Research article

Contribution of Kampong Preak Fish Sanctuary (Tonle Sap Lake, Cambodia) to Livelihoods in Two Adjacent Floating Villages

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Abstract This study focused on the contribution of natural resources (fish, wildlife, vegetation, flooded forest, etc) to the livelihoods of communities living in two floating villages located near Kampong Preak fish sanctuary, Krakor district, Pursat Province. The approach was based on a combination of Rapid Rural Assessment (RRA) and economic assessment methods. Data was collected from 60 households. Stratified random sampling was used to interview rich, medium and poor households. Quantitative information was complemented by interviews of key informants and of village chiefs. Analysis focused on i) quantitative data, and ii) perceptions of interviewees about the contribution of natural resources and of the fish sanctuary to their livelihoods. This study showed that the fish catch is an important element of income. The living standards of villagers varied, depending on fish production and aquatic plant collection. Labor, aquaculture, pig farming and wildlife catching were the other sources of income in the two floating villages. During six months of fishing season, rich households can catch up to 8020 kg of fish worth USD 1938 while medium households can catch 1,950 kg of fish (USD 778) and poor households can catch 1,426 kg of fish worth in average USD 422. The fish sanctuary contributed to household consumption and income generation in all households. Fish, snake, water bird, turtle, edible wild plant and fire wood are most important for daily subsistence of poor households. Overall people in rich households derive more benefits from natural resources because they have more capital to invest on fishing equipment and to bribe law enforcers.

Keywords: Conservation, fisheries, rural development, environmental management

INTRODUCTION

Cambodia has the most productive inland fisheries in the world. With an estimated production ranging between 290,000 and 430,000 tonnes per year (Van Zalinge et al., 2000), the fish yield is one of the highest in the world and contributes between 8 and 12 % of country's GDP (Kurien et al., 2004-2005). More than a million Cambodian rely upon fisheries for their livelihoods and the majority of Cambodian population lives within the central floodplain of Tonle Sap Great Lake and

Mekong River (ADB, 2003). At least 1.2 million people live the Tonle Sap Lake and exploit its resources. They depend on fish, flooded forest and wildlife as primary or secondary sources of income, employment, food and firewood (ADB, 2003, Chanthy, 2006). According to Balzer et al. (2002), in the Tonle Sap Great Lake, many wildlife species including birds, snakes, turtles, bee but also plants are used by the local people. Usually, the rural people catch wildlife for household consumption as well as for sale and income generation.

The Tonle Sap Great Lake is also a site of global ecological and conservation significance and was classified as a UNESCO international biosphere reserve (Royal Decree, 2001).Within this area, fish sanctuaries (i.e. zones where fishing is completely banned) were already recommended by Chevey and Le Poulain in 1940. In fact, two fish sanctuaries in Pursat Province (namely Kampong Preak and Reang Til) existed before 1950s (Deap, 1992). Two more fish sanctuaries (Kampong Pluk in Siem Reap province and Phat Sandai or Pi Stoun in Kampong Thom province) were established during the 1960s (Sovan,1992). Then four more fish sanctuaries were established later on (Chroy Sdey and Dey Roneat in Pursat province, Ba Lot fish in Kampong Thom province, and Park Konteal in Battambang province; Chheng, 2008); thus to date there are eight sanctuaries located around the permanent lake; they are characterized by different levels of law enforcement and of biological efficiency (Chheng, 2008).

The purposes of the current research is to i) identify the different social groups using natural resources in Kampong Preak fish sanctuary, ii) determine how these social groups use natural resources as a livelihood strategy, and iii) assess the contribution of natural resources to income generation in each social group.

RESEARCH METHODOLOGY

The research was conducted between December 2008 and May 2009. A Rapid Rural Appraisal (RRA) approach was used. RRA is a "Systematic, semi structured activity conduced on site, with the aim of acquiring new information and hypotheses about rural life and rural resources" (Coolison, 1981). This method is a way to identify rural priorities in a short time frame, focusing on aspects related to planned intervention or change.

The two villages selected for study were Anlong Raing and Kampong Preak villages, located outside the Kampong Preak fish sanctuary. The two floating villages were chosen because the local livelihoods are based on the natural resources, especially flooded forest, fish and wildlife in the Kampong Preak fish sanctuary. There has not been any organization to protect and conserve it in the past, and at the present there CI to provide funds to protect and conserve endangered animal and fish species as well as flooded forest within the fish sanctuary.

