

AQUATIC RESOURCES AND RURAL LIVELIHOODS IN CAMBODIA: AN ECONOMIC VALUATION

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ABSTRACT

The direct economic values of aquatic resources used in various livelihood activities by households in selected rural villages of Cambodia were estimated using the net economic value approach. Data utilized were from 540 aquatic resources dependent households from 3 provinces gathered using household survey, longitudinal monitoring and participatory rural appraisal methods in 2003 and 2004. Among the major findings were: a) fishing was an important livelihood activity among households; b) households were not only dependent on fishing but on numerous other aquatic resources based livelihood activities; c) the most significant cost item for aquatic resources based livelihood activities was labor; d) while among the extractive activities fishing contributed relatively more to total economic value, other activities such as fish culture, fish processing and the gathering of aquatic plants, animals, and wood also contributed significantly to economic value; and e) other activities which specifically depended on water and not necessarily on resource extraction, such as irrigated rice farming, duck raising, and water transportation, also added significantly to total economic value. Some policy implications were put forward including broadly based management of aquatic resources, active cooperation and participation of other water-based government agencies in aquatic resources management, and promotion of investment and credit for households in selected aquatic resources based livelihood activities.

Keywords:

Economic Valuation, Net Economic Value Method, Lower Mekong Basin, Rural Livelihoods

INTRODUCTION

Inland aquatic resources were a highly important economic base for Cambodia and its people. About 82 percent of the total fish production of the country came from freshwater fisheries [1]. In addition, inland aquatic areas produced several flora and fauna species that have food and livelihood values to the people [2,3]. Freshwater was also a major input in irrigated farming which, together with fishing, were the main livelihood activities of the population in the rural areas.

Although inland aquatic resources were highly valuable, however, their economic importance to the rural households of Cambodia has not been extensively analyzed in the research literature. The succeeding review below showed that, in particular, the economic value of aquatic resources in the wide range of livelihood activities where they were utilized by households still has to be assessed in detail. Understanding the economic value of inland aquatic resources is important in making informed policy decisions affecting them and for promoting overall biological and economic sustainability in their various uses.

REVIEW OF RELATED LITERATURE

A few studies that looked into the economic value of aquatic and forest resources have been done for Cambodia. Bann [4] conducted an economic valuation of the alternative mangrove management strategies in Koh Kong Province using the net economic value (NEV) method. The study found that local fishing benefits of mangroves were approximately at US\$84 per hectare while benefits in terms of fuel wood were at US\$3.50 per hectare. It further found that shrimp farming was not only environmentally unsustainable but also financially unprofitable with farms typically being abandoned after 5 years of operation. Bann [5] also conducted a similar economic valuation study on tropical forestland use options in Ratanakiri Province. The study found that the benefits from the traditional sustainable use of forest resources exceeded the benefits from commercial timber extraction by at least US\$200 per hectare. This finding indicated that that said areas, especially those with high cultural value and environmental significance, may be managed best by local communities.

Hap et al. [6] employed the NEV method to assess the value of flooded forests in Kandal province. The results indicated that flooded forest resources had significant benefits in terms of fishing, fuel wood and vegetable production and were more profitable as they were compared to when they were converted for other uses like agriculture. Sy et al. [7] conducted a valuation study on forest use in Kampot Province, also using the NEV method, and found that the net income from forest dependent activities of local households was significant and formed about 38 percent of total income. Chamroeum et al. [8] assessed the environmental and health effects of agrochemical use in rice production in Takeo Province using the productivity change approach and human capital approach. Although the costs were not quantified, the study found that agrochemical use resulted in negative health effects on farmers, reduced fish productivity in the rice paddies, and increased production costs in rice farming.

De Lopez et al [9] used contingent valuation techniques to analyse policy options for the Ream National Park. The study found that the park was critical to the livelihood of local communities, the existence of trawlers and illegal fishing operators threatened the livelihood of local communities, and the willingness-to-accept tourists for a boat ride in the park was high indicating the great potential of the park as a tourist destination. Roudy [10] conducted a study on the natural resource use and livelihood trends in the Tonle Sap floodplains, mainly using the NEV method, and similarly found that the area significantly contributed to the livelihoods of the local communities.

