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Chapter · January 2011

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CHAPTER 9

Contemporary visions for small-scale aquaculture

Ben Belton¹ and David C. Little

This essay considers ‘small-scale aquaculture’ (SSA) from a variety of perspectives. We first examine the origins and usage of the term and offer a definition based on the social characteristics of those who practice it. We examine drivers of contemporary SSA, the various roles that it plays in supporting agrarian livelihoods and its relationship to wellbeing and poverty with references to examples drawn from across Asia. The challenges and opportunities presented to small-scale producers and culture systems are assessed, and the likely future of small-scale aquatic production systems is discussed.

Introduction

The literature on small-scale fisheries is highly multidisciplinary, with strong social scientific underpinnings. Although much of this work is concerned with implementing approaches to resource management that fulfil development goals (reducing poverty and improving the sustainability of natural resource use perhaps most pressing among them), considerable emphasis has also been devoted, only partly instrumentally, to understanding small-scale fisheries as social-ecological systems in their own right. This is in contrast to work on small-scale aquaculture (SSA) which has remained largely the domain of biologists, and which has more often than not assumed a rather normative tone, concerned principally with enabling the establishment of SSA as a productive activity assumed *a priori* to have positive implications for development. This has meant that detailed intellectually satisfying analyses of SSA and its implications with respect to poverty, livelihoods, food security and gender relations have been notable by their absence; since although most accounts of SSA are liberally peppered with references to these concepts,

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they are usually conceived of in unproblematic and rather mechanistic terms and largely without reference to any broader political-economic context or rigorous interpretive frameworks. Attempts to redress this balance have led to recent debate which has challenged conventional wisdom regarding the role of SSA in poverty reduction and how SSA should best be defined.

It is not our intent to revisit these questions extensively here. Rather we aim to move understanding of SSA forward by considering contemporary culture systems from a variety of perspectives. In doing, so we attempt to trace their origins, to re-evaluate the roles they play in supporting agrarian livelihoods, and to assess the challenges and opportunities presented to small-scale systems of aquaculture and small-scale aquaculture producers. We first provide a synopsis of the SSA narrative and a working definition of SSA to elucidate our treatment of the topic in this essay. The second section examines factors driving development of small-scale forms of aquaculture, particularly in Asia. The third section addresses a variety of pressures and incentives affecting SSA which determine choices regarding management and market orientation. A fourth section looks at some of the livelihood functions of SSA and its implications for wellbeing and vulnerability. Section five asks whether SSA will remain viable in the face of increasingly globalized trade in aquatic commodities and associated regulation of production. The conclusion looks to the likely future of small-scale aquatic production systems.

Origins and redefinition of SSA

'Small-scale aquaculture' has been championed by development institutions for well over three decades, with reference to a narrative which cites its potential to alleviate poverty, enhance food security and promote economic development. Emphasis on *small-scale* forms of aquaculture derives in part from their being positioned in implicit opposition to the 'industrial' shrimp production promoted by multi-lateral donors and national governments during the 1980s, which subsequently fell out of favor as a development strategy in the face of associated ecological degradation and social dislocation that occurred during this period. Nakamura (1985, p. 97) is instructive with regard to the dichotomy in approaches to aquaculture development that emerged as a result:

There are two fundamental approaches to applying aquaculture in developing countries: improving small-scale, subsistence-level

operations to meet immediate local needs or establishing large-scale, commercial industry based on the production of expensive species for export. The latter approach, geared toward increasing cash flow and therefore foreign exchange, may provide some employment for the poor, but mainly benefits only a small sector of society. The former strategy, however, directly benefits a larger number of people, especially the poor, by providing jobs and a modest income as well as a source of inexpensive protein. These two basic approaches are not mutually exclusive, but small-scale aquaculture is the more appropriate approach for rural communities².

As this excerpt indicates, emphasis on *small-scale* aquaculture is based on the assumption that the limited nature of the resources (land, labour and inputs) required for its practice places it within the grasp of poor, subsistence or semi-subsistence farming households that would otherwise be excluded from partaking in any benefits derived from larger commercial aquaculture operations. As Edwards *et al.* (2002, p. 223) put it, 'Rural aquaculture [a term used interchangeably with SSA] defies simple definition although the beneficiaries are clear: the poor'. In addition, SSA has been characterized variously as family owned and operated, reliant predominantly on family labor, utilizing small areas of land and/or water, and spanning a range of systems; from those involving limited investment in assets and operational costs and comprising but one segment of diverse livelihood portfolios, to others requiring more substantial investments in time, labour, infrastructure and capital.

These characterizations are problematic from a variety of standpoints. First, it is by no means certain that the poorer strata of any given community will necessarily be able to muster the resources required to engage in even low-investment, low-input forms of aquaculture. Second, equating scale to the physical area occupied by operations is a rather arbitrary given that culture systems are extremely diverse. This means that a one hectare pond might yield anywhere from a few tens of kilograms to several hundred tonnes of fish per annum and, correspondingly, require anywhere from no outlay to operating costs of several hundred thousand dollars. Third, as

2 In reality what has played out over subsequent decades is a 'third way' characterized by the emergence of an array of systems falling somewhere between these two rhetorical poles. An enormous diversity of systems exists even for shrimp, for which complete realization of the vision of industrial corporately-owned intensive production has been the exception rather than the rule.

