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## When Co-management Fails: A Review of Theory and Lessons Learned from Reservoir Fisheries in the Dry-Zone of Sri Lanka

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## ABSTRACT

Over recent decades co-management has become an increasingly popular form of governance reform in many developing countries. Viewed as a means of promoting sustainable and equitable management of natural resources, it has seen wide application in small-scale inland fisheries. However, perhaps because of its worthy credentials, there has been insufficient critical assessment of the results. This paper commences with a review of underlying theory which is then used to explore the reasons for failure of a co-management initiative in Sri Lankan reservoir fisheries between 2001 and 2002.

Co-management thinking arose from an earlier body of common property theory (CPT) which posited private or public ownership of the commons as the only rational response to increasing resource pressure. By contrast the co-management view states that under certain conditions, management is best left to local users, with support from the state, civil society or market sector where necessary. In turn, critics of co-management's rationalistic underpinnings point to a lack of cultural or political embeddedness which limits understanding of how power and accountability is distributed and shapes collective behaviour. Others suggest that the contentiousness of the CPT / co-management debate has resulted in neglect of key empirical features of fisheries commons – most critically the complex causes and consequences of change in fishing effort.

In the Sri Lankan case-study, emphasis is on understanding the environmental, technical and socio-economic drivers of effort change. The co-management initiatives took place in two small-medium size reservoirs (788ha and 1546ha) in Northwest province. These support artisanal gill-net fisheries, predominantly for exotic tilapias marketed on a highly local basis. The co-management strategy which involved local fisheries officers and fishing co-operatives, centred on fishing restrictions designed to sustain yields and increase mean catch size. Despite initial enthusiasm, the restrictions collapsed after 4-5 months with the onset of opportunistic free-riding. This was due to; lack of enforcement capacity, disproportionate hardship faced by the least economically mobile fisher groups and political patronage relations. Also, as compliant partners, the co-operatives had weak leverage in the decision making process.

Despite the short duration of effective restrictions, simultaneous analysis of local market trends demonstrated a remarkable rebound in yields pointing to the resilient regenerative capacity of the tilapia fishery. Furthermore historic commodity price data reveal long-term tilapia price stability and a close match between demand and supply even as fishing pressure has increased. Despite negative impacts on indigenous biodiversity, these features suggest fears of over-exploitation are unfounded and question the underlying premise for the co-management interventions.

Finally, results are used to highlight contextual differences with floodplain fisheries in Bangladesh, where declining wild harvests and the emergence of a vibrant aquaculture industry present very different challenges. Results caution against over-reliance on co-management as a blue print approach.

There is instead a need for detailed contextual analyses which move beyond a view of fisheries as closed-systems to incorporate broader livelihood based perspectives.

## INTRODUCTION

Common property resources such as fisheries, forests, rangelands, ground water resources and wildlife present formidable challenges to resource managers. Yet inland fisheries, the focus of this paper, are of disproportionate importance to the poor, relative to their volume and extent. Most are small-scale with over 90% of recorded inland fisheries catch; 8.2 million tonnes in 1998 (FAO 1999) coming from developing countries. Actual production is likely to be much higher due to uncertainty associated with micro-dispersed landings and high levels of localised subsistence consumption. Consequently inland fisheries have often been under-valued by policy makers.

Co-management can be defined as a partnership between the community of local resources users, other primary stakeholders (e.g. fish traders, service providers etc.), government and NGO's who together share responsibility and authority for resource management (Macfadyen et al 2005). The co-management approach also serves to shift emphasis from a fish-production to a people centric focus within the more holistic context of rural communities (ODI 2002). Its popularity amongst policy makers has been driven by recognition of a need to formalise existing community management practices within the wider legalistic and governance frameworks as a response to resource depletion and conflicts associated with rising fishing pressure. Decentralisation policies being pursued in many developing countries have also contributed to an enabling policy environment (Macfadyen et al *ibid*).

These factors, perhaps together with the 'participatory' merit implicit in the notion of co-management have resulted in widespread donor support for pilot programmes. However, there has been little rigorous evaluation of the anticipated impacts on target beneficiaries or with regard to the likely sustainability of these institutional forms.

Such assessments are essential if co-management is to be validated against alternative modes of governance reform. This paper is concerned with evaluating the potential of co-management strategies in small-scale inland fisheries as a means of empowering the poorest groups dependent on these resources to benefit from, and manage them sustainably.

The paper commences with a brief chronological review of theory relating to the management of the commons highlighting major policy impacts over recent decades. This is followed by a case study of co-management in two artisanal reservoir fisheries of the lowland Dry-Zone, Sri Lanka. The failure of these interventions is assessed in the context of the preceding theory. Finally, the relevance of the findings is used to highlight the comparative advantages of different co-management options in the context of Bangladesh floodplain fisheries.

## CHALLENGING THE CONSENSUS – A REVIEW OF COLLECTIVE MANAGEMENT THEORY

Over recent years the debate over how to best manage natural resources traditionally used by many individuals under shared access arrangements has revolved around two broad notions of (1) top-down management and (2) community or co-management (Fig. 1). The fisheries NR sector has been particularly instrumental in the development of both schools of thought.

The top-down management approach is associated with common property theory (CPT) which arose from a body of quantitative equilibrium models propounded by economists and natural scientists from the 1940's onwards (e.g. Von Neumann and Morgenstern, Schaefer 1954, Gordon 1954 and 1944, Hardin 1968). Ecological and economic concepts such as maximum sustainable yield, carrying capacity, resource rent etc. were incorporated in strategic game play models which assumed rational self-interest as the basis of decision making behaviour. The now familiar end point of Hardin's game play in his seminal *Tragedy of the Commons* (1968) was that due to opportunistic 'free-riding' behaviour, common property resources will ultimately be over-exploited and depleted without some degree of private enclosure or government access regulation.

This view has since been challenged by the community/ co-management proponents advocating decentralisation and local level management reforms for much of the commons. Rather than being a discrete theory, this view arose from a 'reactionary' body of inter-disciplinary research initiated by human ecologists and anthropologists in the 1970's (e.g. Acheson 1981, Berkes, 1977). These researchers used empirical case studies from natural resource settings around the world to challenge some of the basic assumptions underlying CPT.

