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# Savings-Group Improvements Contribute to Sustainable Community-Fisheries Management: A Case Study in Cambodia

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**Abstract:** Small-scale community fishers dominate fisheries in Cambodia. In the central floodplain of Cambodia, 35% of rural dwellers are part-time fishers and 15% full-time fishers. By 2012, the Cambodian government had abolished all commercial fishing lots and put these resources under the management of community fisheries. One challenge in the implementation of community-fisheries management is budget shortages and resultant livelihood stress. To address this problem, savings groups were established. The Sustainable Communities International program provided establishment and facilitation support for savings groups in 10 community fisheries in the Kampong Chhnang Province. The savings groups were recognized as useful support facilities, meeting the needs of community fishers and sustainable community fisheries operations. However, there were concerns about the sustainability of the savings groups and the fisheries. To date, there are no documented case studies of savings groups for community fisheries. This study was conducted in two community fisheries in the Kampong Chhnang Province. We found that the internal rules of the savings group must reflect the opinions and perceptions of the members to ensure sustainable operation. Education and integrated livelihood activities were important considerations in encouraging participation. These insights are also useful for community fisheries elsewhere.

**Keywords:** small-scale fisheries; savings group; livelihood; sustainability; community fisheries

## 1. Introduction

Rice and fish are staple Cambodian foods and have a long history in Khmer culture [1]. Cambodian fisheries are mainly freshwater fisheries. Most rural Cambodians are both farmers and part-time fishers, with the fisheries providing food and family income. Cambodia still has a high poverty rate, although it has dropped from 47.8% in 2007 to only 13.5% in 2016 [2]. Fishing is easy to start and only requires a small capital input. The number of fishers has subsequently increased [3]. In the 1940s, when the Cambodian population was 3.2 million, there were 0.36 million fishers [4]. As the population increased to 10.7 million in 1995, the number of fishers increased to 1.2 million [4]. However, fish catches have gradually declined [1,5–7]. Fisheries were affected by habitat and environmental degradation and destructive fishing practices, as well as the increase in fishing effort [4]. Conflicts occurred between villagers and fishing-lot owners [8]. In 2001, the Cambodian government introduced fisheries reform, abolished all fishing lots in 2012, and handed the resources over to rural fishers to manage under community fisheries. Under fishery-policy reform and the decentralization and deconcentration policy of the Royal Government of Cambodia, community fisheries have been given the responsibility of

managing their exclusive fishery zones and utilizing these fishery resources for their livelihood needs in a sustainable manner [9]. These community fisheries must design and implement an action plan to conserve and manage fishery resources in their exclusive fishery areas [9].

However, there were many challenges in the implementation of community-fisheries management. Community fishers have very limited capacities to implement community fisheries and exercise their fishery rights. Lack of funds to implement comanagement and conservation plans, such as patrolling for illegal fishing and protecting fish stocks, can be another challenge for community fisheries. There was high fishing pressure. Law enforcement was not so effective. Furthermore, destructive fishing practices occurred in many locations, fish catches per fisher declined, and fish habitats gradually degraded. Flooded forests, which are an important element of fish habitats, were cleared for agricultural land and firewood. They were also intentionally burned for hunting or lost to other accidental fires. Climate change increased flooding and drought, which caused fish to die off in the dry season. Participation in community-fisheries management was very limited owing to poverty and budget constraints. Community fishers led stressful lives and poverty discouraged their participation in community-based fishery management.

Community fishers can apply for loans from several sources for their family needs. Private loans and many microfinance institutions, such as ACLEDA Bank Plc., Hattha Kaksekar Ltd., PRASAC Microfinance Institution Ltd., AMK Microfinance Institution Plc., and VisionFund provide loans to rural communities. Savings groups are groups of people who establish a secure place for borrowing and saving money. The amount of money depends on the ability of the group. Loans are given to group members at low interest rates and without collateral. Savings groups have been established in many community fisheries [10]. The Sustainable Communities International program co-operated with the Cambodian Fisheries Administration's Department of Community Fisheries Development to help build 10 community fisheries in the Kampong Chhnang Province of Cambodia. The program assisted in establishing and strengthening community-fisheries savings groups to meet the urgent budget needs of fishers and contribute to sustainable fisheries management [3]. Community members readily welcomed the savings groups. However, previous studies do not document the success and failure of savings groups in community fisheries, although one study by OXFAM about savings groups in agriculture was published in 2012 [11].

There are several potential problems related to current savings groups. Members may disagree about access to loans or the capacity of committee members or leaders [11]. Some members may be unable to procure loans [11]. Fishers invest the loan amounts in purchasing fishing gear, gas, small businesses, house repairs, boat repairs, and in meeting urgent family needs. Therefore, these loans are not only used for the benefit of community fisheries, but also for the personal needs of individual members. Therefore, studies on savings groups in these community fisheries would provide a more comprehensive understanding of these facilities and highlight important considerations for improving the implementation of savings groups and community fisheries in the Kampong Chhnang Province. The results from this study could also be beneficial to community fisheries in other areas. The objectives of this study are to explore the livelihood activity, fishery resources, and management characteristics of two rural community fisheries, Peam Popech and Phlong, in the Kampong Chhnang Province, and to understand the community members' perception of savings groups and loans in these two community fisheries.

