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Effects of access restrictions and stocking on small water body fisheries in Laos

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Four different management regimes were identified in small water bodies in Laos: open-access fisheries, both with and without stocking of exotics (mainly Nile tilapia *Oreochromis niloticus*); community fisheries with restricted access and regular stocking; and fisheries rented out to corporate entities, based on indigenous stocks only. These regimes represent all possible combinations of the two management measures, access (open/restricted) and stocking of exotic species (no/yes) and a test fishing experiment assessed their effects on stock abundance, richness and diversity. The combination of access restrictions and stocking had a strong positive effect on total standing stocks. Stocks of indigenous fish were significantly increased by access restrictions, while stocking of exotics had no effect on indigenous standing stocks. Community fisheries targeted large sizes of exotic species while reducing the exploitation of smaller size groups, which accounted for much of the indigenous stocks. This suggests that stocking can promote active effort regulation and reduce the exploitation of natural stocks. Data on yields and effort were too limited to allow the use of inferential statistics, but indicated that community fisheries were exploited with much lower effort and gave lower yields than open access fisheries, while providing higher returns to fishing effort. This suggests that active management is effective in increasing standing stocks and the efficiency of exploitation, but does not necessarily increase yields unless optimal management regimes can be identified and implemented by the management institutions. No significant effects on wild stock richness or diversity were detected in the test fishing experiment, but wide confidence limits indicated a low statistical power of the test and therefore no definitive conclusions could be drawn.

Key words: tilapia; carp; enhancement; introductions; diversity; fisheries management.

INTRODUCTION

Small water bodies are generally understood to comprise lakes, reservoirs and ponds <10 km^2 in area, and rivers and canals <100 km in length (Sugunan, 1997). Many small water bodies in the tropics support intensive-capture and culture-based fisheries, used for both subsistence and income generation. Small water bodies (particularly man-made reservoirs) are ubiquitous throughout the tropics, and are often easily accessible from settlements. The size of small water bodies is conducive to active management for two reasons. Firstly, many small water bodies are under the control of a single community, so that management decisions can be made and enforced relatively easily. Secondly, effective technical manipulations of the fishery are often possible even with limited investment. Small water body fisheries are therefore important inland fisheries resources. Bernacsek (1985) estimated that in Africa, for example, the combined

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fish production of small water bodies may match or even exceed that from the larger inland waters. Perennial small water bodies also serve as dry season refuges for species that colonize seasonally flooded habitats such as rice paddies, and therefore the economic and ecological importance of these water bodies may exceed that implied by the yields from direct exploitation.

Active management of small water body fisheries by local communities or corporate entities is not uncommon, and is being promoted widely by governmental and non-governmental organizations (NGOs). Common forms of active management involve the regulation of fishing, and often the stocking of exotic species such as tilapias and carps (Sugunan, 1997). The effects of these measures on fish stocks and yields have rarely been studied systematically. Where relevant information is available, it is often limited to particular management systems and does not allow a comparison between fundamentally different regimes such as open *v*. restricted access, or stocking of exotics *v*. reliance on indigenous stocks.

In Laos, fish is the main source of animal protein, and much of the supply is obtained by part-time subsistence fishing in paddies, small water bodies, and a few larger reservoirs and rivers including the Mekong. Small water bodies are exploited heavily and their active management by local communities is being promoted by the government as well as some NGOs. In particular community fisheries stocked with Nile tilapia *Oreochromis niloticus* L., and common *Cyprinus carpio* L., and Indian major carp *Cirrhinus mrigala* Hamilton and *Labeo rolita* Hamilton, are rapidly gaining in popularity as a result of both government promotion and village-to-village extension. However, little is known about the effects of these management measures, and the widespread stocking of exotic species in small water bodies has raised concerns about possible detrimental effects on natural fish stocks (Claridge, 1996).

