Strategies to improve livelihood of the rural poor: A case study in two small reservoirs in Binh Phuoc Province, Vietnam

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Status of livelihoods of people who live in the vicinity of two small reservoirs, Nong Truong 6 and Dakton of Binh Phuoc province, Vietnam, as well as fisheries and aquaculture activities, are reported here. The two reservoirs are of similar area, but the former is open access and the latter is leased out. These two different modes of management seem having significant impact on fish yield and income of farmers, though it is acknowledged that small sample size of one reservoir cannot warrant firm conclusions. It is also observed that aquaculture and fishing activities in the two reservoirs have been undertaken in a haphazard manner and no proper management strategies have been developed. It is suggested that a policy that encourages development of culture-based fisheries should be introduced as it has proven a useful approach in improving livelihood of the rural poor who live in the vicinity of reservoirs, in Vietnam and elsewhere in Asia.

Introduction

Binh Phuoc Province is located in the Southeast of Vietnam. Agriculture remains the main sector in the provincial economy and the area of agricultural land in the province has expanded steadily. In this context, the demand for water for agriculture is also increasing and there is a need to construct more reservoirs to meet water demand. At present, the total area of all water bodies in the province is estimated to be 20,000 ha (Giang et al., 1997); and it is expected to increase by two fold in ten years, mainly as a result of the development of small reservoirs.

Small reservoirs are believed to offer great potential for developing fisheries. At present, however, the fishery in general and reservoir fishery in particular is not well developed in the province. Small reservoirs are mostly managed by the Agricultural Project Management Section (APMS) of the Provincial Department of Agriculture and Rural Development. The APMS is responsible for identifying, appraising, monitoring and managing agricultural projects. APMS has no fishery specialists, and as such most of the projects that have been developed did not take into account the potentials for fishery development. As a consequence, reservoirs have been leased out to a small group of households to operate the fishery. Planning for the development of these reservoirs is still undertaken in a top-down manner and there is no participation of the local people in their management in general and in fishery management in particular. The leasing of small reservoirs is carried out by APMS without consultation with the local people who may be regarded as the primary stakeholders. The leasing is decided without consideration of the role of the reservoir in the socio-economic situation of the people and the possible impact upon the community who live in the reservoirs vicinity.

Some other reservoirs of Binh Phuoc Province belong to the local rubber companies, impounded initially to support rubber plantations. In contrast to the APMS, these reservoirs are open for use by the local community. At present, the Government of Vietnam is implementing its "Hunger eradication and poverty reduction" program, in which the fishery sector has now become an important component under the so-called SAPA (Sustainable Aquaculture for Poverty Alleviation) Project. It is believed that the fishery sector can provide an affordable source of animal protein for rural poor people and plays an important role in attaining food security at national level.

To date, the number of studies on small reservoir fishery management and development and especially the role and impact of such reservoir fisheries on rural people's livelihoods, are rather limited in Vietnam. Most of these are confined to northern (Nguyen et al., 2001; Nguyen et al., 2005) or central Vietnam (Phan and De Silva, 2000). The present study aims to investigate the effects of small reservoirs management strategies on the livelihood of the communities living in the vicinity of these water bodies in Binh Phuoc Province, Vietnam. The findings could be useful in providing guidelines for fishery development in small reservoirs thereof.

Methodology

Two reservoirs representing two different modes of management were chosen as our study sites. The first reservoir, the Nong Truong 6 (NT6), was built in 1980 and located at Long Ha commune, Phuoc Long district with an area of approximately 30 ha. The reservoir was previously managed by the Phu Rieng Rubber Company. However, at present the ownership of this reservoir is unclear and considered open access. The second reservoir is the Dakton reservoir, which is located in Son Giang commune of the same district as the NT6. Dakton reservoir is 5 years younger than NT6, with 28 ha of surface water area. In contrast to the NT6 reservoir, Dakton reservoir was leased out to a group of farmers including 36 households, who can stock fish and harvest.