A key premise of the 'top-down' management view is that resource users are unable to self-regulate due to the open access nature of the resource. Community management protagonists responded to the reductionism of this view by differentiating between two key features of shared resources; subtractibility - the degree to which one person's use will subtract from another and excludability the ability to control the number of resource users in the production system (Ostrom et al 1999, Berkes 2006). They went on to show under certain ecological and institutional forms, these features were sufficiently low/ high respectively to predispose local level NR management as the most sustainable and cost effective management forms. Communities, they observed, do in fact frequently develop sensible precautions against resource depletion based on a range of legally pluralistic social institutions including unwritten or customary local laws. Their conclusion is that 'open access' and 'common property resources (CPR)' are in fact two sub-sets of a wider 'common pool resource' where locally managed CPR could be considered as a viable fourth property estate (i.e. together with private, public and open access regimes).

In the 1980's the earlier critique of CPT was extended by political scientists influenced by the 'new institutional economics' (Ostrom 1990, Platteau 1989, Pinkerton 1989, Jentoft 1989). The 'neo-institutionalists' argued that economic

outcomes in the commons could be closely correlated with institutional arrangements and their associated transaction costs (literally the costs of co-operation). Here, institutions are narrowly viewed as 'systems of rights and rules providing incentives and disincentives for individuals to minimise transaction costs' (Ostrom 1990), emphasising the distinction between local/customary and external / modern institutions. This resulted in the earlier anthropological emphasis on local community involvement in management progressively giving ground to a broader 'co-management' view operating in the 'interface between the state, civil society and the market' (Ostrom *ibid*). Ostrom's approach to the problem of the commons involved the design of durable cooperative institutions organized and governed by the resource users themselves (i.e. rather than public or private control). Her eight 'design principles for durable common property resource institutions' expounded in her landmark work 'Governing the Commons' (*ibid*) was to have a major influence on other researchers, policy makers and NR managers. The principles include clearly defined resource boundaries, user dominated mechanisms to resolve conflicts and alter rules, monitors who are resource users or accountable to them, graduated sanctions and support / recognition of self-organisation rights by external authorities.

The emergence of the co-management view coincided with the liberalisation of centrally planned economies in many developing countries. It was consistent with over-lapping policy goals of governmental and non-governmental sectors by fulfilling a need for fiscal prudence by states coming to realise that abundant micro-dispersed natural resources traditionally under common ownership were frequently beyond their ability to manage and coincided with the emergence of the participatory development paradigm in the NGO sector.

McCay and Berkes (1994) framed this co-management position within the wider management context (Fig 1) proposing a continuum of seven co-management 'partnership arrangements', distinguished by degrees of power sharing and integration of local and centralised management systems. This framework will be returned to below within the context of a more recent divergence in the 'management debate'.

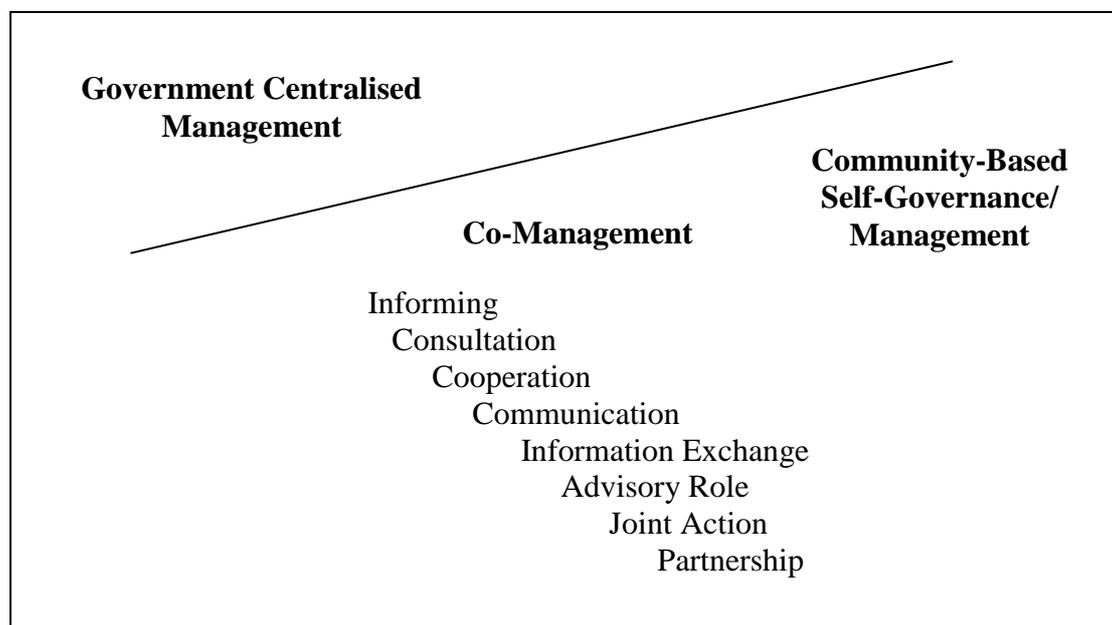


Fig 1. Biopolar co-management framework proposed by McCay and Berkes 1994 (modified from Bene and Neiland 2006)

More recently Jul-Larsen *et al* (2003) critique both sides of the management debate i.e. the model-based management and neo-institutionalist co-management schools. They propose a possible third 'no-management' option as an alternative to classical management theory's emphasis on limiting numbers of fishermen and co-management strategies. Their research focussed on biological, institutional and economic characteristics of small and medium sized lake fisheries of the South Africa Development Community (SADC) region (Democratic Republic of Congo, Malawi, Zambia and Zimbabwe). They illustrate their contention by pointing to the fact that static or slow change in fishing effort in some of the African lakes they studied does not correspond with any effective form of management, either at the state or local level.

The point of departure for their critique is the lack of socio-cultural or political embeddedness in CPT. Such context is critical to understanding how power and responsibility is distributed amongst different interest groups in society. Mosse (2006) makes a similar point, arguing that 'equilibrium outcomes based on autonomous rational self-interest do not adequately represent the social and political forces acting on traditional systems and behaviour'. Bene and Neiland (2003) characterise such forces as the drivers of *de facto* governance, distinguishable from a concept of management as the technocratic implementation of collective actions in accordance with *de jure* rules arising from governance decisions at a higher 'constitutional' level (Schlager and Ostrom 1992).