The aim of the present study was to provide an empirical assessment of the effects of active management on the fish stocks of small water bodies in Laos. A comparative test fishing experiment was carried out to assess the effects of the regulation of fishing and the stocking of exotic species on the abundance and structure of fish stocks. Limited information on yields under alternative management was also obtained and analysed.

MATERIALS AND METHODS

The study was carried out between May 1995 and July 1997 in the Xe Champhone wetlands area in Savannakhet Province, Lao PDR (Claridge, 1996), and comprised three elements: informal surveys of small water body fisheries aimed at identifying prevalent management regimes, a comparative test fishing programme covering water bodies under alternative management, and the analysis of yield and effort data obtained from village records and a household survey.

Informal surveys of small water bodies were carried out using semi-structured interviews and visual methods such as participatory mapping and scoring (Chambers, 1992). This information was used to provide an a priori classification of management regimes for the test fishing experiment.

The test fishing experiment was designed with the aim of evaluating the effects of different management regimes (treatments) on fish stocks, rather than assessing the fisheries of individual water bodies. Consequently, test fishing effort was distributed over a large number of water bodies to provide sufficient true replicates for the assessment of treatment effects (cf. Hurlbert, 1984), with limited effort expended on each individual water body. The selection of water bodies for the test fishing programme was based on results from the informal survey and is detailed in the Results section. Test fishing was carried out using a standard set of eight monofilament gillnets of mesh-sizes 30, 35, 40, 60, 80, 100, 120, 140 mm (stretched mesh). For each sample, the complete set of nets was set by local fishermen at about 1800 hours and retrieved the following morning at about 0600 hours. Fish were recorded individually by species/genus, total length, and net mesh-size. Individual weights were recorded for a sub-set of test fishing events to establish length–weight relationships, which were then used to calculate weights from the length data collected for all samples. Test fishing catch per unit of effort (cpue) was expressed as weight per area of netting per night (g m^{-2} $night^{-1}$) for each individual net, and summed over the eight nets to provide an overall cpue estimate for the complete set. Data collection, including the taxonomic identification of specimens, was carried out in the field by trained staff of the Livestock and Fisheries Section of Savannakhet. Some genera proved too difficult to identify beyond genus level under field conditions. In order to maintain consistency of taxonomic level, the richness and diversity of natural stocks were determined at the genus level. Genus richness was determined as the cumulative number of genera recorded from all samples from a given water body, and diversity was expressed by the Shannon index calculated for biomass (Magurran, 1988).

Test fishing data were aggregated to one representative value per replicate (water body) and analysed by fitting a linear model of the form:

$$E(y)=\beta_0+\beta_1\ x_1+\beta_2\ x_2+\beta_3\ x_1x_2$$

where y is a quantitative dependent variable (e.g. test fishing cpue), and x_1 and x_2 are qualitative independent variables representing the factors access (open=0, restricted=1) and stocking (no=0, yes=1), respectively. The model parameters are: β_0, mean of y in the absence of active management (open access, no stocking); β_1, effect on y due to access restrictions; β_2, effect on y due to stocking; and β_3, effect on y due to the combination of access restrictions and stocking (interaction effect).

Yields and fishing effort in community fisheries were estimated from village records. In addition, a survey of household fishing activities and catches was carried out in the villages operating community fisheries. The survey provided yield and effort estimates for three of the open-access water bodies. In the survey, 20% of households in each village were visited every two months and interviewed about their fishing activities and catches during the previous week (1 week recall). These data were extrapolated to give annual catch and effort estimates for the individual water bodies.

RESULTS

SMALL WATER BODY FISHERIES AND MANAGEMENT REGIMES

Lacustrine small water bodies were abundant in the project area and comprised oxbow lakes, natural depressions and man-made reservoirs. Fisheries were under the *de facto* control of local communities. Many fisheries were open to individual use by all community members, while other fisheries were exploited communally or rented out to corporate entities. Exotic species, primarily Nile tilapia had been stocked in all community fisheries and some open-access water bodies. Four distinct management regimes were identified on the basis of access arrangements and the presence or absence of exotic species: open-access fisheries without stocking of exotic species; open-access fisheries with stocking of exotic species; community fisheries, all with regular stocking of exotic species; and fisheries rented out to corporate entities, all without stocking of exotic species. A more detailed description of the management systems is given in the following paragraphs.