Rural Rapid Appraisal (RRA) methods and questionnaire surveys were used to collect data from the targeted villages around each reservoir. RRA methods were used to obtain general information on the study area and direct the questionnaire survey. Information in the questionnaire includes:

- Data on socio-economic aspects such as age, education level, labor force, land holding, household assets, income, labor inputs (man-day), % fish contribution to daily

Table 1. Social-economic characteristics of people living in vicinity of the NT6 and the Dakton reservoirs.

Reservoir	Area (ha)	Social-economic data							
		Age		Education			Labour force	Income	% Fish in diet
		Mean	Max	Primary	Secondary	High school			
NT6	30	43	72	16.7	73.3	10.0	2.0	18,565,750	42.33
Dakton	28	43.5	77	13.3	75.0	11.6	2.4	23,910,375	44.17

animal protein consumption and the local attitudes and opinions to reservoir fishery.

- Data relating to aquaculture activities such as facilities, level of intensification, cultured species and yield;
- Data on capture fisheries such as gear used, species caught, yield, frequency; institutional arrangements and measures for management (ownership, mechanisms), and accessibility to fishery resources (regulation or rules, mode of payment, amount of payment, type of gear, and species that are allowed to catch).

Questionnaires were administered to two groups of households, including 60 households who are living around the NT6, and 60 households who are living around the Dakton.

The study attempted to assess the changes of poor rural people' livelihood in terms of income and employment opportunities. The income analysis was undertaken to analyze household's income from agricultural sector, fishery sector and others. The analysis of income is conducted as gross income earned by the household, without examination of expenditure. This analysis focused on the proportion of total employment opportunity derived from the fishery sector. The social assessment was undertaken in order to understand opinions and attitudes of poor rural communities about leasing of small reservoirs. SPSS and Excel software were used to analyze linear regression, one-way ANOVA, frequencies, and case summaries of collected data.

Results and discussion

Results of the social-economic survey are presented in Table 1. The present survey showed that the major proportion of populations living in vicinity of the two reservoirs under study is of middle age. The mean and maximum age of populations in the NT6 and the Dakton reservoirs were 43 and 72, and 43.5 and 77, respectively. Levels of education were relatively low, with only 8.3% and 1.7%, and 8.3% and 3.3% completed high school and colleges in the NT6 and the Dakton, respectively. The major proportion of these populations only completed secondary school, and these people are in fact immigrants from northern provinces of Vietnam. It is noted that most people who obtained higher levels of education are young and recently educated.

The local people mostly have a sufficient labor force, and, they mostly possess a relative large area of land in comparison to other places in Vietnam. All have legal ownership of their own land. In this case, the local people are well placed for obtaining bank loans.

There are five major sources of income such as crop production, livestock, off-farm employment, fishing, and aquaculture. Out of these, crop production contributes more than 50% to total income at community level. In addition, returns from labor from crop production is the highest. However, the proportion of income varies from household to household. Aquaculture and fishery contribute only about 20% to total income at community level, which is not much lower than Yen Bai and Thai Nguyen provinces with 23% and 28%, respectively (Nguyen et al., 2001), and about from 20% to 30% of households are involved in these activities.

One advantage of fishery development is that the contribution of fish to daily animal protein consumption is rather high and exceeds 40% in most families. In this context fishing in small reservoirs is only subsistent in general. Both pond and cage culture are practiced in the NT6 reservoir, the former could reach an average yield of 5.26 tonnes/ha and and that of the latter was about 34.76 kg/m^3/year (Table 2). Cultured species include grass carp, *Ctenopharyngodon idella*, common carp, *Cyprinus carpio*, silver carp, *Hypophthalmichthys molitris*, and tilapia, *Oreochromis mossambicus* and *O. niloticus*. The yield of pond culture is average as often pond culture can reach from less than 1 to more than 10 tonnes/ha/year in Vietnam (Binh, 1998). There is only one and two crops in each pond culture and cage culture cycle, respectively. Only pond culture occurred in the areas adjacent to the Dakton reservoir, with higher pond yield (6.52 tonnes/ha before leasing and 9.03 tonnes/ha at present), and also only one crop in each culture cycle.