In summary, the review of literature above showed that studies that empirically valued the direct economic contributions of aquatic resources to the livelihood activities of rural households in

Cambodia were generally limited to fishing related activities, wood extraction, and a few agriculture activities. The available studies, however, demonstrated the great economic importance of inland aquatic resources to the rural households and communities who were dependent on them.

OBJECTIVES

This paper hoped to contribute to the research literature on economic valuation of aquatic resources in Cambodia by measuring the direct use-values of aquatic resources in a broader range of livelihood activities of rural households than previously studied. The paper was one of the outputs of the Aquatic Resources Valuation and Policies for Poverty Elimination in the Lower Mekong Basin Project. The project ran from January 2003 to March 2005, was funded by the Department for International Development (DFID) of the United Kingdom, and implemented by the WorldFish Center in partnership with the Department of Fisheries (DOF) of Cambodia. A full report of the project was presented in Israel et al. [11,12].

The specific objectives of this paper were to a) measure the production levels of the regularly conducted livelihood activities of households; particularly fishing, gathering of aquatic plants, and the gathering of aquatic animals; b) estimate the individual and total direct use values of aquatic resources in various livelihood activities of households; and c) discuss the results and generate conclusions and recommendations.

STUDY AREAS

Cambodia is located in the lower middle region of the Lower Mekong Basin and bordered in the west and northwest by Thailand, in the east and southeast by Vietnam, in the northeast by Lao PDR (People's Democratic Republic) and in the southwest by the Gulf of Thailand. Most of the country is composed of low and flat plains with mountains in the southwest and north regions. Its climate is tropical with the wet season generally from May to October and the dry season from November to April.

The project had three provincial sites in Cambodia: Siem Reap in the west near the Thailand border, Stung Treng in the north besides the Lao PDR border and Takeo in the south bordering Vietnam. The three provinces were selected based on their diverse aquatic resources and aquatic resources-based livelihood activities.

STUDY METHODS

Theoretical discussions on economic valuation applied to the natural resources and environment abound in the literature. More recent works with explanations of the different economic valuation methods applicable in the study of aquatic resources were Barbier et al. [13]; IIED [14], De Lopez et al. [9], CEMARE and SIFAR [15].

The economic tool used by the project was the market-based approach of the NEV method. The NEV from an economic activity, such as the exploitation of an aquatic resource for livelihood purposes, is defined as

$$NEV = TR - TC$$

where TR is the total revenue, or the quantity of output generated from the exploitation of the resource multiplied by its market price, and TC is the total costs that include both the financial (quantity multiplied by the market price of the purchased material inputs; hired labor, paid for transportation, and other purchased cost items) and the non-financial costs (quantity and market price of the unpurchased material inputs, household labor, unpaid-for transportation, and other unpurchased cost items). The term “economic” is used to make a distinction from the term “financial” which purely means the accounting of the money costs and returns to production.

The project used the household as the unit of analysis and utilized data from 3 sources: cross-sectional household survey, longitudinal monitoring and participatory rural appraisal (PRA). The household survey generated the demographic and socioeconomic background and other relevant information using household heads as respondents. It covered 6 villages in each of the 3 provincial sites for a total of 18 villages overall. The villages were aquatic resources dependent as they either bordered major water bodies (Mekong River for Stung Treng villages and Tonle Sap Lake for Siem Reap villages) or located in a floodplain area (Takeo villages). In each village, 30 households were selected for a total of 180 households in each province and 540 households for the three provinces overall. The household survey was done through personal interviews using a prepared questionnaire and generated information on the demographic, socioeconomic and other relevant characteristics of the households, their use of aquatic resources and the constraints that they face to the access to the aquatic resources. The survey was conducted from September 2003 to April 2004.