Purcell and Brown (2005, p. 280) state, 'scales should be seen not as things in themselves with inherent qualities', nor are they external entities to which actors respond; an observation which implies that there is nothing intrinsic to aquaculture practiced on a 'small-scale' that lends it a greater capacity to deliver development outcomes than other forms of production. Indeed, growing recognition of this possibility has resulted in a number of recent publications from authors who have identified capital-intensive forms of aquaculture practiced on a large scale as making significant indirect contributions to poverty reduction. Finally, its rather vague boundaries and lack of theoretical content mean that SSA is an imprecise analytical concept. Recognition of this issue has led Belton *et al.* (forthcoming) to advocate a typology of aquaculture which utilizes relations of production as a heuristic with greater explanatory power than scale regarding the likely developmental outcomes associated with the different forms of aquaculture practiced in Bangladesh.

We will not dwell further on these issues as they have already received substantial attention elsewhere. Rather, for the purposes of this essay we typify SSA as an activity practiced predominantly by quasi-peasant producers, for whom aquaculture constitutes one element of a larger total livelihood portfolio. Ellis' (1993, p. 13) definition of peasants as, 'households which derive their livelihoods mainly from agriculture, utilise mainly family labour in farm production, and are characterised by partial engagement in input and output markets which are often imperfect or incomplete' is useful in clarifying this statement. We use the term 'quasi-peasant' rather than peasant in acknowledgement of the waning importance, eloquently chronicled by Jonathan Rigg (2006), of agriculture in rural livelihoods across wide swathes of Southeast Asia and China in the face of ever stronger urban-rural linkages, which means that classical representations of the peasantry may no longer hold to the extent that they once did. This caveat notwithstanding, Ellis' definition allows for identification of SSA as an activity practiced by households that derive a significant portion of their income from agricultural activities other than aquaculture, utilize mainly family labour in their productive activities, and are not completely integrated into input and output markets for aquatic produce (due, for instance, to consuming some or all of the fish they grow, or to procuring some portion of the inputs they use in fish culture from non-market sources).

Rural roots, urban drivers, multiple forms

The rapid rise of aquaculture has been very closely linked to concurrent economic growth and urbanization. This has been most impressive in the parts of Asia where fish has traditionally been a key dietary item, and in Egypt and Nigeria which also possess a cultural affinity for freshwater fish that can no longer be consistently met from wild stocks, rapid population growth and large urban populations. Typically, such areas have also experienced significant levels of agricultural intensification which have placed additional pressures on wild fish stocks through the modification of aquatic habitats, intensive use of agrochemicals, and exploitation of surface waters for irrigation. Urban income effects have been particularly important drivers of increased fish production in rural and peri-urban areas due to the high income elasticity of fish. This is vividly illustrated by the fact that urban consumers in Bangladesh eat approximately twice as much fish per capita as their poorer rural counterparts, despite the vast majority of production originating in rural districts. Seed availability has been another key driver. A reliance on seed produced off-farm has made fish culture far more dependent on informal seed supply networks than many other forms of agriculture. Until quite recently, dependence on seed captured from the wild limited the geographical scope and market orientation of aquaculture development. Networks of producers and traders of juvenile fish have, however, expanded massively in the last three decades, as private hatcheries have developed to supply them following key public sector investments in artificial reproduction.

Modification of floodplains (the areas which support the highest rural population densities) for purposes of flood prevention, irrigation and road construction has seriously impacted the productivity of inland fisheries but, at the same time, created numerous opportunities and resources for fish culture for large numbers of rural households including those with small landholdings. Much of this potential often remains unrealized however since for most households in these areas changes in access to both common-pool and household-managed water resources have occurred in tandem with dramatic shifts in the availability and scope of non-farm opportunities, particularly in manufacturing and services. These trends mean that many households possessing ponds and other water bodies, such as rice fields and ditches (collectively defined as household-managed aquatic systems) with potential for utilization in conventional aquaculture, choose not to follow this path or, after having attempted to do so, quickly abandon it. These decisions are often related to the low opportunity costs associated with non-stocked

systems (which yield self-recruiting culturally preferred species such as snakehead, walking catfish and climbing perch), since these can continue to meet subsistence needs or even provide a saleable crop at low additional risk and investment. This tendency may be accentuated where, as in Northeast Thailand, off-farm activities reduce the availability of family labor required to manage systems more actively, and where there is a high risk of flood, theft or both. However, the ready availability of hatchery-derived seed means that mixed culture of stocked exotics and indigenous aquatic animals is increasingly defining the management of both household and common property aquatic systems.

