The Political Economy of Community-Based Fisheries Management in Bangladesh

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Criss-crossed by mighty rivers and sitting astride an active and shifting delta, the agrarian economy of Bangladesh depends on a fine balance between water flows and drainage systems. The river systems support a rice-growing agriculture as well as fisheries in one of the most densely populated areas of the world. The river systems of the Ganges and the Brahmaputra deposit vast quantities of silt whose source may be hundreds of miles upstream. The silt deposits make the rivers gradually change course across a flat deltaic terrain, and these shifts in course in turn erode banks and more silt is carried further downstream. The mighty river systems finally converge to meet the sea in the Bay of Bengal where silt deposits continue to gradually create new islands in the sea. The flow of river waters downstream and the ingress of sea water upstream determine the levels of salinity in the coastal river systems. The threat of gradually rising sea levels as a result of global warming may create further challenges in the future. As it is, Bangladesh's farmers and fishermen have to deal with a powerful and diverse hydrological and ecological landscape with several different types of waterbodies, each presenting different opportunities and challenges. Bangladesh is associated in the minds of most outsiders with floods and the devastating effects of too much water coming down its river systems. More recently, however, the problem has been one of declining water flows in the lean season and increasingly polluted water flows. Growing demand in upstream India has resulted in declining water flows, while the growth of industries and of fertilizer and pesticide-using agriculture in both India and Bangladesh have contributed to the growing problem of chemical pollution which has affected river-based capture fisheries.

The flatness of the land and the variety of water flows in the many rivers traversing it has created large variety of relatively shallow water bodies of varying permanence. These are described by a variety of local names. *Beels* are smaller lakes and waterbodies that may be seasonal or permanent, *haors* are larger floodplains which get connected up to form a massive waterbody when the land in between gets flooded during the rainy season, particularly in the north-east of Bangladesh and *baors* are largely closed oxbow lakes that are formed by dead bends of rivers, mostly in the western part of the country.

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Waterbodies can be mostly closed, meaning that they rarely get connected with other waterbodies or they can be mostly open meaning that they are part of an interconnected system. The degree of openness has significant implications for the possibility of conserving fish stocks and investing in enhancing stocks. In between, there are systems that are closed during the critical harvesting period, enabling investments in stocking, even though they are open at other times. Indeed, the partial openness may also be important in enabling the natural re-stocking of these waterbodies through the natural migration of fish. Some *beels* and *baors* may be permanently closed from other parts of the waterbody system, but others, including many *beels* and all *haors* regularly get connected to other waterbodies during the rainy season. Rivers, the waterbodies connected to them and the marine coastal areas provide potentially rich terrain for fish cultivation and capture. The physical features of this ecosystem are particularly important in determining the feasibility of different types of investment and management strategies for enhancing the net output of fishing activities.

As an active delta and floodplain, Bangladesh has approximately 230 large and small rivers with floodplains on their banks as the rivers typically flood in the rainy season. The floodplains are gradually shrinking as a result of various flood protection measures as well as declining water flows in the rivers, all of which flow through water-hungry India. Nevertheless, there are still around 5.5 million hectares of floodplains that are flooded in the monsoon. Three-quarters of the fish catch originate in inland fresh-water fisheries and the rest from marine sources. In this report I only look at inland fisheries. Open water capture fisheries, also known as freshwater capture refer to fishing in open waterbodies such as rivers and interconnected *beels* or *hoars*. Fishing yields in open waterbodies have shrunk as a result of the declining and increasingly polluted river water and the difficulty of investing in fish stock management when the boundaries of the water system cannot be controlled. The contribution of open water capture has declined from more than 60 per cent of the total catch in the mid-1980s to between 35 and 39 per cent of the total in the mid-2000s, depending on different estimates (Toufique 2005; Department of Fisheries 2011). The fastest growing sector was freshwater culture in closed water bodies (aquaculture) where fish are grown and harvested in ponds, smaller *beels*, *baors* and other waterbodies that are not permanently connected to bigger waterbody systems. The closed nature of these waterbodies allows potentially more viable investments in feeding and conserving fish till the optimal catch can be achieved. Between 1984/5 to 2006/7 closed waterbody culture grew at 9.3 per cent per annum, compared to 5.2 per cent for the total fish catch, with its share growing from around 15 per cent in the mid-1980s to between 37 and 44 per cent of the total by the mid-2000s (Toufique 2005; Department of Fisheries 2011). A further complicating factor in devising property rights solutions for enhancing the net output of fisheries is

that for poor people living in the floodplains, fishing is the major if not the only source of protein. The relationship between net output-enhancing institutional solutions and poverty-reducing ones may be problematic in the short run, for instance if the former requires mitigating the free access problem and if this impacts adversely on the poor in the short run.

