SUSTAINABLE MANAGEMENT OF THE NAM NGUM RESERVOIR FISHERY

PURPOSE

This case study examines the challenges of fisheries management in the Nam Ngum reservoir in Lao PDR. Particular attention is given to resource use conflicts and unsustainable fish harvesting practices occurring in the reservoir. Efforts to address these problems through undertaking integrated research to improve understanding of fish populations in the reservoir in support of conservation efforts and promoting greater community involvement in management of the reservoir fishery are highlighted. Institutional and regulatory issues relating to the management of the Nam Ngum reservoir fishery are also considered.

ETP1 COURSE TOPIC COVERAGE:

- SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL AWARENESS
- ENVIRONMENTAL SCIENCE IN THE MRB
- DISTURBANCES TO AQUATIC ECOSYSTEMS IN THE MRB
- INTEGRATED RESOURCE AND ENVIRONMENTAL MANAGEMENT (IREM) CONCEPTS AND BENEFITS
- BARRIERS TO IREM
- IREM PRACTICAL TOOLS FOR IMPLEMENTATION
- DEVELOPING EFFECTIVE IREM IN THE MRB

ISSUES

Specific issues highlighted by this case study are:

1. Open access fisheries are typically characterized by excess harvesting and unsustainable fishing practices
2. Alternative sources of income must be identified for increasing human populations to reduce pressures on natural resources
3. Poor environmental awareness and lack of scientific understanding as contributing factors to fisheries declines
4. Benefits and limitations of community management approaches
5. Promulgation and enforcement of environmental management regulations by responsible authorities

LEARNING OBJECTIVES

On completion of this case study, participants will be able to:

- List the fisheries resources of the Nam Ngum reservoir
- Describe the current understanding of the fishery and ongoing research work being undertaken to conserve and protect the fishery
- Describe the benefits of fisheries management in the Nam Ngum reservoir
- Discuss the existing resource management regime in the reservoir

- Provide examples of activities which are negatively impacting fish populations
- Identify primary socio-economic issues underlying unsustainable management of natural resources in the Nam Ngum watershed
- Recommend alternative approaches to managing the reservoir fishery
- Discuss the expected benefits and limitations of community management
- Identify which harvesting strategy maximizes economic benefits for the Nam Ngum fishery.

PROJECT SUMMARY

Introduction and Background

The Nam Ngum reservoir is situated approximately 90 km north of Vientiane city, Lao PDR. The reservoir was created in 1971 by the construction of a dam on the Nam Ngum River, about 3 km upstream from its confluence with the Nam Leuk River. The reservoir is the largest impoundment in Lao PDR, covering an approximately 370 km^2 area. Additional details of the Nam Ngum dam and reservoir are provided in the following table.

Provinces	Vientiane and Saysomboun Special Zone
Coordinates	18° 32'N, 102° 33'E
Primary Use	Hydropower
Owner	Electricite du Laos (EDL)
Electric Capacity (MW)	110
Dam Height (m)	75
Dam Length (m)	468
Effluent river	Nam Ngum
Annual Dam Discharge ($10^6 m^3$)	1000
Normal Upper Storage Level (m above sea level)	212
Maximum surface area at capacity (km^2)	477
Gross Capacity ($10^6 m^3$)	7010
Live storage ($10^6 m^3$)	4910
Draw-Down (m)	16
Mean Depth (m)	19
Shoreline Length (km)	430
Affluent Rivers	Nam Ngum, Nam Sane, Nam Ke, Nam Pat, Nam Xi, Nam Xong
Catchment Area (km^2)	8460
Catchment Rainfall (mm yr^{-1})	2187
Maximum Temperature (°C)	31
Minimum Temperature (°C)	28.5
Conductivity (µS $cm^{-1)}$	100

Although the main economic benefit of the Nam Ngum dam is hydropower generation, the reservoir has other important uses such as irrigation, flood control, navigation, fisheries and tourism. Thirty villages with a total population of approximately 16,658 are situated in the Nam Ngum watershed.