Open-access fisheries were open to individual use by all community members (but not necessarily outsiders). The fisheries were exploited intensively using a wide range of active and passive gear: gillnets of all mesh-sizes, traps, hook and line, and partial de-watering; sometimes in conjunction with brushpiles used to aggregate fish and to delimit fishing territories. Individual fishing was carried out primarily for subsistence, although fish would be sold occasionally.

Exotic species (Nile tilapia) were present in only two of the open access fisheries studied. Both these fisheries occurred in villages operating community fisheries, and had been stocked occasionally with tilapia seed caught in the community fishery. Both fisheries were classified as stocked, although stocking may have been less intensive than in the community fisheries.

Community fisheries were exploited by and for the village community, as opposed to individual residents. Fish were sold to generate community income, and also consumed at village social occasions. Four community fisheries operated in the study area, and all involved the regular stocking of exotic species, mainly Nile tilapia but also common and Indian major carp. Exploitation was targeted at the stocked, exotic species. Only gillnets of large mesh-size (at least 100 mm stretched mesh) were used, in order to protect the stocked fish until they had reached a marketable size. Most community fisheries were operated by villages with access to several waterbodies, some of which were kept open for individual subsistence fishing. One village with access to only one water body also operated a community fishery, but allowed individual fishing with small gear (dipnets, etc.) for subsistence purposes. Stocking played an important role in the functioning of community management systems. The communal investment appeared to legitimize the communal control of resource exploitation, as well as precipitating a change from subsistence to commercial exploitation. The ease of enforcing access restrictions was a key criterion in the selection of water bodies for community fisheries, and all were located in the vicinity of villages.

Some fisheries had been rented out to corporate entities, usually groups set up by local residents to exploit the fisheries commercially. Three water bodies in the project area were rented out, all by villages with ample access to other water bodies for subsistence fishing. Fishing was restricted to the corporation, and was delayed until the height of the dry season when fish are most concentrated and easy to harvest. Although the corporations aimed to harvest their fisheries completely through intensive fishing and de-watering, this goal was achieved rarely. On the contrary, the effective effort in these fisheries was probably much lower than in open access water bodies. All water bodies rented out were located at some distance from the villages, and were policed by a member of the corporation.

DESIGN OF THE TEST FISHING SURVEY

The four management categories identified above may be represented by a two-dimensional classification using the factors access (open/restricted) and stocking of exotic species (no/yes). The test fishing survey was thus designed as a two-way factorial experiment. The selection of sites for the experiment, and consequently the number of replicates in each category, were determined largely by availability. Preliminary surveys identified only four community fisheries, three water bodies rented out, and two open-access fisheries where exotic species had been stocked at least occasionally; all were included in the sampling programme. Open-access fisheries without stocking were selected at random from sets of water bodies in the vicinity of the actively managed fisheries in order to obtain a similar coverage of physical environments.

The physical and management characteristics of the water bodies studied as summarized in Table I. Water body codes indicate the management category as (A) open access without stocking, (B) open access with stocking, (C) restricted access with stocking, and (D) restricted access without stocking. An analysis of variance was carried out to test for systematic differences in physical characteristics between water bodies under different management regimes, but no significant differences were detected.

EFFECTS OF MANAGEMENT ON FISH STOCKS

While the catch per unit of effort (cpue) of individual test fishing events varied over the study period (Fig. 1), restricted access fisheries (indicated by squares) generally showed the highest cpue, i.e. the highest relative abundance of stocks.