The differences between social groups, their wealth and the corresponding households in each village were determined during a preliminary stratification phase by a wealth ranking exercise and discussion with the village leaders. 60 households of different social group from a total of 148 households collecting directly resources around the fish sanctuary were randomly selected for in-depth interview using a structured questionnaire. The profit of each natural resource from fish sanctuary was calculated by the total income minus by the total expense which was not included the labor cost. The expenditure of employment was covered by the owner.

RESULTS

Contribution of natural resources to the livelihood of different social groups

An analysis of the household interviews gathered in the two floating villages near Kampong Preak fish sanctuary indicates how much natural resources around fish sanctuary are used by different social groups. Table 1 shows that fishing, snake catching, fire wood collection and water bird catching all play an important role in the livelihoods of all social groups. There is a substantial difference between social groups only about turtle catching. Rich and medium household catch turtles by using horizontal cylinder traps and enclosure nets, whereas poor households can not use

them because these gears are expensive and a boat is needed to use them far from their home. There are some differences between social groups involved in the use of edible wild plants because rich and medium household use them also for pig farming, whereas poor households don't raise pigs.

Table 1 Contribution of natural resources to livelihood of different social groups

Sources	Rich households		Medium households		Poor households	
	Frequency	(%)	Frequency	(%)	Frequency	(%)
Fishing	11	100	26	100	23	100
Snake catching	10	91	26	100	23	100
Fire wood collection	10	91	25	95	22	95
Edible wild plants collection	10	91	26	100	23	100
Water bird catching	6	55	14	58	11	55
Turtle catching	4	36	6	23	1	4

Kinds of fish caught by the different social groups

An analysis focussing on fish catch, fish groups and social groups is detailed in Table 2. Among the three fish groups, white fishes consist of long distance migrants (Tonle Sap - Mekong mainstream), black fishes of local residents (floodplain fishes), and grey fishes consist of short distance migrants (Tonle Sap - local tributaries).

Table 2 Fish caught by different social groups in the villages studied during 6 months

Fish guide	Rich households		Medium households		Poor households		Average total catch
	fish catch (kg)	(%)	fish catch (kg)	(%)	fish catch (kg)	(%)	fish catch (kg)
White fish	4,758	59	960	49	716	50	6,434
Gray fish	1,806	23	552	28	358	25	2,716
Black fish	1,456	18	438	23	352	25	2,246
Total	8,020	100	1,950	100	1,426	100	11,396

This table shows that there are substantial differences between social groups in terms of fish catch. In the six months of fishing season between December and May, rich households can catch more than 8,000 kg of fish (including 59% of white fish, 23% of gray fish and 18% of black fish) because they use bigger and illegal fishing gears such as enclosure nets (more than 500 m of nets) and giant lift nets (18m x 18m x 9m); whereas medium household can catch 1950 kg of fish (49% of white fish, 28% of gray fish and 23% of black fish) and poor households can catch only 1,426 kg of fish (50% of white fish, 25% of gray fish and 25% of black fish species) because they don't use large fishing gears and fishing equipment like rich households.

Fishing gear used by different social groups

According to Deap et al. (2003), more than 102 fishing gears have been identified in Cambodia. However, the main fishing gears used by social group in the villages studied are not that many; they consist mainly of gillnets, brush parks or fyke nets (Table 3).

Table 3 Frequency and percentage of different social groups using a given fishing gear

Fishing gears	Rich households		Medium households		Poor households	
	Frequency	(%)	Frequency	(%)	Frequency	(%)
Gill nets (25-35 mm)	10	91	25	95	23	100
Brush parks	8	73	25	96	14	61
Gill nets (65-120 mm)	9	82	18	69	15	65
Hook	6	55	14	54	10	44
Fyke nets made	3	27	11	42	3	13
Enclosure nets	6	55	2	8	-	-
Giant lift nets	5	45	-	-	-	-
Horizontal cylinder traps	3	27	4	14	1	4
Hook long line	1	9	2	8	4	17
Cast nets	-	-	-	-	2	9

Gill nets (25-35 mm or 65-120 mm mesh size) are the most common gear and are used by all social groups because of their low cost compared to other fishing gears. Less fishermen use long line with hooks because this gear catch less fish and requires much time for seeking bait. Brush parks are used by all social groups because they are efficient and cheap (although illegal); they are used between March and May. People from rich households also use enclosure nets (more than 500 m of nets) and giant lift nets (18m x 18m x 9m) because these fishing gears are very efficient although they are very expensive and require paying bribes since they are illegal. With enclosure seine nets fishermen harvest around a patch of water hyacinths previously gathered and under which fish sought refuge. Those gears catch a mixture of small fish species and are used between October and February. There are no differences between social groups in the use of hooks and horizontal cylinder traps. Fyke nets, although illegal, are used when water rises, especially in May - July, and target fish migrating from the river into the flooded forest. Horizontal cylinder traps is a gear targeting only snakehead fish between July and April. This gear can catch from 3 to 15 kg of fish per day, depending on the season; in dry season they catch more than in wet season and then fishermen check and collect fish every two days. Cast nets are only used by 9% of respondents, all of them from poor households; because this gear is cheap but catches less fish than other gears (and small fishes of low value only).