The property rights approach to fisheries has a long history, motivated by the insight that incentives have to be created to invest in fisheries, moderate the rate of catch and otherwise align behaviour to maximize the net value of the fish over time (Gordon 1954; Scott 1955; Hardin 1968). However, as fish move and are hard to observe, and as a waterbody can be connected to other waterbodies, property rights solutions in the case of fisheries face some special problems. In the case of open water capture fisheries in particular, states have had to supplement property rights solutions with direct regulatory policies, such as limiting fishing to particular seasons or fishing days, regulating the technology of fishing by restricting fishing to particular types of vessels defined by their engine power or fishing gear, restricting individual fishermen to use particular types of nets and hooks, and limiting the spatial areas where fishing is allowed. For marine capture fisheries, the 1982 United Nations Convention on the Law of the Sea (UNCLOS) enshrined the 200 mile exclusive economic zone in international law to enable a specific state to take sole responsibility for regulating the use of particular strips of coast (Campling, et al. 2012). The design and allocation of property rights will clearly depend on the objectives, which could be to increase output, to benefit particular classes of fishermen or to conserve and protect fish varieties. Politics matters in determining priorities but also in determining the likelihood of enforcing any particular configuration of rights (Robinson 2010).

Apart from the obvious physical and ecological characteristics describing the complexity of waterbodies, the political economy of Bangladesh has also constrained the development of fisheries in several ways. Fisheries management has been driven by multiple stakeholders often following different priorities and programmes. These stakeholders include the Ministry of Land, the Ministry of Fisheries, and different NGOs and donors running specific programmes. The weakness of coordination suggests that political power and influence are relatively dispersed. The central political authority cannot therefore represent a coherent position nor is it strong enough to impose coordination across agencies. Furthermore, the political economy of Bangladesh (and developing countries in general) is characterized by the relatively weak enforcement of formal institutional arrangements. Informal enforcement by non-state organizations plays an important role in determining the overall effectiveness of enforcement. The incentives and organization of the informal organizations that play a role in enforcement can therefore determine the types of outcomes associated with particular property

rights solutions. Finally, related to the weakness of the enforcement capabilities of the state and the multiple pressures on policy-making, policies in fisheries appear to have targeted very different objectives without explicitly identifying complementarities or trade-offs. For instance, increasing output, achieving greater equity and maintaining and enhancing bio-diversity have been identified separately as desirable goals for policy, without much discussion of the conflicts and trade-offs between these objectives. This can have the inadvertent effect of reducing the effectiveness with which any of these goals can be pursued. For instance, enhancing output may require property right configurations that make exclusion effective, which can have adverse immediate effects on poverty in some cases. Given the weakness of formal enforcement and the likelihood that informal enforcement will be more successful if the residual claimant is powerful, output-enhancing strategies may require allocating residual claimant rights to richer and more powerful organizations. On the other hand, anti-poverty priorities may call for granting fishing rights to poorer fishermen. Maintaining bio-diversity may require constraining some types of fishing in particular waterbodies, even if it reduces the net present value of the catch. The argument in this chapter is that the "clientelist" political settlement in Bangladesh can help to explain weaknesses in identifying coherent policy goals as well as the weaknesses in implementation that have prevented the full potential of fisheries being achieved.