In the economic valuation activity, in each of the three provinces covered, a commune was selected, within which three villages were chosen for coverage. Then, in each village, 6 households were selected for coverage for a total of 18 households in each province and 54 households for the three provinces. Two methods were used to collect data and information for economic valuation: longitudinal monitoring and PRA. The respondents to the longitudinal monitoring were again the household heads while the participants to the PRA were selected heads of households, selected household members including women, village officials and key informants. On the one hand, the longitudinal monitoring involved respondents filling in a questionnaire weekly for a period of one year (November 2003 to October 2004) covering the full cycle of wet and dry seasons. Through the questionnaire, data on the quantity of outputs of aquatic resources-based activities conducted on a regular basis throughout the year by the households were collected. The specific activities covered by the longitudinal monitoring were fishing and the gathering of aquatic plants and animals. On the other hand, PRA techniques, particularly key informant interviews, focus group discussions, and personal observations were used to gather data on the inputs of production of the regularly conducted activities, the prices of the inputs and outputs, and the inputs and outputs of the activities that were seasonally or irregularly conducted. The seasonally or irregularly conducted activities were fish culture, fish processing, gathering of aquatic wood, irrigated rice farming, duck raising, and provision of public water transportation using boats. The PRA activities were conducted at the same time as the longitudinal monitoring.

The questionnaires used in the household survey and longitudinal monitoring were pre-tested before being administered by formally trained enumerators coming from the staff of the provincial offices of the DOF. Question guides and other materials were also prepared in the conduct of focus group discussions and other related PRA activities.

RESULTS AND DISCUSSION

PRA results found that the different aquatic resources based livelihoods common in all the villages in the 3 provinces covered were fishing, fish marketing, fish processing, gathering of aquatic plants and gathering of aquatic animals. Some households in the 3 provinces practiced fish marketing as part and parcel of fishing activity but not as a separate livelihood activity (Households generally sold only their own catch and did not undertake buy and sell). The other livelihoods common in Takeo and Siem Reap were the gathering of aquatic wood and the provision of public water transportation. Duck raising and irrigated rice farming were practiced in Takeo while fish culture was done in Siem Reap. Of the livelihoods, fishing, fish processing, gathering of aquatic plants, gathering of aquatic animals, and the gathering of aquatic wood were resource extractive activities. Duck raising, rice farming, fish culture and the provision of public water transportation were water-based but non-extractive activities. Generally, households conducted fishing and the gathering of aquatic plants and animals regularly on a daily or weekly basis while the other livelihood activities were on a seasonal or irregular basis.

Being regularly conducted by households on a daily or weekly basis, fishing and the gathering of aquatic plants and animals were analyzed using longitudinal monitoring data. The average fish catches by households in the villages seasonally and annually (Figure 1) were significantly much higher in Siem Reap (3,889 kilograms in the wet season and 2,532 kilograms in the dry season) than in Takeo (641 kilograms in the wet season and 316 kilograms in the dry season) and Stung Treng (312 kilograms in the wet season and 274 kilograms in the dry season). This likely reflected the high productivity of the Tonle Sap lake as a fishing resource. In all 3 provinces, average fish catch was higher in the wet season than in the dry season. The difference in seasonal catch was larger in Siem Reap and Takeo than in Stung Treng.

The average seasonal and annual volumes of aquatic plants gathered by households (Figure 2) were much higher in Takeo (411 kilograms in the wet season and 457 kilograms in the dry season) compared to Siem Reap (73 kilograms in the wet season and 304 kilograms in the dry season) and Stung Treng (32 kilograms in the wet season and 13 kilograms in the dry season). This result likely reflected the great abundance of aquatic plants and the higher intensity of gathering in the floodplains of Takeo. Siem Reap households also gathered relatively large quantities of aquatic plants reflecting the abundance of this resource due to the Tonle Sap Lake. Aquatic plants were not plentiful in Stung Treng as shown by the low levels of gathering there. In Takeo and Siem Reap, gathering was higher in the dry season than in the wet season while the opposite was true in Stung Treng. The difference in seasonal quantities gathered was relatively much larger in Siem Reap compared to Takeo and Stung Treng.