Culture-based fisheries – capture fisheries in natural closed water bodies which are largely dependent on artificial stocking for recruitment (Lorenzen, 1995) – have expanded rapidly in recent years. The importance of such water bodies as safety nets for the poor, and the low input nature of fish culture within them, have made them an attractive domain for external interventions. Very large productivity gains coupled with maintained or improved biodiversity and protection of vulnerable beneficiaries have been achieved in some cases (see Garaway *et al.*, 2006 in relation to Laos; Arthur *et al.*, 2010). However, the institutional forms that define the governance of these systems, the variety of water bodies brought under culture, and the range of management options employed are highly variable, leading to outcomes which are also heterogeneous in terms of equity and impacts on biodiversity, and which in some cases have resulted in effective privatization, elite capture, and linked loss of access rights and exclusion of the poor, despite intentions to the contrary among project planners. It is also notable that, at least in Bangladesh, inland common-pool aquatic resources – including large perennial and smaller seasonal water bodies and sections of canals, rivers, streams and floodplains – are increasingly subject to enclosure for large-scale commercial aquaculture as natural stocks decline and the potential and incentives to profitably enhance them rise accordingly. This trend is particularly noteworthy because in the past most inland aquaculture development has occurred on privately owned agricultural lands and thus avoided many of the social and ecological problems associated with the tropical shrimp boom; many of which were a direct outcome of similar processes of enclosure.

Cage culture, which also frequently demands the *de facto* privatization of common pool resources – albeit usually to a more limited and less

problematic degree – has expanded rapidly in a number of locations in response to opportunities offered by growing and increasingly differentiated high value urban markets, even where pond culture is already well developed³. While often occupying a limited physical area, intensively managed cages tend to be dependent on considerable environmental services related to feed supply and treatment of effluents which equate to a large ecological footprint. Relations of production vary significantly among cage-based systems, and include those operated by live-in workers on behalf of absentee owners in the Philippines and Indonesia, and the loosely vertically integrated semi-contract grow-out initiated by transnational feed companies (most notably Charoen Pokphand) in Thailand. In arrangements such as these, partial or complete separation of cage operators from the means of production and the effective or actual exploitation of the surplus value of their labour mean that they cannot be considered to engage in SSA defined as a quasi-peasant activity. However, where cage farmers retain privileged access to seed or feed from non-market sources and the activity remains a component of broader agrarian or ‘aquarian’ livelihood portfolios, it remains largely consistent with our characterisation of SSA. This is the case for producers as diverse as grouper fisher/farmers in southern Thailand (Sheriff *et al.*, 2008), snakehead producers in the Mekong Delta, and grass carp growers in Northern Vietnam.

Intensify or extensify?

One of the most important questions associated with contemporary SSA is whether extensive and semi-intensive forms can persist in the face of the seemingly inexorable rise of intensive, pellet-driven culture systems. Directly integrated semi-intensive forms of aquaculture (in which wastes and by-products from some agricultural sub-systems within the farm are reused as inputs into others) are extremely attractive in terms of their ecological sustainability. However, the most productive and highly developed of these, the pond-dyke systems of South China and the VAC systems of Vietnam (explained below), despite being very highly integrated through complex arrays of on-farm ‘bio-resource flows’, have never been entirely closed in terms of nutrient cycling; demanding the use of additional inputs imported

3 Cage culture is the production of fish in floating net pens. These are often installed in public water bodies. This is in contrast to pond culture which, as the name suggests, takes place in ponds. These are most commonly constructed on land with exclusive use rights.

from off-farm in order to achieve substantial levels of fish production. In their classic work on agriculture-aquaculture systems in South China during the early 1980s, Ruddle and Zhong (1988) reported that no sooner had a small feed factory opened in the commune where they conducted their study, than formulated pig and fish feed began to displace agricultural byproducts sourced both on and off-farm as pond inputs. This tendency has since become ever more pronounced due to the self-evident advantages which pellets offer in terms of feed conversion efficiency, fish growth and labor allocation.

The Northern Vietnamese VAC system, – ‘V’ stands for *vuon* (garden), ‘A’ for *ao* (pond) and ‘C’ for *chuong* (livestock quarters) – shares many features in common with the South Chinese pond-dyke system, having developed in a similar manner partly in response to extremely high population pressure on land and resources experienced in the Red River Delta provinces around Hanoi. Here too, the once highly integrated components of the homegarden system have become progressively delinked, the higher value pond element on many farms has been expanded and intensified at the expense of the others, and inputs such as grasses and manures produced on or near the farm have been largely replaced by commercial formulated feeds. In the process these operations have, according to our definition, ceased to be small-scale or quasi-peasant as a result of the more complete integration into input/output markets demanded by their specialization and intensification. In addition, these households are no longer oriented first and foremost towards satisfying subsistence needs and, in many cases, may have long since ceased to be dependent upon agriculture as a primary occupation as a result of the burgeoning non-farm opportunities available in and around the capital city.