With regard to the attitude towards importance of fishery in the two reservoirs, over 50% of households think that the reservoir fishery is not important to their livelihood, while less than 5% of households said that it is very important. In fact, all the reservoirs belonging to the Phu Rieng Rubber Company are mostly characterized by inadequate clearance of trees from the reservoir area so that it is almost impossible to apply large-scale fishing practice unless the provincial government provides financial support for clearing out trees in the bed of reservoirs. However, there is much controversy with regard to clearing reservoir beds, as submerged vegetation provides suitable habitats for fish and releases nutrients thereby increasing primary productivity. Some reservoirs built by the provincial government (e.g., the Dakton reservoir) are in such an oligotrophic condition

Table 2. Aquaculture production in the two reservoirs under study.

Reservoir	System	Species	Yield (yr^{-1})	Production per cycle
NT6	Ponds	Grass carp, common carp, silver carp, tilapia	5.26 tonnes.ha^{-1}	1
	Cages	Grass carp, common carp, silver carp, tilapia	34.67 kg.m^{-3}	2
Dakton	Ponds	Grass carp, common carp, tilapia	9.03 tonnes.ha^{-1}	1

that fish yields are low. Thus, only a small number of households can obtain income from the fishery, in which no households are involved on a full-time basis.

Statistically, there is no significant difference of income and labor inputs between two periods of time (before and after leasing) ($P>0.05$). Therefore, the impact of leasing reservoirs on the local people's livelihood is insignificant in terms of economical aspects. The data also showed that income generated from aquaculture in leased reservoirs was higher than that in open access ones ($P<0.01$). This could be due to better management as well as the well-defined ownership (hence better protection if fishery resources) and better intensification in aquaculture as the data also showed that labor inputs in aquaculture and fishing are observed in Dakton reservoir ($P<0.01$).

The major and the only disadvantage found in the Dakton reservoir was the conflicts between the local people and leaseholders, especially when the latter are outsiders. Such a problem could be overcome through encouragement of local farmers to form communities or groups and lease the reservoirs and have ownership on the fish resource, and at the same time increase employment opportunities during off-crop season, and hence improve income. This model has been applied successfully in Yen Bai and Thai Nguyen provinces, initially through support from an ACIAR funded project. However, after the first cycle of culture, farmers are willing to have self financial support to sustain culture-based fisheries activities. It is also important to note that farmers in Yen Bai and Thai Nguyen provinces are well supported technically as well, with all technical issues such as suitable stocking density and species combination which are determined through scientific experiments, being transferred to grassroot levels through proper extension network using appropriate extension materials (De Silva et al., 2006; Nguyen & Nguyen, 2007).

The findings both from field discussions and data analysis indicate that key problem at the two reservoirs is low income from the fishery sector in general and low aquaculture and fishery income in particular. For aquaculture, there are two main reasons for the low income: low yields of cage culture and the low price of cultured fish. In fact, the local people at the NT6 reservoir cultured fish in cages based on their own experience, and got very limited technical assistance from the provincial related organizations. They also have difficulties in investment due to lack of financial assistance. Besides, the main cultured species in the local market command a low price so that it is necessary to develop market for aquatic products. It is also necessary to culture other valuable aquatic species in cages and ponds. For fishing, low fish yield can be caused by two factors - the oligotrophic condition in the case of Dakton and inadequate clearance of trees from reservoir area in the case of the NT6 reservoir.

The problems encountered in the two reservoirs reported herein are not uncommon in Vietnam and elsewhere in the Asian region. However, there is scientific evidence that livelihood of people living in vicinity of small reservoirs can be improved through development of culture-based fisheries. Farmers however, firstly need to be equipped with essential knowledge in fish culture, including selection of suitable sites, fish stocking, monitoring, harvesting and marketing. The Government of Vietnam is encouraging such development and as such the practice should be adopted.

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