The highest mean cpue values (wild indigenous and stocked fish combined) were recorded in community fisheries (Fig. 2), followed by water bodies rented out. Open-access fisheries showed the lowest cpue values, regardless of whether or not they had been stocked. Catches of exotics were predominantly of tilapia, with small amounts of common carp in two community fisheries (C1 and C3). A total of 30 genera of fish was recorded in the test fishing experiment, comprising 28 indigenous genera and the introduced *Oreochromis* and *Cyprinus* (Appendix A). The cumulative number of genera recorded [Fig. 2(b)] was variable within management categories, and not noticeably different between them. Tilapia occurred in the test fishing catches of all stocked water bodies, while common carp occurred in only two.

Statistical analysis (Table II) shows that the combination of stocking and access restrictions had a significant and strong positive effect on total cpue. Neither of the main effects were significant, and the effect of stocking in particular was negligible. The reduced (main effects) model showed a strongly significant effect of access restrictions and a weakly significant effect of stocking. The cpue of indigenous stocks was significantly affected by access restrictions, but not by stocking. Richness (cumulative number of genera) and diversity of indigenous stocks were not significantly affected by either access restrictions or stocking.

Further insights into the effects of access restrictions on the stocks are gained from an analysis of cpue by gillnet mesh-size. Access restrictions had a marked positive effect on cpue for virtually all mesh-sizes (Fig. 3). Genus richness (including exotic genera) declined drastically with increasing mesh-size, from over 20–30 mm to no more than three at 80 mm or above. Exotic species were caught rarely in nets of <80 mm, but account for a significant proportion of the catch at $\geqslant 80$ mm. The restriction of harvesting in community fisheries to nets of $\geqslant 100$ mm mesh-size implies that the bulk of the catch was taken from exotic stocks, while indigenous stocks were virtually unexploited. This result is

Table I. Physical and management characteristics of water bodies, number of test fishing samples, and source yield information

Code	Name	Village	Area (ha)	Depth (m)	Secchi (cm)	Conductivity (μS)	Access	Stocking	Test fishing samples	Yield data
A1	Kout Yang	Nongbouaxang	3	1·5	100	60	O	N	4	
A2	Nong Hang	Konggnak	1	1	4	96	O	N	5	
A3	Kout Xehaknoi	Konggnak	6·3	1·5	36	55	O	N	4	HS
A4	Nong Sim	Nahoualouang	60	1·5	4	154	O	N	4	
A5	Huoy Chiao		35	3	27	135	O	N	4	
A6	Nong Lat	Kengkok	7·5	1·5			O	N	2	
A7	Nong Deun	Kengkok	25	1·5	6	380	O	N	3	
A8	Huoy Pikli		10	1	20	250	O	N	4	
B1	Nong Phai	Bungxang	2	2	41	175	O	Y	5	HS
B2	Kout Long	Konggnak	3·5	1·5	30	162	O	Y	6	HS
C1	Nong Bungxang	Bungxang	7	1·5	17	510	R (Comm.)	Y	2	VR
C2	Nong Bua	Xianghom	4·3	5	41	71	R (Comm.)	Y	4	VR
C3	Kout Ban	Konggnak	4·5	2·5	31	115	R (Comm.)	Y	3	VR
C4	Nong Hong	Nonghong	18·5	2	55	95	R (Comm.)*	Y	4	VR
D1	Nong Thomneung	Nahoualouang	15	1			R (Corp.)	N	2	
D2	Nong Thomleung	Nongpham	15	1	5	630	R (Corp.)	N	3	
D3	Nong Koutkhe	Nahoualouang	28	1·2	4	150	R (Corp.)	N	5	

Approximate area at the beginning of the dry season; maximum depth, Secchi depth and conductivity are all given at the height of the dry season (1997). Access arrangements: O, open; R (Comm.), restricted—communal; R (Corp.), restricted—corporate. Number of test fishing samples obtained, and source of yield and effort data where applicable: HS, household survey; VR, village records.

*Individual fishing with small gear (e.g. dip nets) allowed.