## 2. Materials and Methods

### 2.1. Study Sites

This study was formulated to seek the perceptions of two rural community fisheries about how to improve the implementation and arrangement of their savings groups. Two community fisheries were selected from the 10 communities located in the Tonle Sap floodplain supported by the Sustainable Communities International program. The selection of the two communities was discussed with local

fisheries officers for convenient access and communication. They had no distinct characteristics. Descriptions of the two chosen community fisheries are as follow:

#### 2.1.1. Peam Popech Community Fishery

This community fishery was established on 16 February 2005 and is located in Peam Popech Village, Kaoh Thkov Commune, Chol Kiri District, Kampong Chhnang Province, Cambodia (Figure 1). At the time of this study, the village had a population of 1428, which is equivalent to 267 households. The community fishery was managed by 11 committee members. All 11 committee members were also members of the savings group. The committee met 2–3 times per month to discuss issues, such as the action plan, to make implementation arrangements, plan fishery patrolling if there were reports of fish poaching, or for conflict resolution. The community fishing ground extended for 1423 ha. The community's conservation areas covered 35 ha in the lacustrine zone and another, 3 km along a river and the width of the river. There were 15 patrolling members. Patrolling members carried out their patrol activities twice a week.

#### 2.1.2. Phlong Community Fishery

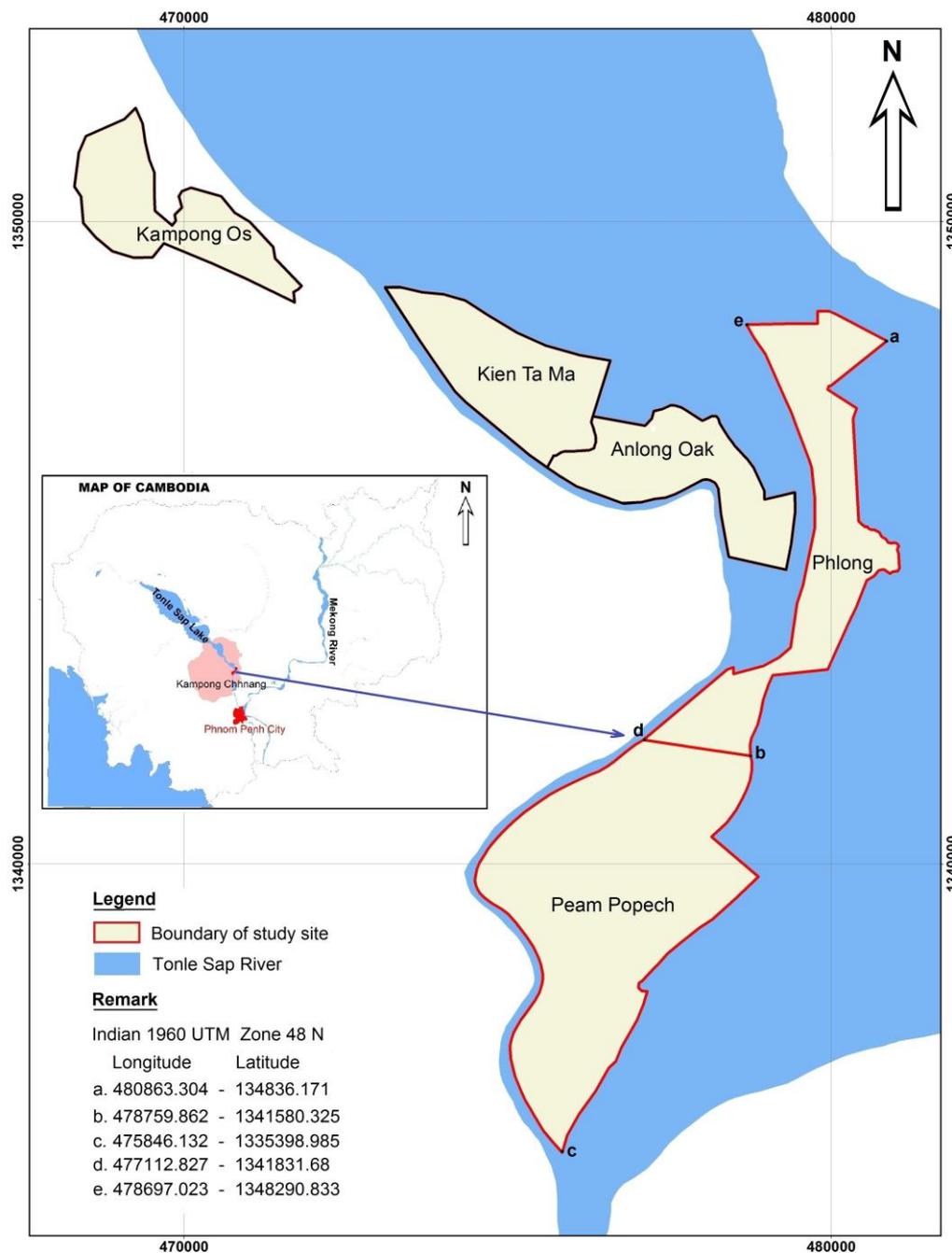
The Phlong community fishery is in Phlong Village, Peam Chhkaok Commune, Chol Kiri District, Kampong Chhnang Province, Cambodia (Figure 1). The community was established in 1997, with 808 members in 209 households. It was managed by 13 members of the community-fisheries committee. The fishing ground of the community extended for 701 ha with 3 ha as a fish-conservation area. Flooded forest covered 25 ha of the community fishing ground. Patrolling members of the community carried out patrol duties to protect the fishery resources 3–4 times per month.