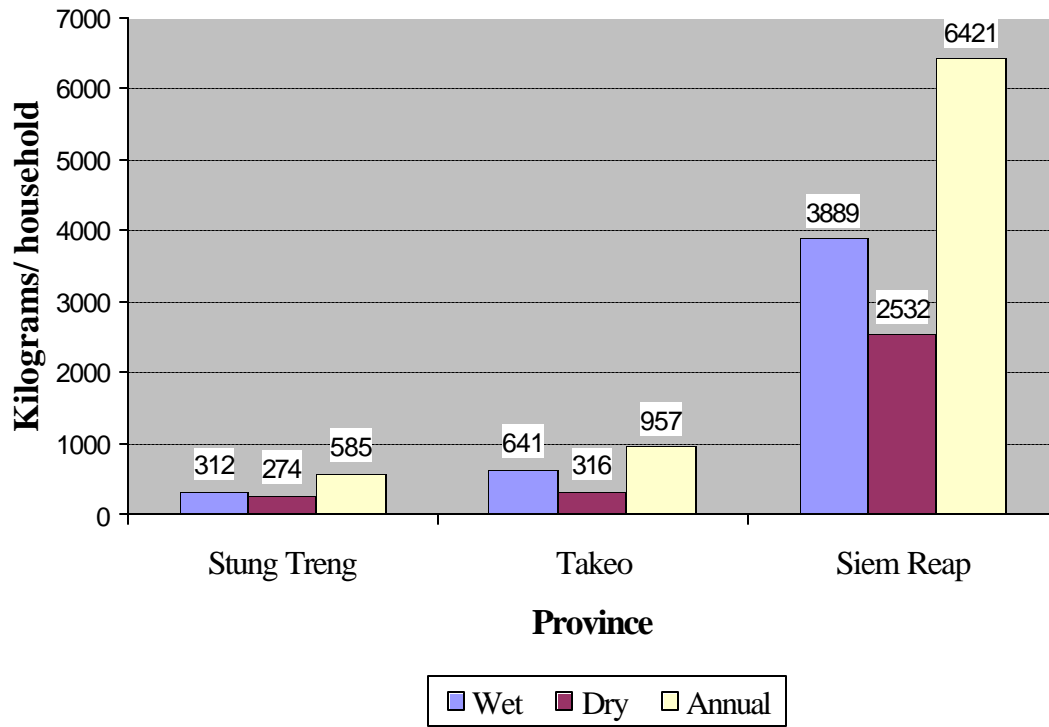


Figure 1. Seasonal and annual total fish catch by households in Stung Treng, Takeo and Siem Reap, Cambodia, 2003 - 2004