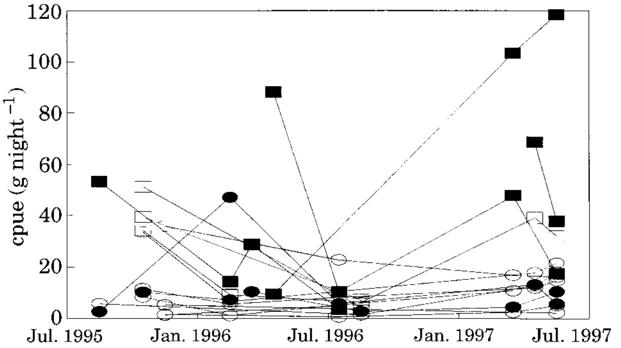

FIG. 1. Test fishing catch per unit of effort (cpue) over the study period. Data from the same water body are joined by lines. The shape of symbols indicates open (○) or restricted (□) access, while the fill pattern indicates stocking (filled) or no stocking (open) of exotic species.

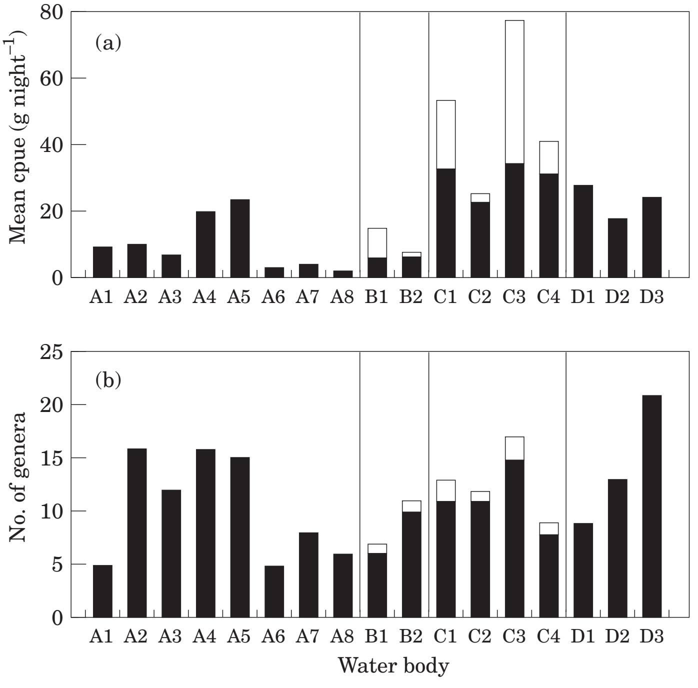

FIG. 2. Mean catch per unit of effort (cpue) (a), and cumulative number of genera recorded (b); for indigenous (■) and exotic (□) stocks. Water body codes indicate management categories: A, open access without stocking; B, open access with stocking; C, restricted access with stocking; D, restricted access without stocking.

consistent with village records, which indicated a dominance of tilapia in the community fishery catch.

YIELD AND EFFORT

Yields [Fig. 4(a)] varied widely within both management categories. On average, yields were higher in open access than in community fisheries (424 *v.* 228 kg ha^{-1} year^{-1}), but the low number of replicates precluded the use of

TABLE II. Effects of access restrictions and stocking on stock abundance (test fishing catch per unit of effort, cpue), the cumulative number of genera recorded (richness), and diversity (Shannon index H') of indigenous stocks: parameter estimates of the linear model with 90% confidence limits

Dependent variable	No active management β_0	Effects of Access β_1	Effects of Stocking β_2	Effects of Interaction β_3
Total cpue				
full model	9·8 [2·2, 17·5]	13·4 [− 1·3, 28·1]	1·4 [− 15·7, 18·6]	24·5 [0·6, 48·4]*
main effects	7·3 [− 0·5, 15·1]	22·7 [10·3, 35·1]*	14·1 [1·3, 26·9]*	
Indigenous cpue	9·8 [5·7, 14·0]	13·4 [5·5, 21·3]*	− 3·9 [− 13·1, 5·3]	10·9 [− 1·9, 23·7]
Richness	10·4 [7·5, 13·3]	4·0 [− 1·6, 9·5]	− 2·4 [− 8·8, 4·1]	− 0·7 [− 9·7, 8·3]
Diversity H'	1·8 [1·5, 2·1]	0·1 [− 0·5, 0·6]	− 0·2 [− 0·9, 0·4]	0·0 [− 0·9, 0·9]

*Significant (P<0·1).