A recent body of anthropological work has also challenged the 'neo-institutionalist' clear-cut dichotomy of modern and local institutions - corresponding with formal and traditional rules of the game often framed in opposition, as a-historical and over simplistic. Instead the rules governing local management systems emerge as 'a result of negotiation and accommodation in long term power struggles with different actors, local and external basing their claims on 'different logics and values' that emerge over time (legal pluralism). Ambiguity and contradiction rather the internal coherence is often the norm. This 'constructivist' view implies that access regulation is a consequence of many overlapping sets of norms rather than just the consequence of a tension between external formal and traditional local rules frequently cited in the co-management literature.

Bene and Neiland (2006) point to the 'tyranny of participation' that can be fostered by uncritical application of the McKay-Berkes co-management framework (Fig 1). As a descriptive framework it has been used extensively for comparative purposes – but unlike CPT offers no analytical basis for assessing mechanisms underlying management reforms. The mono-dimensional concept of a gradient of power sharing at the core of model has, they suggest, mislead many users to over-rely on a lack of devolution/ local participation as an explanation for the failure of co-management approaches. Although participatory theorists emphasise the role of participation as the main or only source of empowerment, it is in fact but one of at least three pillars frequently cited as a requisite for decentralisation to be an effective

governance reform; the other two being transparency and accountability (Power 1997). Bene and Neiland (*ibid*) suggest that accountability – particularly when operating in a downward direction (i.e. towards the consumers of management decisions) – plays a more critical but frequently undervalued role. Indeed, without strong accountability all participatory approaches are likely to fail.

Furthermore, whether downward accountability is best served by weak participation (i.e. consultation or communication) or strong/ direct participation (i.e. joint action – Fig 1.) is likely to be highly context specific. From a review of 50 fisheries in developing countries they conclude ‘each fishery in each society has its own balance point’ on the scale of management intervention from state to local level. The inappropriate imposition of strong participation can have negative consequences such as local elite capture in heterogeneous communities with marked pre-existing power differentials, while the imposition of ‘pseudo-participation’ amounts to manipulation of beneficiaries by development professionals (Deshler and Sock 1985) potentially resulting in increased dependency. Conversely, uncritically citing weak participation/ power sharing for the failure of management reforms may incorrectly lay the blame on the implementing agency rather than the community. The authors conclude that greater attention should be paid to how, rather than how much, power is shared.

Jul-Larsen et al (*ibid*) also critique what they see as the management theorists over-emphasis on ‘who’ rather than ‘what’ should be managed, which they term ‘the management-belief problem’. Firstly they point to a body of work during the 1990’s termed the ‘new ecology’ derived mainly from empirical studies on forestry, pastoralism and other land use (e.g. Ellis 1988). These researchers challenge the traditional view of closed ecosystems free of human interference attaining or moving toward an equilibrium state. Instead they view ‘ever-changing non-equilibrium’ states as the norm due to the influence of key variables outside the system boundary i.e. climatic factors. This has major implications for CPT; an equilibrium approach which considers human intervention as the most significant external variable. In the new ecology view the correlation between fishing effort and the re-generative capacity of the ecosystem – and therefore the predictive value of CPT - is less clear due to the uncertain impact of abiotic variables. This in turn reduces the role for detailed fisheries regulation in certain systems i.e. especially those with a chaotic, seasonal or inter-annual variation. Further more such variability is likely to be much more characteristic of tropical (e.g. flood plain ‘pulse’ fisheries, seasonal reservoirs, lakes) than the temperate fisheries for which most of the models were developed.

Nevertheless the short-comings of CPT cited by the co-management school overlook the fact that it is an analytical model with empirical relevance only when/ if its underlying assumptions are correct. Although its utility as an analytical tool is well demonstrated, the fact that both schools often continue to treat it as an empirical model has often confused and limited the wider scope of the debate.

Jul-Larsen et al (*ibid*) contend that such distraction has resulted in the neglect of key ‘real-life’ empirical features of fisheries commons – most critically the complex causes and consequences of changes in fishing effort. They suggest

where fisheries are viewed as closed systems; increased fishing effort is often over-simplistically correlated with economic or demographic growth. Broader livelihood based perspectives indicate that effort changes are likely to be more dynamic than visions of a Malthusian 'last resort' would suggest (Pauly 1994). Small-scale artisanal fisheries instead frequently act as economic buffer zones with a constant flux out as well as into the sector as opportunities arise in other sectors of the formal or informal economy. Furthermore fisheries often exist as part of a package of diversified livelihood options, concurrent or simultaneous, which the poor constantly juggle to manage risk. Such 'pluriactivity' is especially characteristic of those living in marginal, resource poor or other vulnerable environments for example, fisherman and farmers living on flood plains. Only such a broad context allows us to appreciate the degree of dependency and therefore the extent to which the poor are likely to prioritise fishing as a livelihood activity.

## CO-MANAGEMENT OR NO-MANAGEMENT IN SRI LANKA?

In the second section of this paper, some of the ideas developed above are used to address the case for co-management of commercial reservoir fisheries in the Dry-Zone of Sri Lanka. Findings are based on market research conducted in N.W Province by the author during a 21 month period from 2000 and 2001 (Murray et al 2001).

Following their introduction in the early 1950's, tilapias rapidly colonised most of the country's fresh and brackish water resources, stimulating the growth of what has essentially become a single-species, single-gear (gill-net) artisanal fishery. Today commercial production of tilapias from perennial reservoirs typically amounts to 80-95% of total volume. Most of this production is locally marketed in fresh form by diffuse networks of two-wheeler vendors, while urban demand is predominantly catered for with marine fish supplied by a cold chain. Cheaper small marine varieties such as sardines also augment rural consumption during seasonal periods of lean inland production. Nationally, fresh and dried fish constitutes 65-70% of total animal protein intake rising to as much as 85% in rural areas (NARA 1999, Nathaniel & Silva 1998). Given the economic geography of this production base, it is reasonable to assume that the rise of the tilapia fishery, which accompanied large-scale reservoir rehabilitation, was a key factor facilitating repopulation of the Dry-Zone in the post-independence era.

Fig 2 shows the distribution of small and medium size perennial reservoirs supporting commercial fisheries (>200 – 2,858ha) in the research area. The high storage density combined with a relatively high rural population density (>290 persons/ km<sup>2</sup>) means that most production is marketed fresh, within a 30-40 mile radius around multiple landing points (Plate 1) reaching even the most remote settlements.