This chapter looks at a number of aspects of Community-Based Fisheries Management (CBFM) in Bangladesh that created different types of rights in fisheries under a variety of policies. These experiments are interesting because they created a variety of rights in fisheries with different physical, ecological, political and institutional characteristics. These experiments allow us to compare the conditions that led to the achievement of better results in some cases but not others. In general, under the CBFM, the institutional strategy has been to allocate rights to community-based organizations (CBOs). The most frequent justification for this rights-based approach is that it allocates rights to poor fishermen, thereby creating incentives for the appropriate management of fish stocks while at the same time addressing issues of poverty. However, the physical and ecological conditions are different across different waterbodies and the prior economic and political organization of stakeholders is also different. The creation of formal rights changed the incentives and opportunities of different stakeholders in ways that should have improved the achievement of social goals but in practice the outcomes were significantly different in different waterbodies.

The differences in outcomes can be explained by a number of interdependent factors. First, the physical characteristics of a waterbody define specific problems that a rights-based approach has to address. The diversity of waterbodies in a complex and diverse ecology implies that in many cases a standard set of rights would be simply

inappropriate for addressing different problems. Secondly, even if the rights were theoretically appropriate, in the context of a social order described as a 'clientelist political settlement' (Khan 2010a), a reasonable degree of enforcement depends on the local configuration of power. The social organization of stakeholders in the locality based on their prior property rights, relative incomes, and their connections with political parties and power brokers can therefore determine whether the formal institutions are sufficiently enforced through informal mechanisms to provide outcomes close to the ones expected.

Our dual approach to the analysis of property rights looks at the appropriateness of particular property right solutions by taking into account a) that a number of different and sometimes conflicting problems need to be addressed and b) that the success of enforcement depends on the 'fit' of the property right solution with the configuration of political power. This framework can help to explain some of the important differences in the outcomes associated with different CBFM solutions in fisheries in Bangladesh.

We conclude that the design of a rights-based approach to fisheries management has to be clearer and more explicit about the goals that are being addressed and the trade-offs that have to be faced. Trade-offs can exist between different goals and also between different sequences of achieving multiple goals. This is important because an institutional solution that addresses one goal may not address others to the same extent or at the same time. Attempting to achieve everything may end up achieving worse outcomes than necessary. This exercise in identifying the appropriate goals for policy includes taking into account the very significant differences in the physical, ecological and socio-economic conditions across regions and waterbodies of different types. Biodiversity may be a priority in some areas, anti-poverty measures in others and enhancing output may be the priority elsewhere. Secondly, the institutional solution in each case has to be tailored to the political economy of enforcement. If a theoretically good institutional solution cannot be enforced in the context of the local political settlement, it is actually not a good solution. A different solution that may appear suboptimal in a world where enforcement problems do not exist may be the optimal solution in a context with specific enforcement problems. We discuss the analytical issues in section 2. In section 3 we look at features of the evolution of property rights in fisheries in Bangladesh. Finally, in section 4 we look at case studies of fisheries operating with different types of community-based rights in Bangladesh. We find that their relative success or failure can be explained by the physical characteristics of the waterbodies, the types of property rights they have and the context of the political settlement that determines the enforceability of different types of rights.

Property Rights Solutions and the Development of Fisheries

Property rights over an asset can be defined in different ways to address different economic and social problems. In the presence of transaction costs it is not possible to comprehensively define the rights and responsibilities of all parties affected by the use of an asset in such a way as to ensure that private negotiations will yield the best social outcomes in every contingency (Barzel 1989). Even if we focus on the narrowly defined economic objective of improving the net output associated with fisheries, there are many dimensions of this economic problem. The aspects of property rights that need to be well-defined and enforced depend critically on what we believe are the major constraints on enhancing net output. Given the impossibility of defining property rights equally well along all dimensions, a technical and economic understanding of the dominant constraints should inform the design and allocation of property rights to achieve the desired outcomes. In addition, the definition of property rights in particular ways, their allocation to particular types of agents and their degree of enforcement may be constrained by the political context defined by the political settlement.

In effect, therefore, we should be looking for the best *enforceable* configuration of property rights to solve particular problems given the political settlement. Finally, apart from economic objectives, there may be political or ecological objectives that can constrain the focus on net output maximization. Conflicts between objectives are particularly likely if transaction costs prevent the emergence of credible agreements to use improvements in net output to address other objectives immediately. In the absence of transaction costs, property rights could be fully defined along all relevant dimensions and the different factors constraining efficiency could be simultaneously addressed while also addressing distributive issues.