FISHING IN THE NAM NGUM RESERVOIR

Fishing is the primary source of food for villagers who utilize the more than 55 indigenous species found in the Nam Ngum reservoir. The main species harvested is Pa Keo, *Clupeid clupeichthys aesarnensis*, which are generally taken by gillnet. Fish comprises 56.3 percent of protein in the local diet, with an average household consuming 83.2 kg fish protein each year compared to the Laos national average of 8-10 kg /year (Phonvisay, 1999). About 50% of households supplement family income by selling fish to traders in their villages. The income from fish sales is enough to buy rice to meet basic nutritional needs as well as to cover other expenses. Fishing activity has increased rapidly in recent years as the local population grows and less land is available for agriculture. Villagers are also drawn to fishing by the high incomes they can earn compared to farming. The total number of fishers is now 3,437, of which 1,597 are full-time fishers (i.e., fishing 5 days or more per week).

Harvest rates in the reservoir were first documented in the early 1980's when the total fish yield was estimated at 1,027 tonnes per year (Mekong Committee, 1984). Annual fish production in the reservoir from 1979 to 1983 was estimated at 1,472 tons or 37 kg /ha. Since then, harvest rates and productivity appear to have decreased substantially. Estimated catch rates in the Nam Ngum reservoir had decreased from 50kg /ha in 1975 to about 20kg/ha by 1988, resulting in a total estimated fish production of some 740 tonnes per year (Mekong Committee, 1992). Unfortunately, the actual situation may be even worse. Reliable fish catch assessments are difficult to make due to the problem of under-estimation and miss-reporting of the catch statistics by fishers and fish processors to avoid taxation.

Analysis of catch statistics indicates that the reservoir fishery has progressively shifted from the relatively large-bodied and valuable top-predators to small-bodied, low-value planktivores. This is a common trend in fisheries, referred to as "fishing down food webs" (Pauly *et al.*, 1998). The observed changes in fish species harvested in the Nam Ngum reservoir in recent years suggests that increasing fishing effort has lead to an increase in yield, but also a shift in species dominance. It is likely that Nam Ngum fishery is in a transition phase, where individual fishers experience declining catches and returns, although the total catches are higher than before. A further increase in fishing effort will probably shift the fish stocks even more towards small, fast-growing species which are lower in the food chain, such as Pa Keo. Although the total catch and its value in 1998 was higher than in 1982 due to higher fishing effort, further increases in the fishing effort are unlikely to bring more profits to individual fishers or the fishery as a whole.

Management of the Reservoir Fishery

Conservation and Protection Efforts

To date, fisheries management in the Nam Ngum reservoir has focused on undertaking research to generate much-needed information about the reservoir's fish species and their response to fishing pressure. Other management initiatives have focused on conserving and protecting the fishery through establishment of protected areas in critical breeding and spawning grounds and undertaking stocking programs for selected species. The Living Aquatic Resource Research Centre (LARReC) located at the reservoir has been the focal point for these management efforts. In addition to efforts to manage the capture fishery, caged fish culture has been strongly promoted as a means to provide an alternative source of income for fishers and to decrease pressure on natural fish populations. Since its introduction in the Nam Ngum reservoir in the early 1990's, caged fish culture has grown rapidly, with the number of cages increasing from only 55 in 1997 to more than 300 cages.

Looking to the future, fisheries managers are considering two options: (i) to leave the fishery as it is, which may produce the maximum amount of fish protein, but with a sub-optimal value; or (ii) to attempt to enhance the recruitment of large and more valuable species, such as Pa Sout Yai, *Hampala macrolepidota*, by identifying and protecting spawning and nursery areas and restricting fishing gear which targets immature fish.

Community Involvement in Fisheries Management

In addition to conservation and protection of the existing fishery, responsible authorities are considering better ways to manage the Nam Ngum fishery through greater empowerment of local communities as a stakeholders in fishery management.