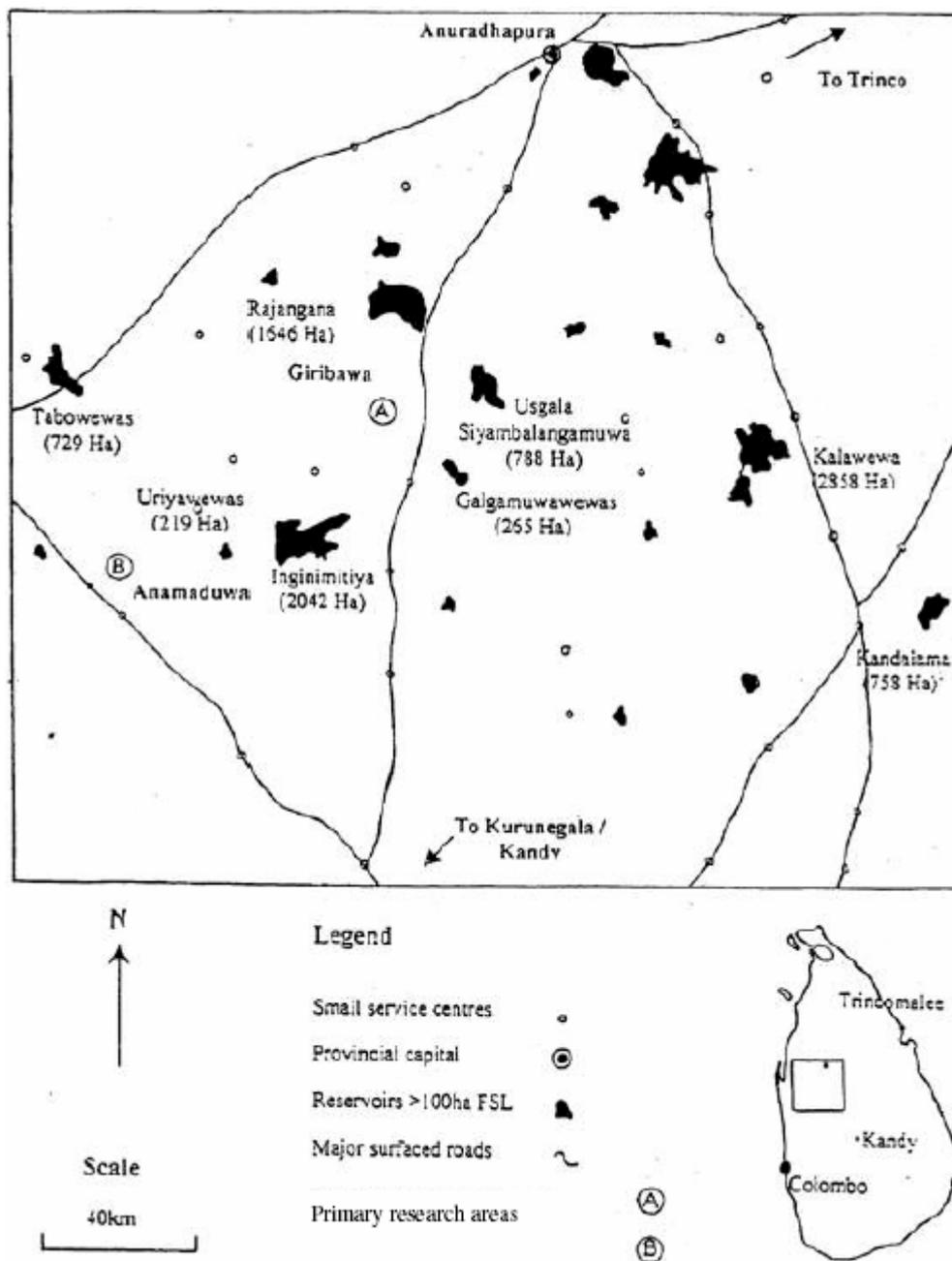


Figure 2. Location of reservoirs with commercial fisheries in the research area, N.W Province Sri Lanka (Murray 2004)



Plate 1 Bicycle vendors purchase tilapia from a landing site on Rajangana reservoir at first light (note wire mesh keep cage (R) and single outside carp (C) in catch)

Detailed longitudinal market research focussed on fresh fish sales in Galgamuwa town, a small administrative and agrarian service centre (Population 14,680 – GOSL 2000) located close to Usgala Siyambalangamuwa (788ha) and Rajangana (1646ha) reservoirs (Fig 1). Most of its inland fish supply originates from these two sources. Volume and price information for inland fish and its principle substitutes was collected on weekly basis between January 2000 and September 2001. Main outlets were a busy junction for inland fish (Fig 2) and periodic roadside stalls for marine and occasionally inland fish.



Plate 2. Cartel of 2-wheeler vendors selling inland fish at Galgamuwa junction

Purely by chance, this research period coincided with attempts by the Ministry of Fisheries and Aquaculture Resource Development (MOFARD) to re-

establish functional fishing co-operatives through co-management interventions. Most of these institutions had effectively collapsed after a politically motivated selective withdrawal of Government financial support to the inland fisheries and freshwater aquaculture sectors from 1989 to 1994.

No reliable official statistics were collected during this period (here-after referred to as the 'ban'), however anecdotal evidence points to increased effort resulting from rising numbers of unregulated casual entrants 'down-fishing' with progressively smaller mesh sizes and intensive methods. The great majority of participants could be characterised as fisherman-farmers, relatively recently diversified into fishing. Only in Rajangane was there a group of specialised fishermen; low-caste (kawara), encroached / landless Christians – of coastal origin. Most observers contend that the inland 'ban' was politically influenced by a desire to deter this low status group from settling permanently in the 'Buddhist hinterland'. As professional marine fishers, they were the first to recognise the commercial potential of the emergent tilapia fishery. At the same time the clear economic imperative presented by the new fishery encouraged the higher-caste farmer group to accommodate and ultimately normalise the practice of commercial gill-net fishing. Even as they retained a traditional taboo on subsistence level fishing using hook and line gears in smaller seasonal tanks (village reservoirs) as low status 'pity work' (Murray 2004).

This trend reflects a frequent occurrence whereby non-traditional fishers move into established fishing grounds of professional artisanal fishers as effort intensifies. The distinctive feature here was the weak informal access rights associated with transhumance livelihood strategies of the 'coastal-inland' fishermen's, as well as their lack of political patronage. Consequently, for the most part they were easily displaced by landed riparian new-comers. The few communities that remained can often be found in semi-permanent settlements illegally encroached in 'protected' forested watershed areas.