### 2.2. Data Collection and Analysis

The data for this study were gathered using a questionnaire (Supplementary Questionnaire S1). The questionnaire was formulated to collect information about education, income, livelihood activities, rice and other cropland, fish consumption, the status of fishery resources, and the savings group. The information about farmland was collected because most members were farmers as well as fishers.

A total 160 households were opportunistically selected for interviewing, of which 77 households were in the Peam Popech community and 83 households in the Phlong community. This represented 29% and 40% of the total households, respectively. The participants in the interviews were 53% men and 47% women in the two communities, respectively. The interviews were conducted from 22–29 March 2016. Ms. Aimee Mori, from the University of Tokyo, designed and conducted the data collection. Fisheries officers of the Cambodian Fisheries Administration assisted in interviews with the community fishers.

The data were entered into Excel spreadsheets and examined using Pivot Tables (2016 Microsoft, Redmond, WA, USA). They were analyzed using descriptive statistics. The Chi-square test ( $\chi^2$ ) was used to compare categorical data, such as age, education, income, livelihood activities, occupation, fish-consumption patterns, household assets (farm- and cropland), status of fisheries, engagement in social community, and the distribution pattern of savings and loans between the two study sites (Peam Popech and Phlong community fisheries) and between the dry and wet seasons with the significant level of 0.05.



**Figure 1.** Map showing the locations of the Peam Popech and Phlong community fisheries. Source: map produced by Mr. Jotra Sou, Fishery Administration, Cambodia [12].

### 3. Results

The results of the study showed the characteristics of the community fisheries, fishery resources, and the savings groups in two community fisheries, namely Peam Popech and Phlong, in the Kampong Chhnang Province, Cambodia. The statistical results of the survey are presented in Tables 1 and 2 below.

**Table 1.** Characteristics of the Peam Popech and Phlong community fisheries in the Kampong Chhnang Province, Cambodia.

No.	Indicator	Variable	Peam Popech	Phlong
1. Characteristics of the community fisheries				
1.1.	Community-fisheries members	Total number of community fisheries members (households)	267	209
1.2	Interviewees	Total number of interviewees (households): 160 households	77	83
1.3	Sex	Number of interviewees:		
		Men	35 (47%)	48 (59%)
		Women	40 (53%)	33 (41%)
1.4	Age (years)	Number of people by age group		
		15–25	3 (3.9%)	3 (3.7%)
		26–35	10 (13.0%)	26 (32.1)
		36–45	23 (29.9%)	16 (19.8)
		46–55	31 (40.3%)	20 (24.7)
		56–65	8 (10.4%)	12 (14.8)
		66–75	1 (1.3%)	4 (4.9%)
		76–85	1 (1.3%)	0 (0%)
1.5	Education	Education level of the interviewees		
		No education	6 (7.8%)	13 (16.7%)
		Not finished primary school	43 (55.8%)	40 (51.3%)
		Finished primary school	14 (18.2%)	12 (15.4%)
		Finished junior high school	13 (16.9%)	13 (16.7%)
		Finished senior high school	1 (1.3%)	0 (0%)
1.6	Household income from fishing in dry season	Number of households getting income from fishing		
		No income from fishing	19 (26%)	16 (19.3%)
		0–30%	45 (61.6%)	45 (54.2%)
		30–70%	9 (12.3%)	21 (25.3%)
		70% up	0 (0%)	1 (1.2%)
1.7	Household income from fishing in wet season	Number of households getting income from fishing		
		No income from fishing	18 (24.7%)	16 (19.3%)
		0–30%	45 (61.6%)	40 (48.2%)
		30–70%	9 (12.3%)	24 (28.9%)
		70% up	1 (1.4%)	3 (3.6%)
1.8	Livelihood activities in wet season	Number of households that received income from different livelihood activities in wet season		
		Rice farming	63 (29.4%)	64 (30.5%)
		Crops	41 (19.2%)	17 (8.1%)
		Factory worker	10 (4.7%)	10 (4.8%)
		Construction worker	9 (4.2%)	10 (4.8%)
		Fish trade	16 (7.5%)	20 (9.5%)
		Fish processing	12 (5.6%)	15 (7.1%)
		Fishing gear making	0 (0%)	0 (0%)
		Livestock	41 (19.2%)	51 (24.3%)
		Other	23 (10.7%)	23 (11.0%)
1.9	Livelihood activities in dry season	Number of households that received income from different livelihood activities in dry season		
		Rice farming	9 (6.4%)	9 (6.3%)
		Crops	10 (7.1%)	4 (2.8%)
		Factory worker	8 (5.7%)	8 (5.6%)
		Construction worker	12 (8.5%)	12 (8.3%)
		Fish trade	17 (12.1%)	21 (14.6%)
		Fish processing	11 (7.8%)	13 (9%)
		Fishing gear making	5 (3.5%)	0 (0%)
		Livestock	35 (24.8%)	48 (33%)
		Other	34 (24.1%)	29 (20.1%)

Table 1. Cont.