However, it would be wrong to read this transition as indicative of a universal or imperative ‘ladder of intensification’, as a variety of other small-scale culture systems in locations where different agro-ecologies and agrarian political-economic realities hold sway have been rather more resistant even to quite limited intensification. Bangladesh is blessed with a vast array of water bodies, including some four million or so homestead ponds or ‘borrow pits’, most of which are less than 0.1 hectare in size and are excavated adjacent to rural homes for the purpose of elevating them above the level of monsoon flooding and providing water for domestic uses. Until the 1980s, fish entered these ponds during floods and were harvested after the waters receded, but the practice of deliberate stocking was rare. This gradually changed as the inland fishery declined and hatchery-produced seed became widely available; a process accelerated by a succession of major donor funded projects which promoted semi-intensive culture based on simple management practices such as appropriate stocking, harvesting, fertilization and supplementary

feeding. At present the vast majority of homestead ponds are stocked with hatchery seed, but although the principles and benefits of semi-intensive pond management are widely understood in rural areas its uptake has been very patchy.

The division of homestead ponds between siblings upon inheritance was once widely recognized to discourage active management for fish culture due to the free riding and intra-familial disputes which often ensued. However, as their value as productive resources has increased, families unable to manage them collectively have tended to lease them to others. This trend (observed both in Bangladesh and West Bengal) has meant that abandoned ponds have become increasingly rare, while lease holders tend to manage them in a commercially oriented manner commensurate with their need to recoup lease costs. Clearly then, the drive to intensify is not uni-causal, nor necessarily universal, nor is the progression from small-scale quasi-peasant production to what we have referred to elsewhere as 'quasi-capitalist' aquaculture, despite what the Chinese and Vietnamese cases might seem to suggest when considered in isolation.

There are a variety of interlinked reasons for this. Vietnam and Bangladesh have superficially similar profiles in terms of the contribution of agriculture to GDP (around 20%), the proportion of the workforce employed in agriculture (approximately half) and, in the Red River Delta, population density (around 1000/km²). However, agriculture in Vietnam has assumed a form which is more intensive, more market driven (including export markets) and, consequently, often of higher value than in Bangladesh, where attempting to ensure subsistence level rice production remains the fundamental goal of the great majority of rural households. The roots of these differences are complex, but reflect, among other things, the more equitable distribution of land and historically higher population density in North Vietnam, the extremely high incidence of landlessness or near-landlessness in Bangladesh, and the generally more dynamic performance of the economy over the last two decades in the former. As a result, a risk-averse 'subsistence ethic' (Scott, 1976), which prioritizes the pursuit of cultivating sufficient paddy to ensure a minimum level of household food security throughout the year above all else, continues to prevail amongst large portions of the rural population in Bangladesh. This outlook seems to impinge upon the uptake of even basic technologies (such as those required to upgrade from extensive to semi-intensive fish culture) which, viewed from the perspective of conventional economic rationality would appear to offer clear-cut benefits. This tendency is compounded by the low opportunity costs associated with extensive fish production in pre-existing ponds located close

to the homestead which allow subsistence fish needs to be met with very little effort or expense.

This risk-averse outlook is reflected in the unwillingness of many households with borrow pits in areas subject to frequent flooding to invest the resources required to raise their dykes in order to protect them – a step which would make it possible to substantially increase their productivity. This subsistence-orientated risk aversion, along with the highly skewed distribution of capital and production factors, helps to explain why the rapid growth of intensive pellet-fed aquaculture experienced in recent years in Bangladesh has not emerged from the evolution of the activities of peasant producers, but from the entrepreneurial actions of an entirely separate class, comprised mainly of educated urban individuals, investing in new forms of aquaculture as purely capitalist enterprises. Although this pattern can be observed throughout Asia, the distinction between practitioners of small-scale peasant aquaculture and intensive capitalist aquaculture is generally less sharply defined in many parts of Southeast Asia, where land and wealth tend to be distributed somewhat more equitably and rural poverty is rather less crushing than on much of the Indian subcontinent. Thus, households which have shifted, over a period of three decades, from partly subsistence rice cultivation, to commercial semi-intensive aquaculture or intensive horticulture and, ultimately, into intensified forms of fish production are fairly commonplace in Central Thailand, but rare in Bangladesh (Belton and Little, 2008).

In the case of Bangladeshi and Vietnamese shrimp cultivation (much of which at least partially fulfils our criteria for consideration as small-scale given, despite strong forward integration into global export markets) there are also clear incentives which work in favor of the maintenance of extensive or diversified systems, despite apparent technical advantages offered by intensified and specialized alternatives. Many of these relate to the endemic nature of shrimp disease, particularly the virulent White Spot Syndrome Virus. The likelihood that stocked shrimp will contract the virus during grow-out, resulting in significant mortalities, is high given the very poor bio-security of extensive shrimp ponds. Under these circumstances, pursuing a strategy of stocking at higher densities and applying more inputs represents an unacceptable risk for all but a handful of wealthy individuals who can afford to invest in closed, semi-intensive systems.