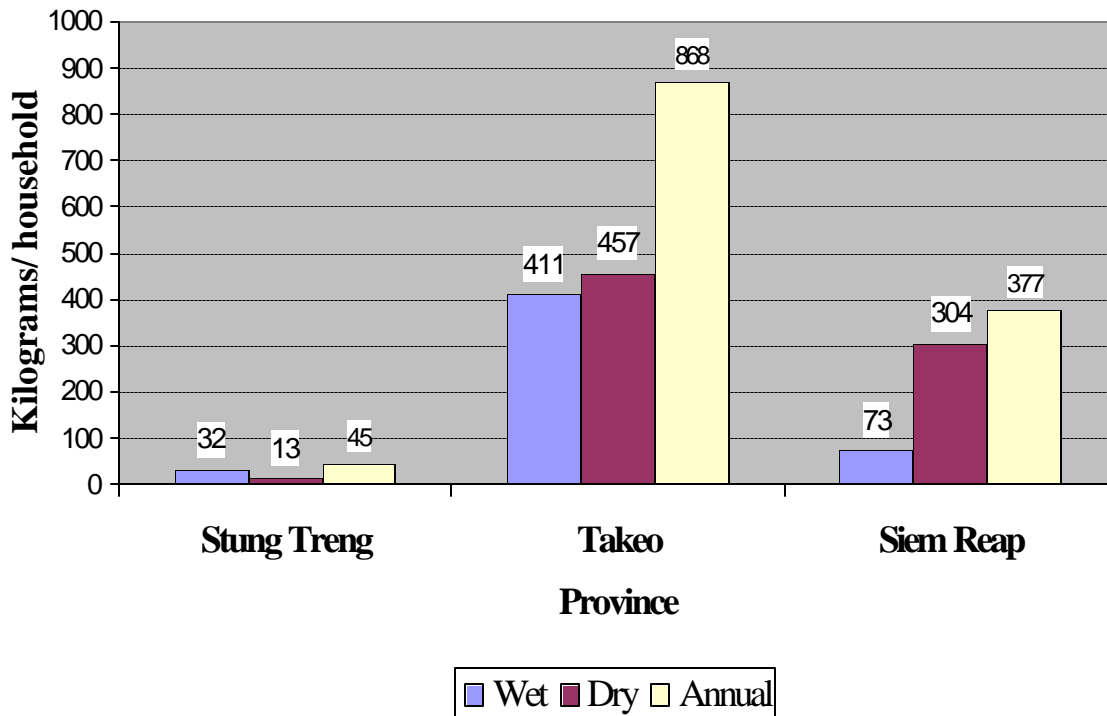


Figure 2. Seasonal and annual total gathering of aquatic plants by households in Stung Treng, Takeo and Siem Reap, Cambodia, 2003 - 2004

Similar to aquatic plants, the average volumes of aquatic animals gathered seasonally and yearly by households (Figure 3) were significantly much higher in Takeo (496 kilograms in the wet season and 597 kilograms in the dry season) compared to Siem Reap (213 kilograms in the wet season and 232 kilograms in the dry season) and Stung Treng (70 kilograms in the wet season and 16 kilograms in the dry season). This result likely indicated the relative abundance and the higher intensity of the gathering of aquatic animals in Takeo because of its large floodplain areas. Siem Reap households likewise gathered relatively large quantities of aquatic animals indicating the abundance of this resource in the province due to the Tonle Sap Lake. Aquatic animals were relatively scarce in Stung Treng as shown by the low levels of gathering by households. In Takeo and Siem Reap, gathering was higher in the dry season than in the wet season while it was the opposite in Stung Treng. The difference in seasonal quantities gathered was relatively much larger in Takeo and Siem Reap and smaller in Stung Treng.