From an economic perspective, property rights can create either or both of a) tradable rights over an asset that can help to change the allocation or use of the resource through negotiation and b) a 'residual claimant' (who can be an individual or a collective) with the right to determine strategies for maximizing its net benefit. Both aspects of property rights can contribute to an enhancement of the net benefit associated with the resource, and both are interdependent in the sense that changing the use of an asset assumes that residual claimants with the appropriate rights exist to whom the asset can be re-allocated. However, there are many potential ways in which the net benefit of an asset can be increased and each requires the specification of the rights of tradability and that of the residual claimant in precise ways. In a world where all dimensions of a property right could be fully defined and enforced, this discussion would not be relevant. In reality, the creation and enforcement of property rights has

potentially high costs. Important dimensions may be either missing in the legal definition of the property right or the formal right may be difficult or impossible to enforce given the political settlement in which the rights are operating. As a result, the initial definition and allocation of the rights can matter greatly in a world where transaction costs exist, a point that has been frequently made but is often ignored (Coase 1960; Barzel 1989).

The creation of fully tradable rights is very unlikely in the case of large indivisible assets like waterbodies, some of which can have impacts on the lives and livelihoods of many thousands of people. With high transaction costs many affected parties may not be able to negotiate with the right-holder and the creation of such rights may fail to remove important externalities. The transfer of a full range of rights over major waterbodies to private owners would also be very likely to face strong political opposition. Therefore, for both political and economic reasons, the rights to manage large waterbodies are likely to be defined in limited ways, particularly in poor and densely populated countries like Bangladesh. Indeed, the management rights that are transferred to manage fisheries (from the state or from private individuals who own the underlying land) are typically leasing rights for defined periods and with defined set of uses being allowed. Given the partial nature of these rights, their initial definition and allocation are obviously significant. Many of the initial characteristics of these rights and their allocation are unlikely to be corrected by further privately negotiated redefinitions or re-allocations of these rights given their partial definition and tradability in the first place.

In particular, these considerations make it important to analyze the types of rights residual claimants need to have to manage fisheries efficiently. The economic analysis of net output in fisheries identifies at least three related yet distinct types of issues that may need to be addressed by configuring rights of residual claimants appropriately. The first is the problem of maximizing the net output with given technology and resources. This is essentially the problem of determining the optimum level of fishing with given technology by excluding outsiders and/or allocating fishing rights to insiders. We call this the *fixed-technology appropriation problem*. A related but different problem is to maximize the net present value of net output over time when investments in infrastructure and in fish stocking and feeding are allowed. This is essentially a dynamic problem of optimizing the level of investment in an asset. This requires a more detailed specification of rights for residual claimants such that the returns from investments can be appropriated by investors, creating incentives for investments. We call this the *investment-enabling appropriation problem*. Finally, increases in net output often also require improvements in the organization and monitoring of the production process so that residual claimants can generate a surplus by managing the production process better. This does not necessarily involve investments in technology to enhance productivity but rather investments in organization and in technologies that allow the

production process to be monitored more effectively so that productivity and the production surplus can be enhanced. This includes improvements in the organization of the team to control pilferage and theft or improve the efficiency of different production activities. We call this the *production monitoring problem.* Clearly, these constraints on net output are closely related, particularly since the failure to solve one can impact on the likelihood of solving another, but they raise different problems for the definition and enforcement of rights. It is therefore useful to discuss them separately before bringing the analysis together again.

The early debate between Gordon (1954) and Scott (1955) identified the difference between managing a resource with fixed or variable technologies. To get closer to the social optimum, property rights would not only have to create incentives for maximizing the net output of a common-pool resource like a fishery at a point in time, but also *over* time allowing changes in technology and scale. The requirements are not necessarily the same, because the level of costs incurred and extraction that is allowed to maximize net output with existing technologies may be quite different from the investments required and extraction rates allowed for maximizing the discounted net present value of the catch when technology is a variable. The property rights that allow one may be insufficient for the other. The same point is made by Gardner, Ostrom and Walker (1990) when they make a distinction between appropriation problems and resourcing problems. The appropriation problem defined by these authors corresponds to our *fixed-technology appropriation problem*. To solve this, the residual claimants must be able to determine the level of fishing that maximizes the net output, and they must have the right to allocate fishing rights across fishermen so that coordination problems that may cause conflicts can be solved. The nature of the waterbody can make these management problems more or less onerous, and therefore require stronger or weaker definitions of rights.