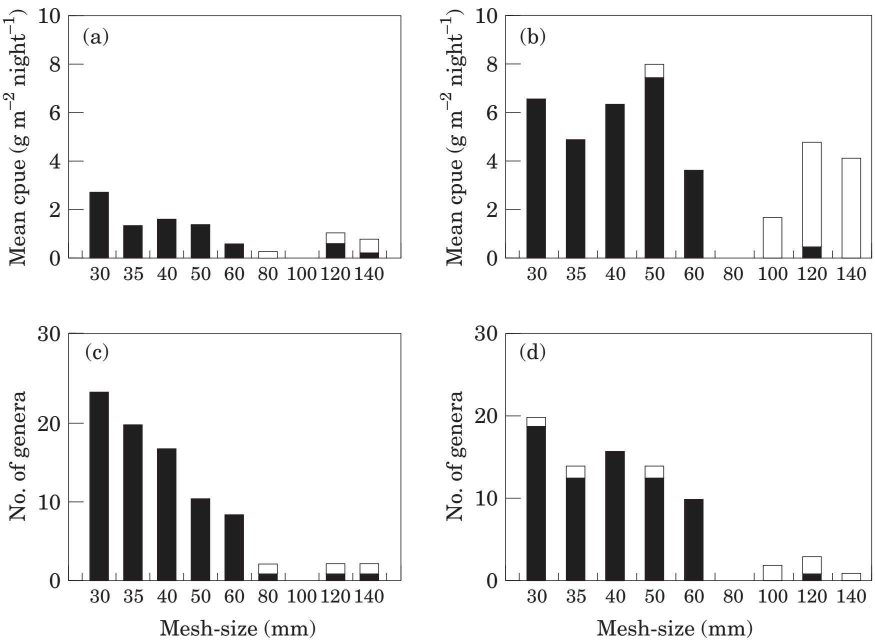

FIG. 3. Mean catch per unit of effort (cpue) (a, b) and cumulative number of genera recorded (c, d) with different mesh sizes of test fishing gill nets. Left-hand side (a, c): open access; right-hand side (b, d); restricted access. Fill patterns indicate indigenous (■) and exotic (□) and exotic stocks.

inferential statistics and therefore definitive conclusions regarding management effects on yields. Fishing effort [Fig. 4(b)] was higher in open access than in community fisheries (average 5966 *v.* 706 h ha^{-1} year^{-1}), but again no definitive conclusions could be drawn due to the limited number of replicates. The average yield and effort figures imply that catch per unit of effort was over four times higher in community fisheries than under open access (320 *v.* 70 g h^{-1}), and this

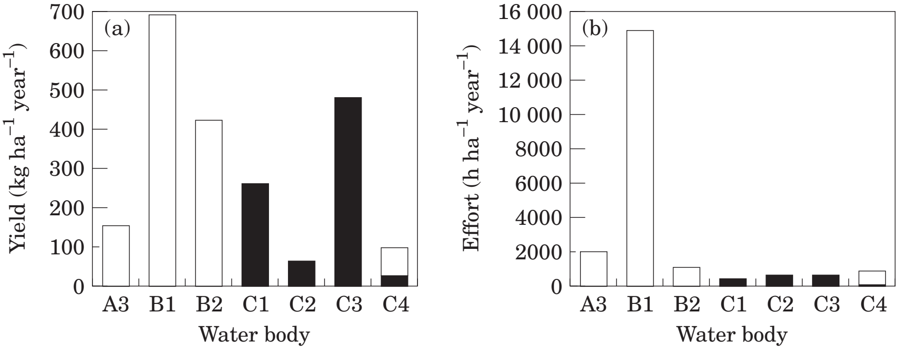

FIG. 4. Comparison of yield (a) and fishing effort (b) in some open access and community fisheries. Yields obtained by individual (□) and communal (■) fishing. Note that C4 was fished both communally, and individually with small gear. Water body codes indicate management categories: A, open access without stocking; B, open access with stocking; C, restricted access with stocking.

is consistent with the test fishing results. Hence community fisheries were exploited more efficiently in terms of the productivity of labour.