Fishing restrictions form the main plank of most co-management strategies and here too the main commitment of MOFARD was to support their implementation and enforcement. The management goal of the restrictions was to sustain or increase yields while adding value through increased mean catch size. Their precise design was based on lengthy consultations between government fisheries officers and the memberships of registered fishermen's co-operatives; 3 in the larger Rajangana and 1 in Usgala reservoir. This included meetings with the entire co-operative memberships and in the case of Rajangana follow-up meetings to broker consensus between the 3 different societies.

In both reservoirs it was agreed to restrict the use of undersize nets (<7.6cm stretched mesh size) as well as highly efficient gears (beach seines, mono-filament and sandwich 'trammel' gill nets) and intensive active-fishing practices know as 'beating'. In Usgala a majority of members requested the imposition of an additional ban on night fishing in order to reduce poaching from gears set to fish passively overnight. This resulted in wastage of fish which perished in the gears early in the night and more seriously conflicts associated with the practice of poaching and damage to competitors' nets under cover of darkness. This was implemented by locking boats up between sunset and sunrise. The consultations demonstrated that the majority of

fishermen were highly supportive of the need for reforms but felt that fishing restrictions would only be effective with external support to help enforce them.

The consequences of the fishing restrictions which commenced in December 2000 could be clearly observed in market trends for inland fish and its substitutes recorded in Galgamuwa Town.

For the first 12 months, similar volumes of fresh inland and marine species were available in Galgamuwa (Fig. 3) with relatively modest and predictable seasonal fluctuations in supply and price. This changed dramatically after the imposition of restrictions. An immediate and sharp fall in yields of medium and small size tilapia (<175g) was the first consequence (Fig. 4). These lower cost, size classes had hitherto constituted the bulk of product reaching remote villages and a smaller but significant component of the town's retail turnover. The deficit was compounded during February and March when priority for the remaining catch was given to feeding agricultural labourers harvesting the main paddy crop cultivated under the same reservoirs. Inland fish prices reached their maximum levels during this period of deficit which lasted from January to May 2001.

This prompted opportunistic marine traders to substantially increase the amount of marine fish coming to market with three new stalls commencing daily operation to cope with the demand. This catered for retail demand in the town, but the greatest volumes were for wholesale distribution through bicycle networks supplying surrounding villages, now with negligible access to their primary source of inland supply. Most of this volume consisted of sardines (72.3% of entire marine sales) which were fortuitously in plentiful seasonal supply during the period of restriction. The low prices of these varieties made them almost perfect substitutes for small tilapias (Fig. 3 - their high cross-elasticity of demand is only impeded by inferior quality perceptions associated with iced fish).

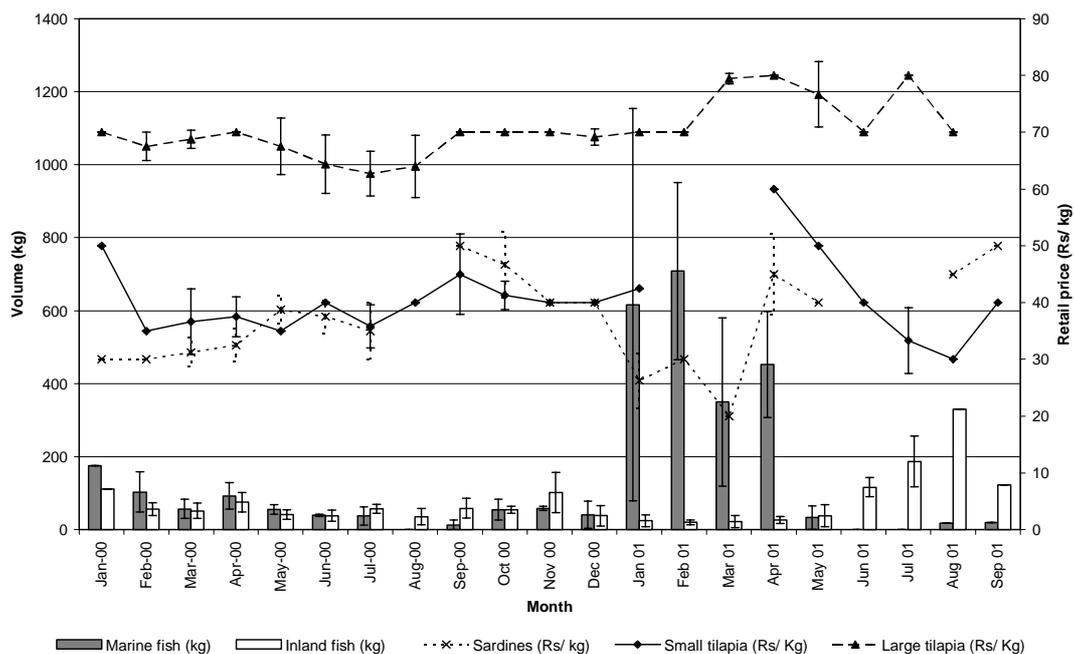


Figure 3 Mean daily volumes of fresh inland and marine fish and mean monthly retail prices for selected varieties in Galgamuwa town NWP 2000-2001 (standard deviations indicated)