The resourcing problem defined by Gardner et al. (1990) is equivalent to *our investment- enabling appropriation problem*. However, in the Bangladeshi case, given the nature of the waterbodies, very significant investments in infrastructure are required to convert semi-closed waterbodies into closed ones suitable for aquaculture. These investments are potentially much greater than is suggested by the term resourcing. The naturally semi-closed waterbodies of Bangladesh present significant opportunities for raising the output of fisheries but in most cases they are not immediately suitable locations for significant investments in aquaculture. However, in many cases, investments in building barriers, sluice gates and other infrastructure can convert semi-closed waterbodies into potentially closed ones. Generally, the investments in question are not necessarily to physically cut off a waterbody from the flood plain, which may not be either possible or desirable, but rather to construct infrastructure that determines

when and how the connection is established. Technically the waterbody remains semi-closed, but with the difference that now sluice gates or other mechanisms can determine when the waterbody is open or closed. This in turn allows the stocking and feeding of fish to become economically viable. Investments in new technology can create closed systems even in entirely open waterbodies. For instance, investments in large submersible net cages where fish can be grown can create pockets of closed waterbodies within vast open waterbodies like *haors*. On a larger scale, investments in sluice gates and appropriate embankments can create seasonally or temporally closed waterbodies in open waterbody systems. The appropriate property rights for the affected stakeholders in these contexts can be quite complex.

Both the fixed-technology and the investment-enabling appropriation problems are related to but also distinct from the problem of improving the organization of production and creating appropriate incentives for management. Individual or collective property rights can in principle solve a fixed-technology appropriation problem but they involve very different internal incentives and problems for the management of the production process. Similarly, rights for different types of investors could address the problem of investment-enabling appropriation, but all types of investors do not have the same relationship to the production activities of a team (for instance some may be outsiders), and therefore they may face quite different types of management problems in organizing the production team and ensuring the profitability of their investment.

The Fixed-Technology Appropriation Problem

This is the "textbook" free or open access problem. The creation of a residual claimant with rights over the residual should in theory help to determine the level and timing of the catch to maximize the net output or rent from the waterbody. However, the creation of a residual claimant with the *incentive* to maximize the net product will not necessarily result in a successful negotiation that restricts activity to the optimum level. The simple assumption that is often implicitly made is that the creation of a residual claimant leaves the organization of production unchanged, for instance individual fishermen still fish using existing technologies, but now the residual claimant has an incentive to negotiate with the fishermen to restrict the catch. This is, of course, unrealistic, because to be able to affect the level of fishing, the residual claimant also has to have the *effective capability* to make and enforce decisions, and this typically involves a change in the organization of production as well. For instance, in the case of an effective residual claimant we may see a transformation from fishing by individual fishermen to an employment contract with the residual claimant or the emergence of some form of partnership, and each of these organizational forms may have additional incentive effects on production and the technologies used that we discuss later under 'production monitoring'. In other words, the emergence of an effective residual claimant is very likely

to change technology broadly defined to include the organization of productive activity. At the very least, even in a fixed technology context, the residual claimant (which can be a collective) has to have effective 'control rights' to determine the number of fishermen and their catch rate. A residual claimant without effective control rights will not achieve the desired results.