DISCUSSION

STUDY DESIGN

The validity of the conclusions derived from the test fishing experiment relies on the assumption that the experimental units do not differ systematically between treatments with regard to inherent properties that may have a bearing on stock abundance, richness or diversity. Ideally, treatments would be allocated at random (and in a balanced way) to the experimental units, but this approach was not practicable in this case where management decisions were made independently by local communities. The allocation of treatments was therefore non-random, apart from the unmanaged units selected at random from larger sets. However, there was no indication of any systematic differences in physical properties (area, depth, Secchi depth, conductivity) between water bodies subjected to different treatments. The main criterion used by villagers in the selection of water bodies for community management was the ease of policing, rather than any property related to biological productivity. Hence there is no indication that treatment units have been selected in a way that would introduce bias and violate the above assumption.

While the study showed significant effects of management on standing stocks, numbers of replicates were too small to allow a conclusive assessment of effects on genus richness or diversity.

MANAGEMENT IMPLICATIONS

The alternative management regimes identified in small water bodies in Laos reflect different underlying objectives of resource use. Open-access fisheries were used primarily for subsistence, while restricted access fisheries were used to generate community and/or individual income. These different objectives must be borne in mind when considering the implications of the identified management impacts on fish stocks and yields.

Open-access small water body fisheries in Laos are heavily exploited. Fisheries under restricted access showed significantly higher total standing stocks than under open access. The stocking of exotic species (Nile tilapia and common carp) also had a significant, positive effect on total standing stocks when combined with access restrictions. This illustrates the crucial importance of the exploitation regime in determining the impact of stocking on total fish abundance. Standing stocks of wild fish were affected significantly by access restrictions, but not by the stocking of tilapia and common carp.

The high abundance of wild stocks in community fisheries is a result of conservation measures adopted to protect the stocked fish, although limited incentives to fish communally and limited local demand to buy fish may also play a role. This shows that stocking must be assessed in the context of the overall management regime, rather than simply as the technical intervention of releasing fish (see also Lorenzen & Garaway, 1998). The question under what circumstances stocking can be instrumental in promoting a more sustainable exploitation of aquatic resources is intriguing and merits further investigation.