No.	Indicator	Variable	Peam Popech	Phlong
1.10	Occupation in dry season	Number of occupations per household in dry season		
		0 occupation	4 (5.2%)	7 (8.4%)
		1 occupation	27 (35.1%)	33 (39.8%)
		2 occupations	29 (37.7%)	25 (30.1%)
		3 occupations	12 (15.6%)	12 (14.5%)
		4 occupations	5 (6.5%)	5 (6.0%)
1.11	Occupation in wet season	Number of occupations per household in wet season		
		0 occupation	0 (0%)	1 (1.2%)
		1 occupation	4 (5.2%)	10 (12.0%)
		2 occupations	30 (39.0%)	30 (36.1%)
		3 occupations	26 (33.8%)	30 (36.1%)
		4 occupations	12 (15.6%)	9 (10.8%)
1.12	Fish consumption in dry season	Number of households that reported different weekly consumption levels of fish in dry season		
		Not consumed	1 (1.3%)	1 (1.2%)
		Less than 3 days	1 (1.3%)	3 (3.7%)
		3–5 days	40 (53.3%)	44 (54.3%)
		Everyday	33(44.0%)	33 (40.7%)
1.13	Fish consumption in wet season	Number of households that reported different weekly consumption levels of fish in wet season		
		Not consumed	0 (0%)	2 (2.4%)
		Less than 3 days	5 (6.5%)	2 (2.4%)
		3–5 days	32 (41.6%)	33 (39.8%)
		Everyday	40 (51.9%)	46 (55.4%)
1.14	Household assets	Size of owned farmland (ha) *		
		0–0.5	3 (4.2%)	21 (32.8%)
		0.5–1	13 (18.3%)	7 (10.9%)
		1–1.5	32 (45.1%)	10 (15.6%)
		1.5–2	9 (12.7%)	5 (7.8%)
		2–2.5	10 (14.1%)	8 (12.5%)
		3–3.5	4 (5.6%)	9 (14.1%)
		4–4.5	0 (0%)	2 (3.1%)
1.15		Size of owned cropland (ha)		
		0–0.5	6 (12.5%)	1 (5.3%)
		0.5–1	13 (27.1%)	5 (26.3%)
		1–1.5	18 (37.5%)	10 (52.6%)
		1.5–2	2 (4.2%)	1 (5.3%)
		2–2.5	6 (12.5%)	1 (5.3%)
		2.5–3	1 (2.1%)	1 (5.3%)
		3–3.5	1 (2.1%)	0 (0%)
		3.5–4	1 (2.1%)	0 (0%)

Table 1. Cont.

No.	Indicator	Variable	Peam Popech	Phlong
<b>2. Status of fishery resources and management</b>				
2.1	Status of fisheries resources	Status of black fish abundance compared to the past 10 years *		
		Serious decline	37 (48.1%)	38 (45.8%)
		Small decline	22 (28.6%)	40 (48.2%)
		Remain stable	2 (2.6%)	1 (1.2%)
		Small increase	6 (7.8%)	1 (1.2%)
		High increase	10 (13.0%)	3 (3.6%)
2.2		Status of white fish abundance compared to the past 10 years*		
		Serious decline	36 (46.8%)	39 (47.0%)
		Small decline	23 (29.9%)	40 (48.2%)
		Remain stable	1 (1.3%)	1 (1.2%)
		Small increase	9 (11.7%)	1 (1.2%)
		High increase	8 (10.4%)	2 (2.4%)
2.3		Size of white fish compared to the past 10 years		
		Much smaller	35 (45.5%)	45 (54.2%)
		Smaller	38 (49.4%)	33 (39.8%)
		Remain similar size	1 (1.3%)	4 (4.8%)
		A little bigger	2 (2.6%)	1 (1.2%)
		Much bigger	1 (1.3%)	0 (0.0%)
2.4		Size of black fish compared to the past 10 years *		
		Much smaller	17 (22.4%)	38 (46.3%)
		Smaller	55 (72.4%)	38 (46.3%)
		Remain similar size	2 (2.6%)	5 (6.1%)
		A little bigger	2 (2.6%)	1 (1.2%)
		Much bigger	0 (0%)	0 (0%)
2.5	Engagement in social community	Number of households engaged in an association *		
		Community fisheries	70 (90.9%)	80 (96.4%)
		Farming association	0 (0%)	2 (2.4%)
		Savings group	42 (54.5%)	20 (24.1%)
		Women's group	16 (20.8%)	9 (10.8%)
		Water management community	12 (15.6%)	8 (9.6%)
2.6		Number of households engaged in different number of associations		
		Not engaged in any association	5 (6.5%)	3 (3.6%)
		Engage in 1 association	24 (31.2%)	51 (61%)
		Engage in 2 associations	32 (41.6%)	19 (22.9%)
		Engage in 3 associations	12 (15.6%)	8 (9.6%)
		Engage in 4 associations	4 (5.2%)	2 (2.4%)
<b>3. Savings and Loans</b>				
3.1	Financial status	Concern about getting a loan from a microfinance institution		
		Agreed fully	55 (72.4%)	54 (65.9%)
		Agreed somewhat	3 (3.9%)	7 (8.5%)
		No idea	4 (5.3%)	9 (11.0%)
		Disagreed somewhat	1 (1.3%)	3 (3.7%)
		Disagreed completely	13 (17.1%)	9 (11.0%)

Table 1. Cont.