In Bangladesh, most producers adopt the opposite strategy, relying on the extensive cultivation of wild shrimp post-larvae (PLs) which are trapped in ponds flooded by the tide and consume only naturally occurring food. These are usually augmented by multiple low level stockings of hatchery

produced black tiger shrimp PLs. In these systems disease is probable, but low stocking densities and investment mean that it is unlikely to prove financially catastrophic. Whereas intensified systems tend towards specialized monoculture, in these extensive systems yields of fish (both deliberately stocked and naturally present) usually equal or exceed those of shrimp, and are sold on local markets or consumed on-farm, thereby offsetting disease-induced shrimp losses and contributing to local food supply. The effect of such extensification and diversification strategies is that these systems are quite resilient in the face of chronic disease. Other common diversification strategies such as alternate rotations of rice and shrimp have also proven less disease-prone than back-to-back shrimp cropping cycles.

An additional incentive to maintain small-scale shrimp farming in low-intensity states may ultimately derive from preferences for 'ethical' modes of food production among some sets of Northern consumers since, these farms produce shrimp which are effectively 'free-range' as compared, for instance, to the extremely intensive systems deployed in Thailand; the latter being in many ways analogous to feedlot livestock production and appropriating more ecosystem space and services than the former due to their reliance on fuel and manufactured feeds.

Wealth, welfare or well-being?

The issue of values brings us to consideration of SSA's contribution to well-being. Well-being is increasingly understood to include both a material dimension (the connotation of welfare or standards of living, suggesting a foundation in economic prosperity) and a 'subjective' dimension related to personal perceptions and levels of satisfaction (White, 2010). Not surprisingly, the material aspects of SSA (its ability to raise levels of household income and food intake) have been foregrounded in work on the topic to date. Far less attention has been paid to whether subjective factors unique to the individual – emotions, values, personal preferences – play a role in determining choices regarding SSA, or rank among the outcomes derived from participating in it.

Revisiting old evidence with this new conception of well-being in mind suggests that subjective dimensions may play an important role in mediating farmer involvement in SSA. Two excellent studies evaluating the circumstances of SAA development in the disparate contexts of Laos and Zambia reveal a number of interesting points of comparison. In Laos, fish farming is associated with modernity in both national policy discourse and the popular imagination, with the result that, 'fish ponds are an aspirational

asset that is used as an indicator of wealth and class' (Bush, 2004, p. 231). In some cases, ponds constitute 'a space of power' where guests are invited to socialize with the senior members of village committees and are entertained with food and liquor, furnishing the pond owner with respect from community members as well as contributing to the maintenance of local power relations. As Bush has noted, this does not negate the fact that farmers may obtain income and nutritional benefits from their ponds. It does however indicate that 'the decision to adopt aquaculture... is embedded within wider social and political aspirational goals' (p. 232).

A comparable tendency is reported by Harrison (1996) who found that rural inhabitants in Luapula, Zambia, identified certain characteristics including fish pond ownership and cash crop production as symptomatic of being "developed", while development workers saw farmers who had constructed fish ponds as "progressive". As Harrison notes, 'for some, though not all, self-identification with such progressiveness is important', and 'may provide both status and material benefits through access to development assistance' (p. 273). In both cases, SSA introduced through external interventions is equated with modernity and prestige in the eyes of developers and those they seek to develop. The construction of a pond and production of fish thereby bestows a measure of status and, presumably, personal pride or satisfaction, upon the owners, and may have the additional effect of facilitating access to, or production of, other ostensibly entirely unrelated resources and non-economic capitals. Thus, although not couched in terms of well-being, these accounts appear at least partially amenable interpretation to this manner, and perhaps also hint at the existence of self-reinforcing connections between the subjective and material aspects of personal well-being.

Harrison has also shown that, in Zambia, practicing fish culture allows pond owners to meet the obligation to slaughter an animal in order to honor visitors; an outcome which has subjective as well as instrumental social outcomes. The ability to 'gift' fish to relatives and to feed household guests also featured in a list of 23 factors identified by Haque *et al.* (2010) as incentives for producing tilapia fingerlings in rice fields in Northwest Bangladesh, which contributed to the activity's widespread uptake despite rather modest monetary and caloric gains. Homestead ponds in Bangladesh are also often valued more for the regular supply of fresh fish that they provide for home consumption than for the cash incomes they generate, even when the market equivalent value of the two is approximately equal. This suggests a trade-off between economic imperatives and affective reasoning in a culture where fish is a highly prized food, whereby households that can

afford to consume fish opt to do so for reasons of the emotional satisfaction that it provides, in preference to earning cash income. In other contexts, even the decision to culture fish may be the result of enjoyment derived from the activity itself, as the increasingly common phenomenon of hobby fish farming in Thailand suggests.

The material aspects of SSA also deserve some attention, since, as noted in the introduction, its poverty reducing capacity is often uncritically cited by proponents. However, as Harrison has observed in Zambia:

Most fish farmers, although not from a recognizable “elite” have certain characteristics in common. Adopters are more likely to be men, to be slightly better off, to be slightly better educated, and much more likely to be active participants in social and political activity than others in the community. These facts are closely connected with one another and to some extent causally associated (1996, p. 271).