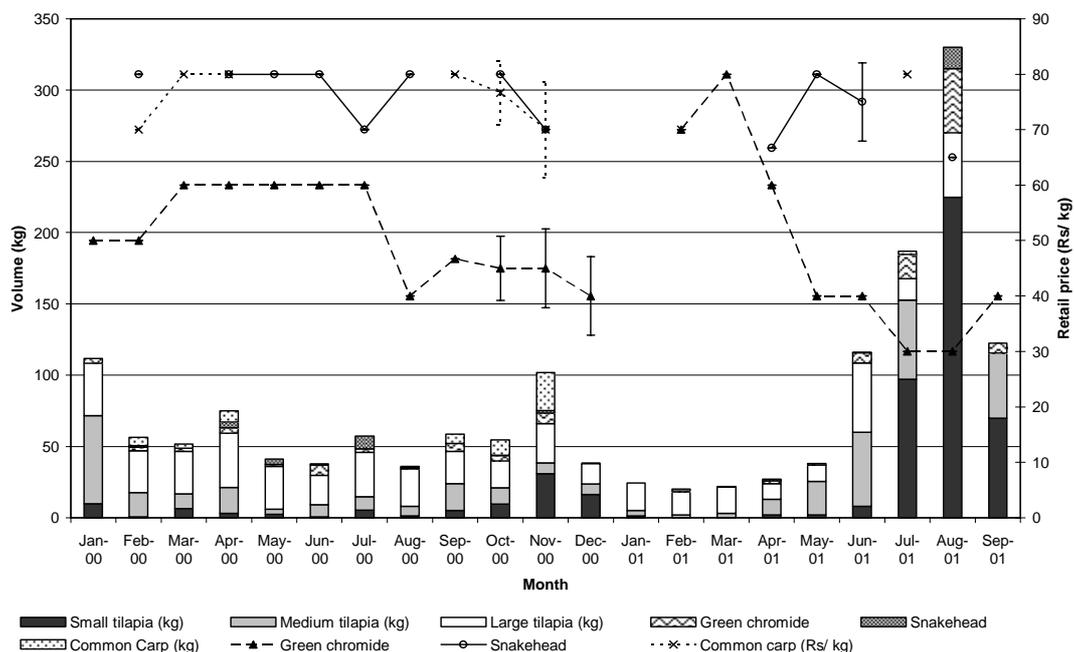


Figure 5. Mean total daily volumes for principle fresh inland fish varieties and mean monthly retail prices for selected varieties in Galgamuwa town NWP 2000-2001 (price standard deviations indicated)

After a period of rigorous compliance the restrictions began to break down and once free-riding commenced the complete break-down of rules ensued rapidly; first in Rajangana reservoir and subsequently and more progressively in Usgala. In the first instance conflicts between the different co-operatives occurred when the gears of the *kawara* group who had extended their informally accepted fishing range (for want of alternative income activities), were damaged by a second group. In Usgala the breakdown was internal to the single group and commenced with the resumption of night fishing by a small number of individuals. The incentive to free-ride was enhanced by dramatic yield reductions in the short-term, indicating that a more progressive system of restrictions may have been more sustainable. In this respect, the uniform adoption of a ban on small-mesh gillnets <7.6cm, (the prevailing though rarely observed legal limit), suggests that the outcomes of the consultation process were to some extent pre-determined by MOFARD to comply with national statutes.

Attempts by the co-operatives to resolve the conflicts failed as no effective external enforcement mechanism was available. This was despite the good intentions of local fisheries officers who were few in number and lacked resources (e.g. officers frequently relied on public transport to visit reservoir sites). There was also a lack of co-operation between different government agencies and political patronage was offered to influential free-riders.

By June 2001 intensive fishing practices had resumed in both locations with production levels rebounding to the highest levels and lowest prices observed during the survey period. Total volume reached over 330kg per day consisting

mainly of smaller tilapias whose price fell to Rs30/ kg during August 2001. Marine supplies immediately fell as a consequence – with the same stallholders moving to trade surplus tilapia while the glut lasted. This surge in productivity, which was well above the usual seasonal dry-season increase in CPUE can be attributed to the protection given to younger cohorts during the effective period of fishing restriction.

The intensive gillnet fishery has undoubtedly had negative secondary impacts on indigenous biodiversity; once commercially significant minor cyprinids such as *Labeo porcellus*, *L. dussumieri* and *Puntius sarana* are now at the edge of consumer memory. However the rapid total yield recovery demonstrates the outstanding resilience of tilapia stocks to the same pressure and explains their increasing contribution to total catches. This is attributable to tilapia's r-selected ecological traits which include: high fecundity; small size; short generation time; and the ability to disperse offspring widely. Such traits confer advantages in unstable or unpredictable environments, exemplified in this instance by wide hydrological fluctuations associated with periods of intense fishing effort. The ability to reproduce quickly at small size is especially crucial in this context. Tilapias can breed at sizes well below 20g, will reach sexual maturity after only 6 months and breed much more evenly throughout the year than other indigenous and exotic carps whose reproductive behaviour is tied more closely to the monsoonal cycle. Therefore even in an intensive open access fishery, a highly responsive dynamic equilibrium is likely to operate as participants move in and out of the fishery in response to yield variations. Although CPUE levels were not evaluated in these commercial fisheries, subsistence fishermen harvesting seasonal tanks in the same area rarely extended fishing activity at levels below 0.5kg/hr (Murray 2004).

It would be instructive to test the generality of this thesis against official inland catch statistics. Unfortunately, such statistics are extremely sensitive to monitoring capacity which was all but absent during the 'ban' and remains weak. Yet they are still an important basis for formulation of fisheries management policy so will be considered briefly. The period of the 'ban' is of particular interest – as it was effectively a reverse of the current case study – deregulation followed by an attempt to restore management systems. Available statistics (Fig. 5) suggest a dramatic crash (1989) followed by a steep rebound in freshwater yields after withdrawal of the 'ban' (1994) whereas an immediate surge in production would be a much more likely consequence of de-regulation. This is supported by results from a scientific case-study of 5 reservoirs (Amerasinghe 1999) which detected a decrease in mean landing sizes for the two dominant species of tilapia in the fishery shortly after the 'ban'.

Regardless of provenance, the official figures have been used to support resumption of some 'pre-ban' (1980's) intervention strategies which attract sizeable bilateral grant or loan support e.g. culture based-stocking enhancements. Low recovery rates of stocked fish, particularly in larger perennial water (>700ha Amarasinghe 1988) have resulted in a shift of focus to smaller perennial and semi-seasonal water bodies. However, here too, little evidence exists to suggest sustained community involvement or incentive for private sector seed provision (Murray 2001).

The largest surge in reported production during the late 1980's correlates more closely with state rather than private sector investment. Heavily subsidised gears (fibre-glass out-rigger canoes and gill-nets) were provided by the government from 1979 onwards (Amarasinghe 1999). This also had institutional consequences. Funds were to be channelled exclusively through newly established fisheries co-operative societies providing an incentive for almost all fishermen operating in the country's perennial reservoirs to register for membership (Amarasinghe *ibid*). MOFARD then implemented management policies through these institutions. This client-focused arrangement suggests that local resource users had negligible institutional leverage to demand downward accountability and decentralisation of decision-making processes from MOFARD. Even where real political will to decentralised governance exists – such institutional leverage is a key feature of sustainable co-management options.