No.	Indicator	Variable	Peam Popech	Phlong
3.2		Savings should be available to all community members		
		Agreed fully	25 (33.3%)	37 (44.6%)
		Agreed somewhat	28 (37.3%)	30 (36.1%)
		No idea	4 (5.3%)	2 (2.4%)
		Disagreed somewhat	12 (16%)	8 (9.6%)
3.3		Disagreed completely	6 (8%)	6 (7.2%)
		For the benefit of the community as a whole, not everybody can have equal access to savings		
		Agreed fully	16 (21.3%)	26 (31.3%)
		Agreed somewhat	34 (45.3%)	37(44.6%)
		No idea	4 (5.3%)	6 (7.2%)
3.4		Disagreed somewhat	19 (25.3%)	9 (10.8%)
		Disagreed completely	2 (2.7%)	5 (6%)
		The appropriate distribution of loans should be prioritized over individual relations with community fisheries *		
		Agreed fully	31 (40.8%)	46 (55.4%)
		Agreed somewhat	24 (31.6%)	28 (33.7%)
3.5		No idea	3 (3.9%)	3 (3.6%)
		Disagreed somewhat	17 (22.4%)	4 (4.8%)
		Disagreed completely	1 (1.3%)	2 (2.4%)
		Was the leadership of the savings group strong? *		
		Agreed fully	32 (42.7%)	33 (40.2%)
		Agreed somewhat	25 (33.3%)	42 (51.2%)
		No idea	2 (2.7%)	1 (1.2%)
		Disagreed somewhat	16 (21.3%)	6 (7.3%)
		Disagreed completely	0 (0%)	0 (0%)

\* denotes the existence of the difference between Peam Popech and Phlong based on the Chi-square test ( $\chi^2$ ) with the significant level of 0.05.

Table 2. Hypothesis testing of the income of the households.

No.	Variables	Dry Season vs. Wet Season
1	Number of households getting income from fishing	Peam Popech Phlong
2	Number of households getting income from other livelihood activities	Peam Popech * Phlong *

\* denotes the existence of the difference between the dry and wet seasons based on the Chi-square test ( $\chi^2$ ) with the significant level of 0.05.

### 3.1. The Characteristics of the Community Fisheries

#### 3.1.1. Education

The level of education of the community-fishery members in this study is defined in accordance with the official determination of Cambodian education. They were similar between the two communities, with more than half of the members not having finished primary school (55.8% in Peam Popech and 51.3% in Phlong) and 7.8% in Peam Popech and 16.7% in Phlong with no education at all (Table 1, No. 1.5). Other characteristics of the two community fisheries are described below:

### 3.1.2. Income and Livelihood Activities

Number of households getting income from fishing was similar between the two communities and between both the dry and wet seasons (Table 1, No. 1.6 and 1.7, Table 2, No. 1), although fish was expectedly less abundant in the dry season. Small-scale fisheries can legally operate year-round in both the wet and dry seasons in lakes and river. The majority of the households, 61.6% in Peam Popech and between 48.2% and 54.2% in Phlong, gained up to 30% of their income from fishing in both the wet and dry seasons (Table 1, No. 1.6 and 1.7).

The community fishers made their living from integrated livelihood activities, such as farming rice and other crops, factory work, construction work, fish trading, making fishing gear, and livestock farming, depending on the opportunities available in both the wet and dry seasons (Table 1, No. 1.8 and 1.9; Table 2, No. 2). The livelihood opportunities in the two communities were different in both the wet and dry seasons (Table 2, No. 2). Community members up to 33% earned their living from farming rice, other crops, and livestock (Table 1, No. 1.8 and 1.9).

One household may have up to six occupations a year (Table 1, No. 1.10 and 1.11). Some households, 35.1% and 39.8% in the dry season (Table 1, No. 1.10) and 5.2% and 12% in the wet season (Table 1, No. 1.11) in Peam Popech and Phlong, respectively, reported only one occupation. However, most households reported 2 occupations, 37.7% and 30.1% in the dry season (Table 1, No. 1.10) and 39% and 36.1% in the wet season (Table 1, No. 1.11) in Peam Popech and Phlong, respectively.

### 3.1.3. Fish Consumption

Most households in both community fisheries (39.8–55.4%) preferred eating fish 3–7 days per week in both the dry and wet seasons (Table 1, No. 1.12 and 1.13). Less than 6.5% of the households consumed fish fewer than 3 days per week (Table 1, No. 1.12 and 1.13).