This, we would argue, represents a fairly accurate reflection of pond-based SSA in a great many other locations, although the degree to which women are involved varies considerably from place to place, and active participation of pond owners in social and political activities may be less of a defining feature where the activity is very widespread and less closely linked to externally inserted development efforts. That individuals or households practicing SSA are likely to be in a better than average position relative to others in their communities might seem to imply that the activity is unlikely to bring about much poverty *reduction*. Such a conclusion overlooks the potentially important and rather less obvious role that SSA may play in poverty *prevention* – a distinction which Béné *et al.* (2010) have also made with reference to small-scale fisheries – particularly given that in locations such as Bangladesh the situation of even those who are well-off relative to their neighbours may remain perilous at best.

For households such as these, fish produced in the homestead ponds, rice fields, trap ponds and other connected resources which make up farmer-managed aquatic systems represent fungible assets which can be strategically liquidated to reduce or avoid high interest debt burdens associated with rice cultivation, the purchase of rice for home consumption or other essential expenses. These systems may therefore provide a buffer against transient poverty, with possible long-term implications contingent on the manner in which the debt is to be repaid and the ability of the household to repay it. A number of convincing studies in South Asia have found that even quite well-off families frequently slide into poverty in the long-term as a result

of the capriciousness of circumstance and that, had these numbers been smaller, net reductions in overall poverty would have been much larger; suggesting that the poverty prevention role of SSA may be important at the aggregate level also. Rather than conceptualizing SSA as a simple economic mechanism for reducing poverty in the medium term, it may therefore be more appropriate to view it as a household insurance policy against future hardship which also enhances the subjective well-being of its members in the present.

Co-existing or competing?

Another question pertinent to SSA is whether it will continue to prove viable or attractive as the specialized aquaculture which already accounts for the bulk of output in most Asian countries continues its remarkable expansion. Seen from one perspective, the story of Vietnamese pangasius appears to suggest not. In the space of scarcely a decade, pangasius has been transformed from a fish virtually unknown outside Southeast Asia (grown in the Mekong Delta for partly subsistence purposes in tiny household ponds fed with human excreta), into a global commodity worth more than \$1 billion per year, sold in over 100 countries worldwide, and rivalling Atlantic salmon in terms of volumes traded. This unprecedented developmental trajectory, particularly over the last five years, has been matched by an equally precipitous decline in the numbers of very small producers. This is the result of rapidly rising costs, ever tighter margins and, increasingly, greater regulation and traceability requirements; all of which translate into an inability to compete with far less numerous but cumulatively far more productive large capitalist farms. On the face of it, this appears to be a classic case of industrial consolidation, mirroring that which took place, albeit over a considerably longer timeframe, in the global salmon industry and for a range of other non-traditional agricultural export crops.

However, as Khiem *et al.* (2010) have shown, this 'adverse incorporation' of small producers into a newly established global value chain has not resulted in widespread dispossession and proletarianization. That this did not occur is in part a function of Vietnam's voracious domestic demand for aquatic products. This has meant that many producers who found it

necessary to abandon catfish grow-out have been able to utilise their ponds to either 'outgrade' into farming a range of other fish species with lower production costs or 'downgrade' into nursing pangasius, red tilapia and the seed of other species⁴. The fact that producers at this lower end of the spectrum often continued with other agricultural activities such as rice cultivation and orchards whilst they engaged in pangasius production also contributed to their resilience. The value that ponds retain as productive assets even after the failure of particular culture systems is also apparent in Central Thailand, where numerous unsuccessful inland shrimp producers have taken up culture of tilapia and other fish species.

It may be that successive waves of entry, maturation, failure, adaptation and diversification are symptomatic of aquaculture development played out over the long run, leading to gradual increases in the number of species cultured and the variety of systems in which they are grown. While in some cases (such as the VAC system) this will tend to result in a shift away from quasi-peasant forms of production, it may also result in the creation of sufficient space for the co-existence of a variety of systems, including those characterized as SSA. An indication of the likely persistence of certain forms of SSA is provided if one refocuses attention so that it rests not on the aquaculture component of the farming system alone, but views the pond as an indivisible component of the homegarden.

There is a substantial literature detailing the composition and functions of homegardens throughout the world. In Bangladesh,

A typical homegarden... occupies a small space adjacent to the house within the farmstead compound. It is very intensively cultivated to grow and raise a wide variety of plant and animal species utilizing primarily household female and child labor. The primary production goal here is to meet household consumption demand (Ali, 2005, p. 266).