Economic activities of the different social groups

An analysis of household interviews in the villages studied indicates how much social groups earned from the use of natural resources during the 6 months of the study (Table 4). In fact natural resources contribute more or less to income generation depending on the social group. The expense of some kind of resources was zero as it was already included in fishing expense.

Fishing is the main source of income; this activity contributes more than 60% of income in rich and medium households and 82% in poor households. Over six months of fishing season, rich households can earn around USD 2000 in average from fishing, while medium households make around USD 800 and poor households USD 400. Aquaculture and pig farming are the second sources of income for rich and medium household. Aquaculture contributes 22% of income in rich households (USD 630), 19% in medium households (USD 244), and pig farming (on floating platforms) contributes 7% of income to rich and medium households. Snake catching contributes 7% of income to medium and poor households. Turtles catching, fire wood collection and bird catching made the smallest, often negligible, economic contribution. Thus respondents from rich and medium household get income from fishing activities, aquaculture and pig farming, but did not have any other sources of income; conversely, medium and poor households rely largely on income from young workers who migrate to urban areas.

Table 4 Contribution of each activity to livelihoods of different social groups

Sources	Rich household		Medium household		Poor household	
	Average (USD)		Average (USD)		Average (USD)	
	Income	Expense	Income	Expense	Income	Expense
Fishing	1,938	813	779	255	422	113
Aquaculture	630	283	244	150	0	0
Snake catch	23	4	84	13	39	5
Employment	8	0	68	0	45	0
Pig farming	195	166	92	81	0	0
Fire wood	0	0	11	1.5	7	0.5
Turtle catch	9	0	0.5	0	2	0.5
Bird catch	3	0.25	0	0	0	0
Total	**2,806**	**1,266.25**	**1,278**	**470.5**	**515**	**118.5**
Profit (USD/6 months)	**1,540**		**807.5**		**396.5**	

Source: Field survey 2009, 1 USD was equivalent to 4,150 Riel during 6 months.

Overall these results show that rich households benefit much more, economically speaking, from natural resources than other social groups, and that people do not emigrate towards urban areas if they can get enough income from local harvesting activities.

DISCUSSION AND CONCLUSIONS

This study shows that natural resources from Kampong Prak sanctuary play a critical role in the lives of people living around that protected area. Fishing activities are the major source of differences between social groups (both household consumption and income generation). Aquaculture and pig farming are secondary sources of income for rich and medium households. Firewood collection and catching snakes, water birds and turtles are sources of subsistence for poor households. The people living in the villages studied preferred to collect edible wild plants during the flooded season and to catch water birds in the dry season. They preferred to catch turtles, from the end of rainy season until the dry season. These results confirm those of Chanthy (2006) and Rahut et al. (2007) who also showed that fishing is an important source of income in floating villages. Thouk and Sina (1997) also found that very poor households, although they spent more time fishing than rich households, had a lower catch per unit effort. In better-off households, the higher importance of fishing is explained by the fact that men fish more, use bigger fishing gears and travel further to exploit better fishing grounds. Labor and fish cage culture are another source of income for rural livelihoods. Flooded forests play a role in supporting aquatic life and rural livelihoods as a source of fuel wood, handicraft materials, wild vegetable, wildlife and traditional medicines (ADB, 2002). Snakes represent an important income source and food sources for some of poorest people in Cambodia (Roudy 2002, Brooks et al. 2007). Snake catching is more popular than other wildlife catching, because villagers can process the snakes locally and sell processed snakes at a high price (12,000 Riel per kilogram).

From our study it can be concluded that natural resources from the fish sanctuary contribute very substantially to the livelihood and income of people living in floating villages around Kampong Prak. The use of natural resources is different between social groups, and that the living standards are proportional to the level of fish catch. Fishing is thus the main source of income for livelihoods in floating villages, but it requires a higher investment than the collection of other natural resources. For that reason, rich households collect more natural resources, in particular more fish, than medium and poor household. Wildlife and plants also make a substantial

contribution to the livelihood and diet of villagers, in particular since they are easy and cheaper to collect.

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