### 3.1.4. Land Use for Agriculture

In both communities, 10.9% to 45.1% of households owned 0.5–1.5 ha of farmland (Table 1, No. 1.14). Up to 3.1% of households owned 4–5 ha of farmland and 5.6% to 14.1% of households owned 1.5–4 ha of farmland (Table 1, No. 1.14). Farmland is mainly rice farmland in lowland flooded areas. In both communities, a small number of households (up to 12.5%) owned 0.5–4 ha of cropland (Table 1, No. 1.15). The majority of households (26.3–52.6%) possessed 0.5–1.5 ha of cropland (Table 1, No. 1.15). Cropland is the home lot and land near homes in upland areas, and usually used for planting vegetables and other crops and raising animals. The size of farmland was different between the two communities (Table 1, No. 1.14).

### 3.1.5. Status of Fishery Resources and Management

Most households (28.6–48.2%) in both communities had slightly different opinions that both black and white fish had undergone either a small or a serious decline in abundance in the past 10 years (Table 1, No. 2.1 and 2.2). Few households (less than 13%) observed stable or increased abundance of fish (Table 1, No. 2.1 and 2.2). Most households (22.4–72.4%) in both communities perceived that both black and white fish had reduced in size (Table 1, No. 2.3 and 2.4). Only a minority of households (less than 6.1%) claimed that fish size remained stable or increased (Table 1, No. 2.3 and 2.4). The opinion about abundance of white fish and size of black fish was different between the two communities (Table 1, No. 2.2 and 2.4). The black fish are sedentary fish species, which is black in color and tolerant of bad water quality, such as the striped snakehead (*Channa striata*) and blackskin catfish (*Clarias meladerma*). The white fish are migratory species, which are white in color and sensitive to changes in water quality, such as the thicklip barb (*Probarbus labeamajor*) and iridescent shark catfish (*Pangasianodon hypophthalmus*). These terms are usually used by rural Cambodians.

Almost all households (90.0–96.4%) in both communities engaged in fishery management as members of community fishery (Table 1, No. 2.5), although their livelihood did not fully depend

on fishing. Only up to 2.4% of the households were members of the farming association (Table 1, No. 2.5), although rice farming was their most important livelihood activity. The second-highest percentage of households (54.5% in Peam Popech and 24.1% in Phlong) was members of a savings group. Several households, 20.8% in Peam Popech and 10.8% in Phlong, were members of women's groups (Table 1, No. 2.5). Each household could be involved in up to four different social associations, namely, community fisheries, farming association, savings group, and the women's group (Table 1, No. 2.6). Most households (22.9–61%) engaged in only one or two social associations (Table 1, No. 2.6). The engagement in social community was different between the two communities (Table 1, No. 2.5).

### 3.2. Savings and Loans

Most community members (72.4% in Peam Popech and 65.9% in Phlong) expressed their concerns about obtaining a loan from a microfinance institution (Table 1, No. 3.1). A minority of the community members had little or no concern about this (Table 1, No. 3.1). This level of worry was similar between the two communities (Table 1, No. 3.1). The majority of members (33.3–37.3% in Peam Popech and 36.1–44.6% in Phlong) suggested that savings should be made available to all members of the community (Table 1, No. 3.2). The remaining households (2.4–16%) had no opinion or suggested an opposing idea (Table 1, No. 3.2).

For the general benefit of the community fisheries, most community members (21.3% and 45.1% in Peam Popech, 31.3% and 44.6% in Phlong) fully or partially agreed that all members of the community should not have equal rights to access the savings (Table 1, No. 3.3). The minority of households (less than 25.3%) held the opposite opinion about access rights to savings (Table 1, No. 3.3).

The majority of members (31.6% and 40.8% in Peam Popech, 33.7% and 55.4% in Phlong) fully or partially agreed that the distribution of savings should be prioritized over each individual's relationship with the community fisheries, such as contribution to community fisheries including participation in fisheries-management activities, patrolling for illegal fishing, conservation of fishery resources (Table 1, No. 3.4). Most community members (33.3–42.7% in Peam Popech and 40.2–51.2% in Phlong) felt confident that the leadership of the current savings group was strong (Table 1, No. 3.5). Less than 21.3% of the members had little or no confidence in the leadership of the savings group (Table 1, No. 3.5). The opinion about the appropriate distribution of loans and the leadership was different between the two communities (Table 1, No. 3.4 and No. 3.5).

## 4. Discussion

### 4.1. Characteristics of Community Fisheries

The characteristics of community fisheries have important implications for livelihood development and fishery resource management. Fishing is a vital source of livelihood in rural communities [13]. Allison et al. (2012) mentioned that success in encouraging the participation of community fishers in fishery management requires that it address a direct threat to their livelihood [14]. Community fishers will become involved in community-fisheries management when they expect their livelihood to improve [15]. In addition, Allison et al. (2012) also reported that many factors that promote involvement in fishery management can be outside the scope of fishery policy or management institutions [14]. Some factors discussed here have no direct connection to fisheries. These include education, income, livelihood activities, and savings groups.

Most community-fisheries members were not highly educated and the percentage of households that had not completed primary school was much higher than the Cambodian national rate (51.3% and 55.8% vs. 25.8%) [16]. However, the noneducation rate was lower than the national rate (7.8% and 16.7% vs. 22.5%) [16]. The 2013 Cambodian population census reported that the literacy rate was lower in agriculture, forestry, and fisheries [16]. Education is essential for sustainable economic development [16]. Human capacity and skill development is a key element in promoting livelihood

development and participation in community-fisheries management [17]. Low skill and education levels are a challenge in the implementation of fisheries comanagement.