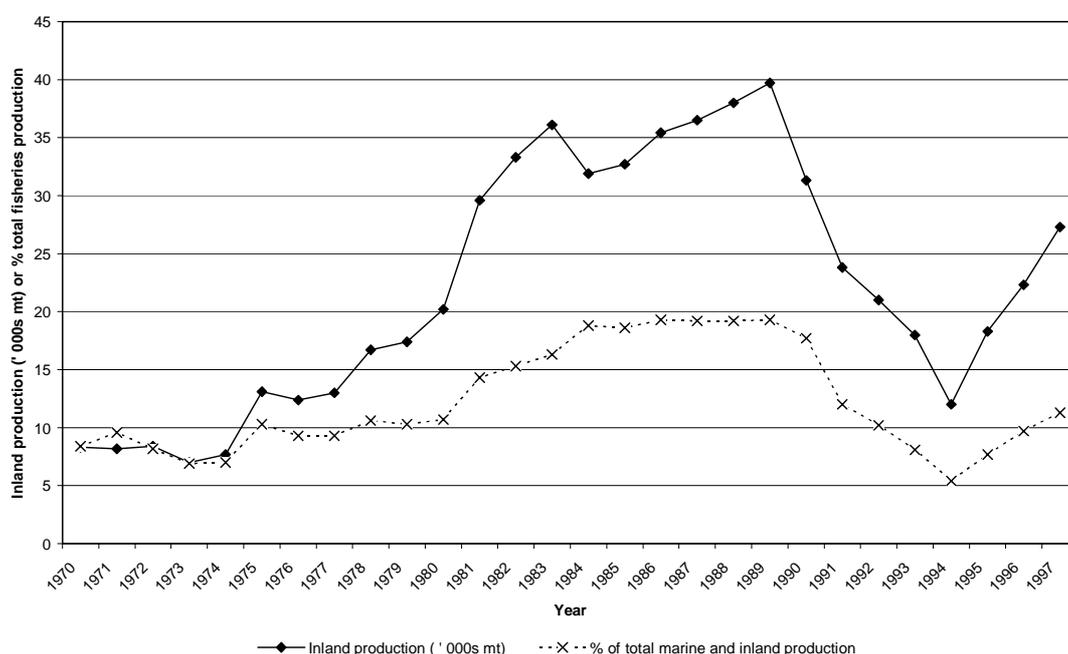


Figure 5. Inland fish production in Sri Lanka 1970-1997 (source NARA Fisheries Year Book 1998)

Commodity price indices offer a more reliable means of evaluating the balance between population-driven increases in demand and available supply (Fig 6). Between 1992 and 1998, the retail price of tilapia rose almost in parity with inflation which averaged 12.2% per annum equivalent to a compound rate of 103% over the same 7 years (Central Bank 1998). This historic stability also points to the resilient regenerative capacity of the fishery and suggests fears of over-exploitation are unfounded despite anecdotal reports of decreases in individual fisher yields. Such resilience together with the highly segmented demand for inland fish (i.e. predominantly rural) is also the main reason for the lack of an economically viable inland food-fish aquaculture sector in Sri Lanka – yet kick-starting this sector also remains a key tenet underlying technical assistance grants solicited by the state.

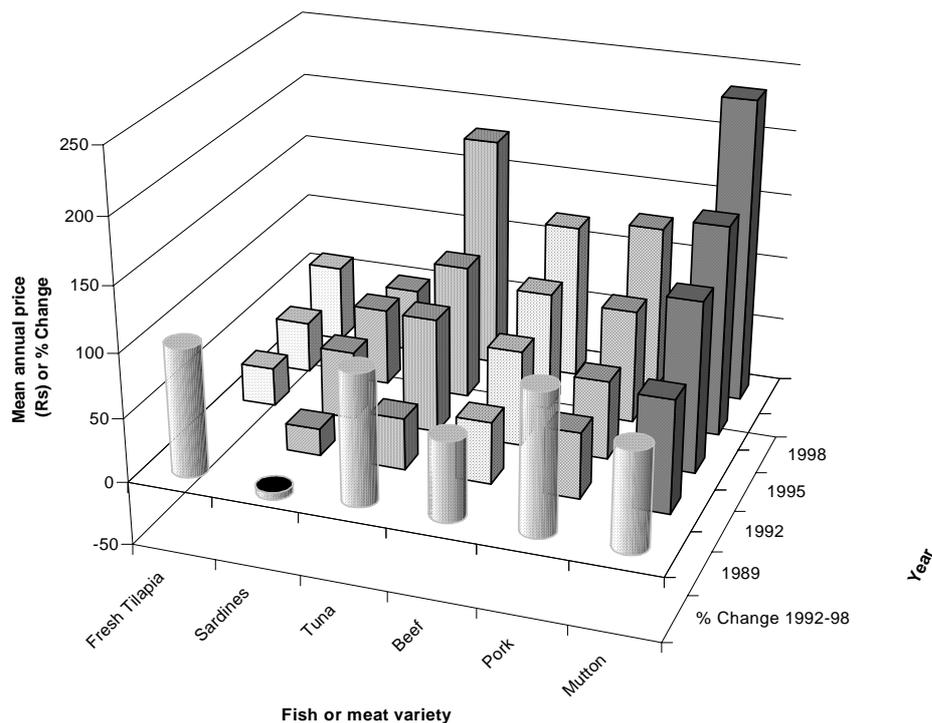


Figure 6. Historic trends in fresh fish and meat substitute retail prices, Colombo 1989-1999 (Data Source ARTI 1988). Note: round bars = total % increase in retail price over the 7 year period.

Findings from this research bear some striking parallels with those of Jul-Larsen et al (*ibid*) on SADC small and medium-scale lake fisheries; particularly with regard to their caution against over-reliance on classical management theory emphasis on limiting numbers of fishermen and uncritical application of co-management strategies.

In both studies fishing intensification resulted mainly from increasing numbers of fishers over and above investment or technology driven change (e.g. more efficient gears). Furthermore, environmental rather than economic factors appear to be the predominant causal factors underlying this change. The regenerative resilience of the tilapia fishery, the principle environmental driver was considered above. The economic drivers of intensification are assessed in the remaining part of the text.

The incentive for external investment driven growth is limited due to the fact that the market already equates closely to the elusive assumptions of 'perfect competition' underlying micro-economic demand and supply theory i.e. there exists (1) a highly homogeneous quality fresh product, (2) free access to market information associated with localised demand (3) all actors are price-takers (4) only 'normal' profits are available resulting in highly equitable value chain margins and (5) low trading overheads in dispersed rural markets for inland fish promote free entry in and out of the market.