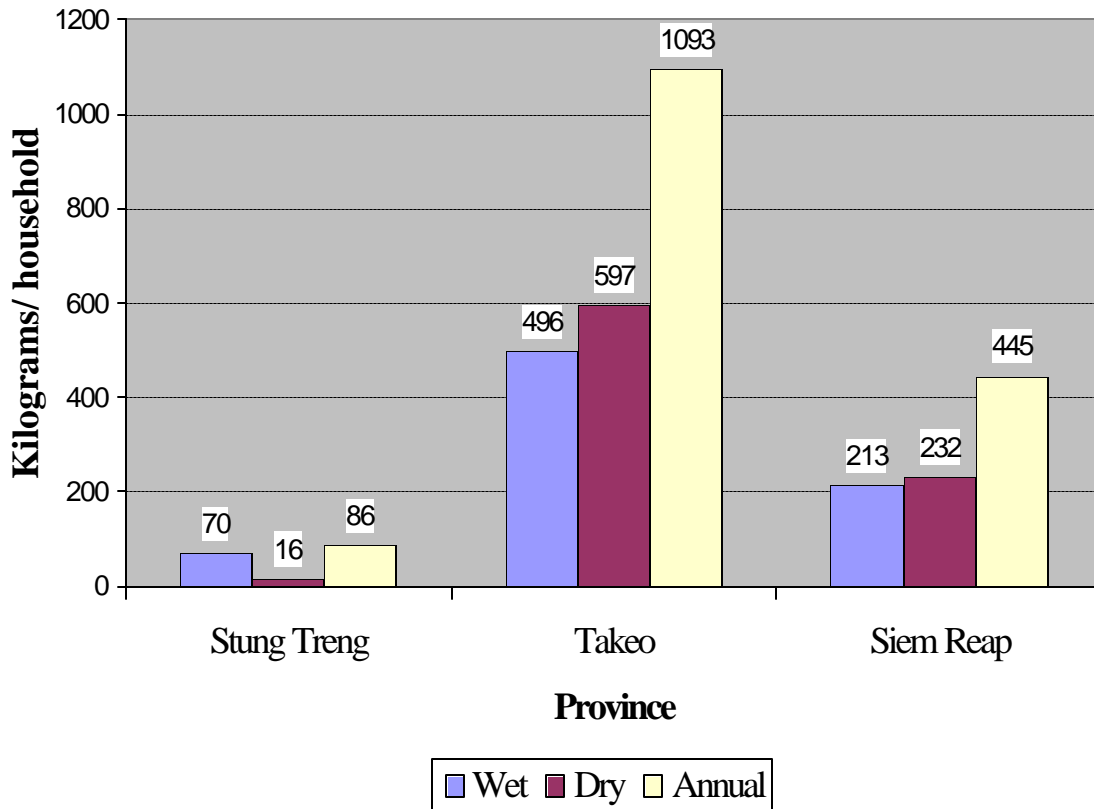


Figure 3. Seasonal and annual total gathering of aquatic animals by households in Stung Treng, Takeo and Siem Reap, Cambodia, 2003 – 2004

The following discussion showed the results of the economic valuation. Detailed calculations and the tables containing the figures were provided in Israel et al (2005b) and not presented here due to space limitations. The results showed that there were significant differences in the economic values of different household livelihood activities across villages in the 3 provinces. Both motorized and non-motorized fishing and fish processing were significantly more profitable in Siem Reap than in Takeo and Stung Treng. Fishing and fish processing activities were conducted at a more intense level in Siem Reap likely because the province did not have the same farming opportunities compared to the other provinces and had access to the large aquatic resources provided by the Tonle Sap lake. Fish culture was also found to be highly profitable in Siem Reap.

The gathering of aquatic plants and of aquatic animals were significantly more profitable in Takeo than in Siem Reap and Stung Treng. The gathering of aquatic wood was also more profitable in Takeo than in Siem Reap. Irrigated rice farming and duck raising were highly

profitable activities in Takeo while the provision of public water transportation was more profitable in Takeo than in Siem Reap.

The economic values of some of the aquatic resources-based livelihood activities were similar in the wet and dry seasons. Examples included fishing and the collection of aquatic animals. The economic values of other household activities were significantly different in the wet and dry seasons. For example, fish processing was significantly more profitable in the dry season than in the wet season, especially in Siem Reap due to higher production output in the dry season. The economic value of gathering aquatic wood was relatively higher in the dry season compared to the wet season in Takeo. Water transportation provided a higher net return in the wet season in Siem Reap since it was the only form of transportation at that time when the villages are flooded. On the other hand, in Takeo, water transportation was less profitable in the wet season when gasoline was used to run boats compared to the dry season when manual paddling was common.

A few of the activities were unprofitable when labor costs were included in the computation of costs. These included motorized fishing in both wet and dry seasons in Stung Treng. By itself, motorized fishing resulted in losses due to the partial nature of the activity in the province. The motorized boats, however, had other uses to households, such as for personal transport, transport for business purposes, and other uses that made boat ownership worthwhile to households. The Gathering of aquatic plants in both seasons and gathering of aquatic animals in the wet season were unprofitable in Stung Treng when labor costs were included in the computations, emphasizing the purely subsistence nature of the activity there.

In general, the largest cost item for all livelihood activities was labor. Labor costs were especially high for fishing (motorized and non-motorized), gathering of plants, gathering of aquatic animals, gathering of aquatic wood, and rice production, ranging from 30 to 90 percent of total costs. Labor was not a dominant cost item for fish processing (6 to 26 percent of total costs, where the purchase of mixed fish and salt were the significant cost items), and water transportation (9 to 30 percent of total costs, where gasoline was a significant cost item).