Community fishers utilize fish for food and to earn family income [14]. Fishing is linked closely with rural-community livelihoods. Cambodians eat 67 kg fish/person/year [6]. This study found that rural-community fishers ate fish 3–7 days per week. This frequency of fish consumption was consistent with the 2013 agriculture census in Cambodia, which reported that 90% of farming households in the Tonle Sap region engaged in fishing for fish, snails, crustaceans, crabs, freshwater shrimp, etc., for family consumption and ate fish and other seafood four days per week [18]. A study by WorldFish (2016) reported that a household with insufficient income consumed floodplain resources such as snails, shellfish, crabs, and snakes more frequently than other meats, such as wild animals or birds [19]. Those resources can be found in the flooded grassland, marshland, and deep pools or small lake habitats in the Tonle Sap Floodplain [20]. The report added that Cambodians ate more than twice as much fish as pork, chicken, or beef (15.7 kg/person/year for these three items) [19]. Notably, when food and income is not secure, fishers will employ destructive fishing methods, as demonstrated in Bangladesh [21]. Surprisingly, 83% of interviewees in the Philippines said they would not stop fishing although other occupations could generate higher income [22]. People value fisheries when it is vital for their livelihoods [23].

In addition to food consumption, fishing provided an annual family income of around US\$589–1433 [16]. The money gained from fishing is not only used as family cash income, but also to buy fuel, rice seeds, and fertilizer for rice farming. The income from fishing contributed to a household requirement but provided only part of the family income because a household generally needs five times as much as the income from fishing, when considering the Cambodian GDP per capita in 2016 (US\$1269.9) [24]. The average family size in Cambodia is five persons [16]. Tietze (2016) found that in most cases, fishing did not provide sufficient income for the household's needs [25]. Diverse economic activities were necessary to fulfill family needs, and most community fishers both fished and farmed. When a household has access to diverse income opportunities, it is less sensitive to the effects of climate change [26] and when a community depends highly on nutrition, income, and employment from fishery, they are more sensitive to the effects of climate change [27]. Typically, a household has more than one occupation, and may grow crops, run a small business, or raise cattle, pigs, chickens, or ducks in their home lots. Seventy-eight percent of the households in the Tonle Sap region raised livestock and/or poultry [28]. They performed other fishery-related activities, such as fish processing and marketing [10]. Hap et al. (2016) [29] and McKenney and Tola (2002) reported that there was a need for community fishers to perform many economic activities to earn a living [30]. The diversified livelihoods of these rural communities were also reported by Marschke and Berkes (2005) [15]. This study found that most rural households in the two communities owned farmland of approximately 0.5–1.5 ha and cropland of a similar size. This finding was similar to the 2013 census of agriculture in Cambodia, which found that rural Cambodians owned an average of 1.64 ha of farmland [11]. Rice-production yield, on average, is 4.2 tons per hectare [11]. Cambodians consumed an average of 143 kg rice/person/year [16]. This allows for a surplus of rice to exchange for some household income. These diverse livelihood activities may contribute to improved fishery management, as it could divert some efforts to alternative appropriate occupations and relieve the pressure on natural resources [15]. Tietze (2016) suggested that alternative livelihood opportunities are a priority for improving fisheries conservation and management [25]. In the case of the two communities, the savings group provides some fund for livelihood activities and fishery management. In addition, it is important to have effective fishery-management measures.

Although the income of the two rural communities did not depend fully on fishing, members of the community fisheries were likely to focus on fisheries. Almost all community members were members of community fisheries, more than any other social associations. Effective fishery comanagement requires the involvement and active participation of local community members [15,31]. It is essential to obtain the involvement of the direct users of fishery resources. The community members found

it important to manage the fishery resources in their communities to maintain their livelihoods. Community fishers are legally expected to participate in fishery conservation and management and are concerned about the decline of fish stocks. These community fishers could report the historical status of fishery resources in their communities. Their observation of fish-catch decline confirmed the report by Marschke and Berkes (2005) [15]. The decline in fish abundance and size was addressed in 2002 by Zalinge et al. (2002) [4]. The 2006 Cambodian fishery law provides community fishery members with rights and the responsibility to manage fishery resources in their designated fishing grounds [9,32]. Community fisheries are expected to develop their own fishery management plan [6]. Community fisheries are responsible for developing, managing, conserving, and utilizing fishery resources in their designated area in a sustainable manner [9,32]. The community fishers are required to protect the fish habitat and ecosystem, participate in the monitoring and the control of fishery resources, and prevent destructive activities [9,32].

#### 4.2. Savings Groups and Loans

Savings groups and microcredit options were implemented in the two community fisheries. The establishment and implementation of savings groups were facilitated and supported by the provincial fishery cantonment and nongovernmental organizations [33]. The concern of the community fishers about taking loans may be related to their debt. The incurrence of debt may be connected with agriculture and other business activities, but not fisheries [19]. A rural fishing-dependent household in the Tonle Sap region had an average debt of US\$372 [19], which was one third of their national GDP per capita of US\$1269.9. Community fishers receive loans for their family's needs and for buying rice seeds, pesticides and fuel for farming, livestock production, education, healthcare, and to pay other debts [17,34]. Savings in community fisheries are different from agricultural savings because part of the interest earned from the loans is used for fisheries management and the conservation of community fisheries. The savings group is a useful activity in community fisheries [17].