Overall yields from community fisheries appear to be lower, or at best equal to those from open access resources. The much higher cpue in community fisheries implies that these are exploited more efficiently than open-access systems. Interviews with villagers indicated that the increased returns to labour in community fisheries were noticed, and valued highly. Nevertheless, the question remains whether yields from community fisheries could be increased while maintaining acceptable returns to fishing effort. To address this question, it is useful to access the exploitation status of community and open access fisheries. The ratio of exploited to unexploited standing stock of a population provides an indicator of its exploitation status. The Schaefer production model predicts maximum sustainable yields (MSY) to be attained at 0·5 times the unexploited standing stock, while more general production models predict MSY to be attained at somewhat lower ratios, sometimes as low as 0·25 (Shepherd, 1982). Production models may also be used (albeit with caution) in the assessment of aggregated multispecies stocks (e.g. Pauly, 1979; Ralston & Polovina, 1982), particularly when the size and species composition of the aggregated stock is not strongly affected by exploitation, as in the case of the small water body fisheries (Fig. 3). While the test fishing survey did not include any unexploited stocks, it is clear that the ratio of heavily exploited to unexploited stocks must be smaller than that of heavily exploited to lightly exploited stocks. The ratio of standing stocks in open-access relative to restricted-access water bodies was 0·26 for combined indigenous and exotic stocks, and 0·33 for indigenous stocks only. Both values are at the lower end of the predicted ratios at MSY, and indiate that the open-access fisheries are likely to be overexploited. Restricted-access fisheries on the other hand appear to be underexploited, given their high standing stocks and apparently low fishing effort and yield. This suggests that maximal yields may be achieved at exploitation intensities intermediate between those presently realized in open- and restricted-access fisheries. The smaller indigenous stocks were virtually unexploited in community fisheries. The analysis of catches by gillnet mesh-size (Fig. 3) suggests also that exotic fish were caught rarely in small-mesh nets. It therefore seems possible that a certain level of fishing effort with these mesh-sizes could be sustained without significantly affecting the fishery for exotic species. Similar observations have been reported from Sri Lankan reservoirs (De Silva & Sirisena, 1987; Pet & Piet, 1993). The notion that none of the prevalent management regimes achieve maximum yields is also supported by a comparison of the available yield estimates with those obtained for culture-based community fisheries in neighbouring north-east Thailand. Lorenzen *et al*. (1998) found yields from 16 Thai community fisheries to be in the range of 26–2881 kg ha^{-1} $year^{-1}$, with a median of 652 kg ha^{-1} $year^{-1}$. Average yields in Laos were less than half of the median Thai yield, which was reached by only one out of seven Lao fisheries. In conclusion, the present management practices in community fisheries are effective at increasing standing stocks and the efficiency of exploitation, but fine tuning of the management regime would be required in order to increase yields. This may be achieved best through adaptive (experimental) management, a process that will almost certainly require adequate scientific support. The scope and need for an adaptive approach should be recognized by organizations promoting active management of small water body fisheries.

No significant effect of the stocking of Nile tilapia and common carp on the richness or diversity of natural stocks could be established. Point estimates suggest slight positive effects of access restrictions and slight negative effects of stocking on both richness and diversity, but neither was significant (Table II). The extremely wide confidence limits of both effects suggests a low statisical power of the test, and therefore the failure to demonstrate a significant effect must not be mistaken for a positive proof of its absence. A more extensive survey would be required before definitive conclusions with regard to management effects on diversity could be drawn. Given the continued expansion of tilapia and carp stocking in Laos and other Asian countries, this should be carried out as a matter of urgency.

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APPENDIX A. Genera recorded in the test fishing survey and presence/absence in individual water bodies

Genus	A1	A2	A3	A4	A5	A6	A7	A8	B1	B2	C1	C2	C3	C4	D1	D2	D3
Anabas	×	×			×			×		×	×	×		×	×		×
Chanda			×										×				
Channa	×	×	×	×	×		×		×	×	×	×			×	×	×
Chela		×											×				
Cirrhinus													×				
Clarias	×	×		×	×			×	×		×			×	×	×	×
Cyclocheilichthys		×	×	×	×	×	×	×			×		×	×			×
Cyprinus											×		×				
Dangila		×		×	×						×	×	×			×	×
Hampala	×	×	×	×	×		×		×	×	×	×		×	×	×	×
Kryptopterus													×				
Labeo							×									×	×
Macrochirichthys							×										
Macrognathus		×	×									×	×				
Mystus		×	×	×	×		×					×		×	×	×	×
Nandus					×			×									
Notopterus		×	×	×	×	×			×	×		×	×		×	×	×
Ompok		×	×	×	×			×		×			×	×	×	×	×
Oreochromis									×	×	×	×	×	×			
Osteochilus		×	×	×				×		×	×	×	×	×		×	×
Oxyelotris				×	×		×					×			×	×	×
Parachela						×							×				×
Paralaubuca		×		×		×			×	×	×		×			×	×
Pristolepis				×	×												×
Puntioplites				×	×	×	×				×					×	×
Puntius			×	×					×	×	×	×	×				×
Scaphognathops				×	×						×						×
Sikukia		×															×
Thynnichthys		×	×	×						×		×	×				×
Trichogaster	×	×	×		×					×			×	×	×	×	×