Such homegardens produce fruits, timber, firewood, litters, vegetables, live-stock fodder, as well as meat, dairy, fish, and organic fertilizers, based on cultivation practices which 'maximize output at a minimum risk since the cost of input is very low compared to output' (Ali, 2005, p. 266). They are there-

4 'Downgrading' is the opposite of upgrading, corresponding to a reduction in the functions of an activity within a value chain. 'Outgrading' refers to the exit, either strategic or forced, from a value chain or a 'strand' within it, and entry into an alternative lower level activity (Khiem et al, 2010).

fore resilient in social-ecological terms, and are reported to contribute half of farm income in Bangladesh on average; a figure which rises to more than 80% among near landless households. The integral role which these systems play in supporting rural households means that, considered not as a standalone enterprise but as a single component of the larger homegarden, SSA is unlikely to decline even in the face of huge expansion of intensive capitalist aquaculture. Indeed, there is evidence that markets and products are becoming increasingly differentiated along rural/urban lines in Bangladesh, with the carps typical of quasi-peasant production continuing to dominate fish consumption in rural areas while pangasius and tilapia from large commercial systems gain an increasing share of urban markets. The persistence of actively managed ponds in homegarden systems is also evident in North-east Thailand despite the ever greater importance of the non-farm economy in rural livelihoods.

The continuation of certain forms of SSA aimed at semi-subsistence or local consumption is thus likely, even as the character of agrarian livelihoods continues to undergo rapid transformation. It should also be noted, however, that where overwhelming incentives to commercialize exist, as in the case of the VAC system (which is essentially also a form of homegarden), modes of production may change rapidly. Other markedly different dynamics exist where quasi-peasant producers have been incorporated into the value chains of global export commodities. Mounting traceability requirements imposed with the aim of ensuring food safety in the Global North, and the proliferation of private third party certification schemes into which these have been integrated, mean that the position of this type of producer may become increasingly difficult to maintain over time, given logistical difficulties in implementing product traceability and standards compliance among large numbers of resource poor producers. As the example of Vietnamese catfish indicates, the effect of any exclusion of small producers from export markets will depend in large part upon the range of alternatives available to them.

Future visions for SSA

Urbanization and economic growth in many of the rice-fish societies where SSA has become established suggests that the expansion of quasi-capitalist and capitalist production systems will continue in coming decades. The tendency for these to become more intensive and uniform in their production processes and output will, on the one hand, satisfy the growing demand of mass markets for safe animal-source products but, on the other,

is unlikely to meet the strong cultural attachment to the diverse and local that is still prevalent in rapidly growing areas of Asia, where a high cultural (and monetary) value is attached to traditional and often 'wild' foods. Such is the resilience of food cultures, particularly in Asia, that it is possible to envisage the continued existence of considerable market space for small-scale producers (perhaps seeking to out-grade from the production of mainstream species) to meet these aspirations, which are already tangible in the consumption habits of the trend-setting middle class. Such development would in some respects mirror, or pre-empt, the renewed interest in local food and culture in Northern economies, where a parallel economy in local food and drink has emerged, or been revived, alongside modern agri-food systems dependent on global supply chains.

The nature of the development experienced in emerging Southern economies is crucial in determining the future of SSA. Improved transportation infrastructure and the expansion of urban regional and district centres appears to be facilitating more local and temporary migration from rural to urban contexts, as compared to earlier longer-term and permanent migration from rural areas to a handful of megacities. By allowing families to continue straddling a rural-urban divide, this trend may encourage retention of cultural memory and indigenous rural knowledge, and facilitate the persistence of agrarian elements in livelihoods which would otherwise be lost following wholesale relocation to distant cities. The rapidly increasing growth in demand for aquatic products relative to local supply is also likely to provide continued opportunities for domestic expansion by Southern producers, which may well prove preferable to the more stringent and unpredictable demands of ultimately much smaller European, North American and Japanese markets, particularly for those producers at the smaller end of the spectrum. South-to-South trade in cultured aquatic produce is also increasingly prevalent for high volume products such as Chinese tilapia, which now features strongly in African markets, and Vietnamese pangasius, which is making inroads in Latin America and is also widely consumed in neighboring Cambodia. Producers associations and other groups with protectionist leanings frequently claim that such developments will hinder the development of infant aquaculture of all stripes in importing countries, but it remains to be seen whether these fears prove valid.

The rapid growth of aquaculture and broader development are occurring at a critical time in human history, during which increasing unpredictability associated with climate change and greater volatility in food prices and food security are already a reality. Climate change is expected to bring particularly severe impacts to the densely settled deltas of Asia where SSA is

most prevalent and where, if maintained or further developed, it might play an important part in adaptation approaches intended to enhance social-ecological resilience. The incorporation of wetlands into urban and peri-urban landscape planning and management to reduce impacts of flooding is becoming mainstreamed and provides opportunities for fish culture. Diverse SSA strategies from aquatic vegetable production to floating cage-based aquaculture have also been trialled and promoted as a basis for easing future disruptions in food supplies in flood affected communities. Studies which have documented aquaculture in high flood risk contexts also point to numerous indigenous adaptive modifications in site selection and design. In line with the strong linkages between SSA, and the persistence of traditional homegardens mentioned above, the development of contemporary models that serve local recreational and aesthetic as well as local food security and flood mitigation functions are to be expected.