The experiences of a savings group in Bantoat Bos Village, Cambodia showed that, with the help of a savings group, a poor community member who was not in the habit of saving money could do it and gain access to a loan [34]. The loan relieved financial difficulty and could be used to generate more income from raising livestock and growing vegetables [34]. The current savings implemented in those communities by the Sustainable Community International program was small. However, it was appreciated by the community fishers, as it was easy to access without collateral. A study in Pakistan showed that although microcredit was small, it had a positive effect on poverty reduction [35]. This community savings fund could help relieve the stress of paying off other debts. The savings group also provides an incentive for strengthening local community fisheries and solidarity. A study on the sustainability of the Elephant Marsh Fisheries in Malawi suggested that a strong local institution has a strong effect on the sustainability of fisheries management [36].

According to the Cambodian sub-decree on community fisheries, the budget needed for community fisheries to implement their action plans permits the communities to seek technical and financial support from charities, government, nongovernmental organizations, international organizations, and other legal sources [9]. The communities can also collect contributions from their community members as a membership fee [9]. Engaging in fishery ecolabeling could be an opportunity to access additional sustainable sources of funding for implementing community fisheries' action plans. The savings group must be sustained so that it can sustain the community fisheries fund.

Funding from the savings group is part of a solution to relieve budget shortages in community fisheries. However, this study found some concerns among community households about the savings operation. These concerns were about the rights of community members to access the savings and their distribution. Consultation meetings should be conducted with members of savings groups to gather their opinions and collect further details about the current internal rules and regulations of savings groups. Any implementation procedures should be agreed to by all members. Archer (2012) reported

the recommendations of the Community Development Fund that the funds should be managed in a way that the community members play an active role, and therefore, adapt to the system [37].

In this regard, a study of savings groups in Cambodian agricultural production in 2012 by OXFAM [12] suggested that, to ensure good operation and sustainability of the savings group, the implementation arrangement and procedure should consider the following:

- Group size: some savings groups failed because there were too few group members. A larger number of group members were found to accumulate larger funds and could more quickly fulfill the demand for giving loans. However, the most suitable size for the group is 15–25 members [38].
- Lending to nonmembers: past experiences of lending to nongroup members gave both a good advantage and high risk. However, it depended on the decision of the group members and the availability of money.
- Rules and procedure: holding regular meetings and more participation in meetings showed a stronger organization. The rules and regulations, such as to have regular meetings and to return loans and deposit money in a timely manner, were implemented to reinforce the activities of the savings group. However, in some cases, punishment would cause tension within the group. Meetings are essential to keep members well-informed, improve communication among members, and to understand the importance of savings for the community.
- Committee or leadership of savings group: Trust and belief is very important in the savings group. The savings and loans must have accurate records and accountability. This is to build trust and belief. It is essential that the leader or committee is good at conflict resolution and has financial or book-keeping skills. Females were found to be good recorders and good leaders of saving groups [17]. Capacity building should be conducted to enhance accounting and book-keeping.
- Available funds: the savings should make funds available, which can be mobilized among group members.

Funding from a savings group is financial capital for reinvesting in livelihood activities such as fishing, farming, livestock, and small businesses. The fishers and farmers joined a network or association to work together as community fisheries and savings groups. They joined such networks or associations to maintain the sustainability of their natural assets. Livelihood was defined by Scoones (1998) [39] as consisting of the capabilities, assets, and activities required for a means of living. Scoones (1998) added that livelihood strategies can be implemented depending on the basic material and social, tangible, and intangible assets that people possessed [39]. Fishery resources, farmland, and cropland are the assets these communities own and use for their livelihood.

## 5. Conclusions

The characteristics of the two community fisheries, Peam Popech and Phlong, were relevant factors for the successful implementation of community-fisheries management and livelihood development. The community fisheries members did not fully depend on fishing; however, it was a very important source of food and income for the rural households. Part of the income from fishing was invested in other economic activities. Facing the problem of fish decline, this study suggests that fishery management shall be further strengthened to maintain sustainable fishery resources for the communities.

The findings from this study suggested that the implementation arrangement and procedure should be reviewed and strengthened to encourage the active participation of savings group members. The procedure should reflect the opinion and perceptions of the savings group members and incorporate experiences from elsewhere. A shortage of funds is an obstacle to livelihood activities and community-fisheries management. The part of the savings fund is used for sustainable fisheries management. Funding from a savings group may help relieve the stress of financial shortages in community fisheries. Loans from these savings were used by the community fisheries members to invest in diverse livelihood activities to generate more family income. The government should have a

national financial policy to facilitate community fishers in investing in their fishery-related activities. The lessons learnt from these community fisheries will be beneficial to other communities elsewhere.

**Supplementary Materials:** The following are available online at <http://www.mdpi.com/2071-1050/10/8/2905/s1>, Questionnaire S1: Questionnaire for the Interview, Peam Popech and Phlong Community Fisheries, Kampong Chhnang Province, Cambodia.

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