conflicts between groups to keep the water and to use areas for farming indicatethe weak governance in water management in the irrigation scheme.	About 70 families have a farmland less than a hectare. About 25 families are landless and they live by providing labors. Of the total population, about 50 families have farming land close to the irrigation and farming is influenced by irrigation. Farming is dependent on rainfall and irrigation schemes. No other initiatives have taken place in this area. Farmers are too much dependent on government and other actors to provide this development.	Community fishery is organized within the village to manage fishing areas. The fish refuse areas is organized in Tramper village to conserve the fish stock in the deep pool areas. Community fishery is established, but seems to not function well. The committee members and CFi members seem to be struggling to manage the areas. They do not manage it well.	FiA is active in supporting CFi with supports from NGOs and government projects such as TSSLP. However, FiA is facing limitations due to lack of financial support. The management of CFi is facing difficulties. Thus, FiA did not meet CFi often. Provincial MoWRAM is also active only with the project in the village. The Provincial MAFF is facing limitations too in engaging with small farmers.	There are many NGOs such as ANKO, AARR, TSSLP, German Red Cross, and others. The coordination among these NGOs are limited although they work in the same village.	There is no specific private actor working in this village. Only the private commercial banks operate in this village such as ACLEDA, HataKasekor, Amrith and so on. Traders are buying and selling goods with the villagers. Villagers interact closely with traders.

Village	Village characteristics	Governance			Actors involved		
		Water	Agriculture	Fisheries	State	Non-State	Private
ChnocTru	This village is a floating community. All houses float on water. As such, the human waste is discharged into the water, polluting the lake and causinghealth and environmental problems.	As this is a floating community, water management is central to the development of ChhnocTru. There is no ownership over water but in practice some forms of informal ownership exist and are recognized by villagers.	There is no farmland.	Fishing is a main source of income and livelihood. All households are doing fishing for their living. But fishing is dependent on individuals and there is no community fishery established to manage the fishing areas in ChhnoTru.	FiA is active in this area, and powerful. no conservation area in ChnocTru but in PhatSanday commune closed to ChnocTruand this conflicts with fishing communities. Fishing conflict is still major and this affects the governance of fishery in ChhnocTru.	There are NGOs working in this areas such as Live & Learn, ADIC, and others, but they do not coordinate. The cancellation of fishing lots does not benefit people in ChhnocTru, and still they face limited fishing grounds.	Many actors are working in ChhnocTru. Fish traders are active and they work with fishing communities.
Phat Sanday	Floating community. Fishing is the main occupation.	The community is floated year round on water. Management of water is key. This community is close to ChhnocTru. Please read ChhnocTru as it is similar.	There is no farmland.	Fishing a key livelihood activity activities for people in PhatSanday. The cancellation of fishing lot benefits PhatSanday at large. Community fishery was established and active.	FiA is active and has a local office at PhatSanday and doesday-to-day management on the ground. The FiA has less power as more institutions are involved in the monitoring of fishing activities in PhatSanday. However, illegal fishing still happens.	There are more NGOs and community based fish management groups working there. NGOs are better coordinated, but still need improvement.	There are number of fish traders, but they work based on informal relation with the community members. Community members are interacting closely with traders as part of everyday life.

Annex 6. Zoning of the Tonle Sap and the governance system

Zoning the Tonle Sap	Characteristics	Categories	Governance System
Fishery Management	1. Fish Sanctuary Conservation—about 8 fish sanctuaries were set up for fish conservation in the Tonle Sap in 1989.	• The **Conservation** area has existed since 1989 via 8 fish sanctuaries in the Lake.	• Conservation Area—Fish sanctuary is managed by the state and FiA is responsible for managing that area. This is a conservation area. • Thus, the management regime is transformed from the private property regime into the state property resource regime.
	2. Fishing Lot Areas–Large fishing areas in the Tonle Sap were divided up into a number of fishing lots. All fishing lots have been cancelled and it turned into open access and fish conservation areas.	• Thirty-seven fishing areas were transformed into conservation areas in March 2013. • -K. Chhnang 7 fish Sanctuaries • -Pursat 2 fish Sanctuaries • -Battambang 6 fish Sanctuaries • -B. Meanchey 2 fish Sanctuaries • -Siem Reap 3 fish Sanctuaries • -Kampong Thom 3 fish Sanctuaries	• The cancellation of commercial fishing has turned this area into conservation areas. The management system has been transformed from the private property resource management regime to the state property resource management regime. • FiA still has authority over this, but more institutions have been involved in the lake management.
		• The cancelled fishing lot areas were converted into public fishing area or **"open access."** The cancelled fishing lot areas have been established as a **'community fishery'.**	• The management system has been transformed from the private property regime into the "open access." • FiA still has authority over this, but more institutions have been involved in managing this area. The management system has been transformed from "private resource management regime into the open access', and then into the communal property resource management regime."
	3. Public Fishing Area—Large fishing is designated as a public fishing areas where all fishers could access and fish for medium and small-scale. The cancellation of fishing lots has contributed to the expansion of the public fishing areas. Some areas have been transformed into the community fishery	• Large part of the public fishing areas is managed as **'open access.'**	• The management system has been transformed from the "private property resource management regime into the "open access system." FiA is responsible for managing the open access.
		• Some public fishing areas have been established as a **'community fishery'.**	• The management system has been transformed from "private resource management regime into open access', and then into the communal property resource management regime." • FiA still has a responsibility to manage this area.' • Other institutions have more roles to play in the management of the Tonle Sap.

Zoning the Tonle Sap	Characteristics	Categories	Governance System
Conservation—Biosphere Reserve	1. Transition Zone—More socio-economic activities including farming and other activities. 2. More socio-economic activities are allowed in this zone.	**Conservation and farming area—Multiple use area**	Ministry of Environment (MoE) is a state agency, responsible for the management of this area. However, this area is not clearly demarcated and overlaps with the fishing lot areas and areas that communities use around the lake.
	3. Buffer Zone—This zone is a buffer area to the core zone and it restricts some activities that could harm the biodiversity in the Tonle Sap.	**Conservation plus some development activities**	The state property regime is used to manage this area. MoE is a state agency, responsible for the management of this area. This area is not clearly demarcated on the ground. This area overlaps with the former fishing lot areas.
	4. Core Zone: Three Core Areas—1) PrekToal in Battambanng; 2) BoeungChmar in Kompong Thom and 3) Stung Sen in Kampong Thom.	**Conservation**	The state property regime is used to manage the Core Zone. MoE is responsible for the management of Core Zones. It was conflicting with the fishing lot areas.
Flooded Forest Zoning	Zone One—Between Zone 2 and the National Road: More farming activities—allowing all activities	**Multiple Use Area—farming Area**	This is a newly established zone marked by the Sub-Decree to designate the area where there are multiple uses of the area. All livelihoods activities can be allowed in this area. The Tonle Sap Authority (TSA) is the main state agency responsible for overseeing activities in this area.
	Zone 2—Transition Zone located between zone 3 and 1: Requiring approval from Provincial Administration	**Protected flooded forest areas, but allowable livelihood activities** with close monitoring by the TSA. Some farming area is located in this area.	All activities in this zone require close monitoring by the TSA. The TSA has authority to stop activities in this area that could be harmful to the flooded forest or the environment of the lake.
	Zone 3—close to the lake: Any activity in this zone is prohibited.	**Protected flooded forest**	Tonle Sap Authority (TSA) prohibits any activities on cutting, reclaiming, digging out clearing and occupying flooded forest.

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