Such evolution is likely to occur in parallel to a more general industrialization of food production, but the greater inherent energy and nutrient efficiencies of low-intensity household level systems may provide further incentives for their maintenance. Resource pressures make hikes in the relative costs of energy and limiting nutrients such as phosphorous inevitable in the medium term. These tendencies may mean that production systems in which energy and nutrient efficiency is high, especially those based on polycultures that exploit aquatic food webs *in situ* and encourage closer linkages between the effluents from fish production and crop fertilization requirements, ultimately gain a renewed competitive advantage as compared to more energy consumptive intensive alternatives, and could favor their persistence as forms of SSA which meet the food fish needs of very large numbers of poorer consumers. Evidence for this is the continuance and indeed growth in demand for small carps and tilapias, raised semi-intensively throughout Asia for poor urban and rural consumers, which has occurred alongside expansion of markets for both high- and low-value pellet-fed fish.

The likely future of SSA is therefore by no means homogeneous, nor fixed, being indivisible from the broader historical context in which it is situated. This landscape represents the sum of: interactions between local and global economic forces and transformations; the interplay between agrarian change and urbanization and its accompanying restructuring of livelihoods and modes of production; global environmental change and shifting resource availability; and cultural and individual subjective preferences. The inherent complexity associated with these elements and their interactions mean that it is impossible to predict a single overriding fate for SSA. Rather, we must anticipate multiple futures in which a huge diversity of aquatic production

systems – at least some of which are small-scale – persist, emerge, adapt or disappear in response to the specificities and imperatives presented by diverse configurations of development in different locales.

References

- Ali, A. M. S. (2005) Homegardens in smallholder farming systems: examples from Bangladesh. *Human Ecology*, 33(2), 245-270.
- Arthur, R. I., Lorenzen, K., Homekingkeo, P., Sidavong, K., Sengvilaikham, B. and Garaway, C. J. (2010) Assessing impacts of introduced aquaculture species on native fish communities: Nile tilapia and major carps in SE Asian freshwaters. *Aquaculture*, 299, 81-88.
- Belton, B. and Little, D. (2008) The development of aquaculture in central Thailand: domestic demand versus export-led production. *Journal of Agrarian Change*, 8(1), 123-143.
- Belton, B., Haque, M. M. and Little, D. C. (Forthcoming) Does size matter? Reassessing the relationship between aquaculture and poverty in Bangladesh. *Journal of Development Studies*.
- Béné, C., Hersoug, B. and Allison, E. (2010) Not by rent alone: analysing the pro-poor functions of small-scale fisheries in developing countries. *Development Policy Review*, 28(3), 325-358.
- Bush, S. R. (2004) *A Political Ecology of Aquatic Living Resources in Lao PDR*. PhD Thesis. Sydney: University of Sydney.
- Edwards, P., Little, D. C. and Demaine, H. (2002) Issues in rural aquaculture. In Edwards, P., Little, D. C. and Demaine, H., eds., *Rural Aquaculture*. Wallingford: CAB International.
- Ellis, F. (1993) *Peasant Economics*. UK: Cambridge University Press.
- Garaway, C. J., Arthur, R. I., Chamsingh, B., Homekingkeo, P., Lorenzen, K., Saengvilaikham, B. and Sidavong, K. (2006) A social science perspective on stock enhancement outcomes: lessons learned from inland fisheries in southern Lao PDR. *Fisheries Research*, 80, 37-45.
- Haque, M. M., Little, D. C., Barman, B. and Wahab, M. A. (2010) The adoption process of ricefield based fish seed production in Northwest Bangladesh: an understanding through quantitative and qualitative investigation. *Journal of Agricultural Extension and Education*, 16(2), 161-177.
- Harrison, E. (1996) Digging Fish ponds: perspectives on motivation in Luapula Province, Zambia. *Human Organization*, 55(3), 270-278.

- Kheim, N. T., Bush, S. R., Chau, N. M. and Loc, V. T. T. (2010) Upgrading Smallholders in the Vietnamese Pangasius Chain. ODI grant number RO334. Long Xuyen: International Development Research Centre.
- Lorenzen, K. (1995) Population dynamics and management of culture-based fisheries. *Fisheries Management and Ecology*, 2, 61-73.
- Nakamura, R. (1985) Aquaculture development in India: a model. *BioScience*, 35(2), 96-100.
- Purcell, M. and Brown, J. C. (2005) Against the local trap: scale and the study of environment and development. *Progress in Development Studies*, 5(4), 279-297.
- Rigg, J. (2006) Land, farming, livelihoods, and poverty: rethinking the links in the rural South. *World Development*, 34(1), 180-202.
- Ruddle, K. and Zhong, G. (1988) *Agriculture-Aquaculture in South China: The Dike-Pond System of the Zhujiang Delta*. UK: Cambridge University Press.
- Scott, J. C. (1976) *The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia*. USA: Yale University Press.
- Sheriff, N., Little, D. C. and Tamtikamton, K. (2008) Aquaculture and the poor – is the culture of high-value fish a viable livelihood option for the poor? *Marine Policy*, 32, 1094-1102.
- White, S. (2010) Analyzing wellbeing: a framework for development practice. *Development in Practice*, 20(2), 158-172.