These factors also help explain the persistence of low-tech production and distribution networks (canoes, gill-nets and bicycles) with low reliance on external inputs e.g. fuel or refrigeration costs. This is in marked contrast to the marine and other agricultural sectors where availability of scale-economies (e.g. bulking-opportunities) and provision of costly external inputs are closely associated with tied-marketing contracts and long-term credit and other service provision by a relatively small number of external agents with access to investment capital. In the inland sector, such transactions are for the most part highly localised, small-scale and take place mainly on an informal relational basis directly between producers and one or more vendors.

Such features effectively insulate the inland fishery from external 'shocks' experienced in the wider liberalizing economy e.g. policy fluctuations on state market interventions, input/ output subsidies, volatile energy and agrochemical prices etc. For example, technology driven intensification in the marine sector followed by increasing fuel prices drove many artisanal motorised day-boats from the inshore sector prior to the tsunami (Kelegama 1999). Viewed in this 'vulnerability context' – the resilience (see below) and distributive equitability of the inland sector clearly makes it directly and indirectly, a vital safety-net to large numbers of the rural poor: producers, market intermediaries and consumers. From a policy perspective in this sector at least, a precautionary approach should be taken to promotion of external investment driven growth; for example through attempts to promote urban consumption of inland fish to promote an aquaculture sector. Such attempts are anyway unlikely to have much realistic chance of success given the current configuration of robust fishery and segmented consumer demand.

Social differentiation between resource users was a further key-feature of the current study. Only the full-time low-caste (kawara) fishermen could be considered users of the last resort and consequently, it was they who were the first to be driven to significant levels of opportunistic free-riding behaviour. By contrast the great majority of landed fishermen-farmers with more diversified livelihood portfolios relied on fishing more as an economic-buffer than a sole-income provider. This relative economic mobility undoubtedly enhanced their propensity to comply with sanctions, added to which the main period of the sanctions also coincided with the busiest season in the agricultural calendar.

The current case study not only demonstrates a failure of the planned co-management strategy – but also raises serious questions regarding its wider applicability as a governance reform in the specific environmental and socio-economic context of the Dry-Zone reservoir fishery. Firstly there is a lack of clear evidence that productivity gains would justify the additional institutional transaction costs given the highly regenerative capacity of the tilapia fishery. Secondly in the absence of effective enforcement, restrictions on smaller sized catches are likely to have disproportionately adverse effects on the poorest groups in the market chain including remote consumers. Furthermore significant private-sector investment driven growth is unlikely given the current market configuration whereby simple fishing methods with lower CPUE are likely to prevail over more capital intensive technologies. In this context it seems evident that the bipolar management framework (Fig 1) should be expanded to incorporate a more laissez-faire or 'no-management' approach.

## RELEVANCE OF FINDINGS TO BANGLADESH FLOODPLAIN FISHERIES

These findings also point to useful comparative lessons with other resource settings – especially where there is comparable reliance on inland fish as a provider of high-quality dietary protein. For example, population-driven intensification in Bangladesh floodplain fisheries has also resulted in catch composition moving towards small and fast maturing species low in the food chain. Self-recruiting r-selected exotics such as tilapia (first introduced here too in the 1950's) are likely to become more significant in wild catches though environmental conditions are far less favourable for tilapia than in Sri Lankan reservoirs. Inland fishery yields have declined dramatically over recent decades contributing to the emergence of a rapidly growing and diversifying aquaculture sector which today constitutes some 30% of a total annual fisheries yield of 1,400,000 mt (De Graaf and Latif 2006). This trend seems set to continue and seems to be the most realistic means of securing the country's future fish needs (Gregory *et al* 2007). Yet such intensification inevitably demands higher investment security including secure property rights, which, in turn is likely to drive increased privatisation and enclosure of seasonal floodplain commons. Given the traditional reliance of large numbers of functionally land-less farmers and fishermen on such shared aquatic resources, there appears to be a compelling role for co-management approaches within development policy. These approaches may have potential for application within the stagnating fishery and emergent aquaculture sectors (see below).

Co-management enabling factors include the wide availability of NGO sponsored micro-credit and improving access to relatively un-segmented (compared to Sri Lanka) local and regional markets and a favourable policy environment. Constraints to community-based fisheries management (CBFM) include: complex social relations, weak public-sector capacity for longer-term institutional support, insecure and overlapping access rights, to floodplain resources, rent seeking by local elites, competing land-uses, competing off-farm employment opportunities (including aquaculture!) and uncertain returns to effort.

In terms of economic sustainability at least, aquaculture based co-management systems appear to have demonstrated greater promise than CBFM models, most of which remain pilot initiatives strongly supported by donor projects. Two recent examples of the former approach are predicated on the pooling and enclosure of private lands under seasonal floodplains for semi-intensive aquaculture. The first, developed by Worldfish and the local NGO, Proshika (Dey and Prein 2005) relies on temporary enclosure (fencing which also permits ingress of small wild fish) culture-based stocking and feeding. The so-called Daudkandi model, named after its area of origin near Comilla and originated by the NGO SHISUK, is a more intensive model requiring higher investment in earthen dykes which extend the inundation period.

The models also have markedly different institutional frameworks with consequences for poverty-impact (this is highly significant since both models

exclude traditional fishers from their communal fishing grounds). The first relies on traditional NGO advocacy to support inclusion of the landless-poor as labourers. Unfortunately such transaction costs are rarely acknowledged or fully-costed, raising serious doubts over their sustained inclusion once external support is withdrawn. The Daudkandi model is a more novel joint-venture co-operative model incorporating low-cost micro-credit share options for poorer community members. The NGO also engages as an active share-holding partner committing them to a longer term presence and there is clear evidence of sustained positive impacts on local economies including employment and service opportunities for the poor, nutritional benefits and higher interim rice yields.

Nevertheless, here too questions remain regarding potential for longer-term elite capture (Gregory et al 2007). SHISUK are currently testing the model in perennial beels (shallow floodplain lakes - with fisheries under public ownership) where many CBFM models have been applied with limited evidence of sustainable adoption.

In conclusion co-management projects are likely to fail if they ignore contextual issues which influence the propensity of the individual to participate in mutually beneficial collective actions. Despite claims to the contrary, no effective blueprint approaches exist. Instead adaptive approaches are required. The observations presented here underscore the importance of moving beyond the view of a closed system to placement of fisheries within their wider environmental, social and economic context.

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