The average annual values of the aquatic resources in a typical village in each of the three provinces were computed. The values were generated by multiplying the economic values per household per livelihood activity by the estimated average number of households involved the activity in a typical village (see Israel et al. 2005b). The total NEV of aquatic resources with labor costs included in the computation of costs was highest in Siem Reap at 1,781.9 million riels or 445.5 thousand US dollars at the current exchange rate of \$1=4,000 riels, followed by Takeo at 586.8 million riels or 146.7 thousand dollars and Stung Treng at 24.4 million riels or 6.1 thousand dollars. NEV was highest in Siem Reap because both motorized and non-motorized fishing had significantly higher contribution to net benefits in the province compared to Takeo and Stung Treng. While this is so, the results also showed that in all the three provinces covered, the livelihoods contributing significantly to NEV included not only fishing but other aquatic-based livelihood activities as well.

Another important highlight of the results was the importance of the water resource itself, in addition to the live aquatic resources found in it, to the livelihood activities of rural households. The findings showed that the NEV contributions of water-based but non-extractive activities

were highly significant in the households and villages they were conducted. In particular, irrigated rice farming in Takeo contributed significantly to household incomes. Both duck raising and the provision of water transportation were also profitable activities although practiced only by a selected number of households. These results emphasized the diverse uses of aquatic resources, beyond just fishing and wood extraction.

SUMMARY AND CONCLUSIONS

This paper presented the results of economic valuation of aquatic-based resources and livelihood activities in Cambodia done by the Aquatic Resources Valuation and Policies for Poverty Elimination in the Lower Mekong Basin Project. The main findings were: a) fishing was an important livelihood activity among households; b) households were not only dependent on fishing but on numerous other aquatic resources based livelihood activities including fish culture, fish processing, gathering of aquatic plants, gathering of animals, gathering of aquatic wood, irrigated rice farming, duck raising and the provision of public water transportation; c) fish catch was highest in Siem Reap likely due to the abundant resources of the Tonle Sap lake while the aquatic plants and animals gathered were highest in Takeo likely because of its abundant floodplain aquatic resources; d) the most significant cost item for most aquatic resources based livelihood activities was labor; e) the net economic value of aquatic resources was highest in Siem Reap, followed by Takeo and Stung Treng; f) differences in fishing output and returns accounted for most of the variations in net economic values between provinces; g) other extractive aquatic-based activities outside of fishing also contributed significantly to net economic values; and i) livelihood activities which depended on the water use and not on resource extraction, such as irrigated rice farming, duck raising and water transportation, also contributed significantly to net economic values.

Some of the implications of the results of the economic valuation presented in this paper are the following. First, since the importance of aquatic resources goes far beyond just fishing, aquatic resources management cannot be focused on fisheries alone but must encompass a broader set of aquatic resources including aquatic plants, animals and wood and others with potential economic uses. This management approach has not been pursued by the Cambodian Department of Fisheries at present which focuses mainly on fisheries as a sector of coverage.

Second, the results indicated that not only were the living aquatic resources important but the water itself also contributed significantly to the livelihoods of the rural households, including in both irrigated rice farming, fish culture, duck raising and public transportation. This means that aquatic resources management must involve not only the traditional fisheries agencies at the national and local levels but also other agencies that manage water resources.

Third, given the dominance of labor as a cost item in aquatic resources based livelihood activities, there appears to be strong potential for greater capitalization and investment in at least some of these livelihood activities as a means to address rural unemployment and poverty. A long-term micro-credit program for fish processing, duck raising and fish culture, for instance, may help as employment generators and as livelihood alternatives to fishing and other resource extractive activities.

In conclusion, the results of the economic valuation done by the project were limited to the marketable and direct uses of aquatic-based resources. A broader understanding of the total economic value of these resources could be attained by expanding research into the indirect use values and non-use values of these resources. The study area could also be expanded to consider other provinces in Cambodia and other Lower Mekong countries.

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