A co-management approach to managing the Nam Ngum fishery is being considered which would include greater involvement of local communities in managing the fishery as part of a participatory management body involving all stakeholders (i.e., villages, district and province authorities, the reservoir management authority, and the fish dealers). Priority initiatives identified by stakeholders in seeking to address existing problems in the fishery included:

- Establishing clearly defined village fishing boundaries to avoid conflicts among fishers regarding access rights to fishing grounds
- Limiting access to the fishery by establishing a fish licensing system
- Improvement and enforcement of regulations to prevent illegal fishing practices
- Initiate regular monitoring and patrol of the fishery
- Undertaking a major fish re-stocking program
- Increasing protection of fish sanctuaries and conservation areas

- Establishing fair selling prices from fishers to stabilize incomes and provide for more equitable distribution of profits from the fishery

The challenge ahead in implementing these initiatives will be in achieving a balance between devolution of powers to local communities to provide for increased stewardship by the fishermen themselves and proactive responses by authorities at various levels (villages, districts, provinces) in ensuring that necessary institutional and regulatory reforms are undertaken. Questions remain about the capability of local communities to effect the necessary management actions and the interest of other stakeholders in diluting their management roles and in acquiescing to proposed changes to the existing management framework. An extended discussion of the challenges and opportunities lying ahead in improving management of the Nam Ngum fishery is provided in the attached reference readings.

Complicating the future management of the Nam Ngum fishery are plans to construct additional dams upstream. The Nam Ngum 2 dam, which is planned for construction at Keng Noi directly above the existing dam, may have major consequences for the Nam Ngum reservoir fishery.

SITE VISIT METHODOLOGY

Course participants will complete a one day visit to the Nam Ngum reservoir to learn more about the reservoir fishery and the challenge of managing this resource in a sustainable manner. Participants will be accompanied by knowledgeable resource persons during visits to the LARReC to find out about ongoing fish conservation and protection initiatives, to the fish market to view fish landing and handling, and during a tour of the reservoir to observe fishing practices (i.e., capture fishery, cage culture).

During the site visit, participants should consider the following questions:

- What is the state of fish populations in the reservoir?
- What fishing practices are commonly used by fishers?
- What changes have been observed in harvest rates and catch composition over the last 20 years?
- What predictions do fisheries scientists have for the future of the reservoir fishery?
- What do the fishers think the fishery will be like in 10 years time?
- What factors are contributing to over-fishing in the reservoir?
- What resource use conflicts are apparent in the reservoir?
- Are there alternatives to the capture fishery?
- Who are the stakeholders and interested parties in the Nam Ngum fishery?
- What role should local communities have in stewardship of the fishery?

- What actions can local communities take to address existing problems in the fishery?
- What measures could and should be taken by responsible authorities to improve management of the fishery?
- What is the optimum way of managing the fishery to maximize economic benefits? Is this strategy ecologically sustainable?

On completion of the site visit, the small groups will discuss their findings with emphasis on the practical lessons learned by participants which reinforce sustainable development and IREM theory taught in the course.

TAKE HOME MESSAGES

Anticipated lessons learned by course participants in completing the case study and site visit might include:

1. Open access fisheries such as the Nam Ngum fishery are inherently unsustainable in the long term. Possible responses are allocation of well-defined fishing rights (i.e., limit access to the fishery) combined with measures to restrict harvest rates to sustainable levels and to eliminate illegal fishing practices.
2. Community management of fisheries by itself is unlikely to be successful in ensuring the sustainability of fisheries. To succeed, local authorities (e.g., village elders) must be able influence individual fishers to practice sustainable fishing practices and to limit the number of people from their villages entering the fishery and have the authority to restrict access to the village's designated fishing grounds by fishers from other villages.
3. Underlying causes for resource management problems must be well understood if effective solutions are to be identified. A primary contributor to over-fishing in the Nam Ngum reservoir is the increasing size of the local population and the corresponding entry of increased number of people to the fishery. Proposed future management strategies for the fishery must provide for alternative sources of income for local communities if the problem of excess fishing pressure is to be resolved.
4. Effective fisheries management is inextricably linked with the understanding of the fish resource being managed. Unless fisheries managers properly understand the needs of fish species (e.g., habitat requirements) and population dynamics (i.e., in terms of determining allowable harvest rates and allowable fishing gear), they will be unable to set targets for management of the fishery and predict how fish populations will respond to harvesting pressure.

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