In Bangladesh, few waterbodies have physical characteristics where the primary problem is simply to regulate the rate of catch in line with the natural rate of reproduction of the fish. Most waterbodies in Bangladesh are either open or semi-closed. In open waterbodies the optimal rate of catch depends on the availability of fish, and the benefits of conservation cannot be captured by the residual claimant who has control only over part of the waterbody. However, the residual claimant can be made responsible for enforcing national regulations limiting the timing of the catch, and restricting the allowable gear to maximize the overall catch from the open waterbody system. For instance, in Bangladesh, the Department of Fisheries enforces the relevant parts of the Protection and Conservation of Fish Act of 1950 by imposing punishments on fishermen for violating regulations. In closed or semi-closed waterbodies, high levels of biomass depend on investments in stocking the waterbody with fingerlings. This is an investment problem which has additional characteristics that we discuss under the investment-enabling appropriation problem. The regulation of the catch is not a major issue in many semi-closed waterbodies, even when the residual claimants invest in stocking. If the waterbody reverts to being open during some parts of year, the varieties chosen for stocking are harvested at the end of the season before the waterbody becomes open. In these cases, restricting the rate of catch at harvest time is again not the main issue. Only in the case of relatively small closed waterbodies like ponds where the varieties of fish being cultivated have a growth cycle extending over several seasons is the monitoring and regulation of the rate of catch a primary problem. The fixed-technology appropriation problem in open waterbodies and many semi-closed waterbodies in Bangladesh is simply to solve the coordination problem of selecting fishermen and their fishing spots during the harvest season, and the objective is to harvest all of the available fish.

At one extreme consider the fixed-technology appropriation problem in an open waterbody like a river. Parts of it could be leased to a lessee to manage (though in Bangladesh this type of river leasing was suspended in 1995). But here there may not be much of a possibility of increasing net output on that part of the river simply by restricting the rate of catch. The task of the lessee is primarily to deliver revenue to the state that is later collected from fishermen by selling fishing rights and at best to solve coordination problems by allocating fishing spots to individual fishermen. In this case, the leasing process and the selling of fishing rights to fishermen does not result in any significant

changes in the rate of fishing using fixed technology or any changes in the organization or technology of fishing, and so the effect on net output is negligible. However it provides a surplus to the lessee that can be perceived as unwarranted and this is probably why the system was eventually abandoned.

In contrast, in a waterbody like a *beel*, that may be effectively closed for parts of the year, the residual claimant may have a more important task of experimenting with the level of fishing to maximize the reproducible catch year after year with given technology. Here, the rights of the residual claimant have to be defined to enable this, including the right to permanently exclude outsiders and to restrict or manage the catch of individual insiders if the net-output maximizing level of fishing is to be discovered and adhered to. Once again a residual claimant is required but the requirements are stricter. If net output can be varied by the level of fishing, the residual claimant must retain control rights if we want incentives to be aligned for the maximization of net output. So the problem of creating rights over the residual to solve the fixed technology appropriation problem has to be jointly considered with the production management problem. For instance, if a lessee with formal rights over the residual sells rights to fish in a closed waterbody, the lessee is actually no longer the residual claimant and does not retain control rights. The individual fishermen who are buying the right to fish are paying a fixed fee or a share of the catch and thereafter *they* become full or partial residual claimants with control rights on the amount of fishing they do. These individual fishermen may be unable to coordinate their fishing decisions and fishing may continue well beyond the point at which the marginal cost of catching fish is equal to its price. Once again, the primary role of the lessee is simply of a revenue collector. Clearly, a fixed fee or a share of the catch to be paid to the lessee can raise the average cost faced by fishermen and so fishing may not extend to the point where the initial average cost of catching fish was equal to the price (the open access outcome). Even so the outcome will not in general correspond to the net-output maximizing level of fishing. In general, neither the marginal cost of fishing nor the optimal rate of fishing is known *ex ante*. Theory only tells us that *if* the residual claimant has residual control rights, experimentation with the rate of catch will allow the rent-maximizing level of fishing to be discovered. This discovery process cannot happen if control rights to determine the aggregate level of fishing are transferred to fishermen by sub-leasing the right to fish.

This means that to discover the optimal level of fishing the residual claimant should not sell fishing rights as a way of making money. In theory, only in the accidental case where the price of the 'right to fish' is set equal to the externalities that each additional fisherman inflicts on the others will the optimal level of fish emerge through this process. As this is unlikely, the sale of fishing rights should in general yield a lower surplus to the lessee than maximizing the rent directly as a residual claimant through

experimentation, so it may be thought that the rational lessee will want to remain the residual claimant. But in fact maximizing the residual through the exercise of control rights to determine the aggregate level of fishing has large transaction costs in organizing and managing the fishing process, unless the specification of rights also enable changes in the organization of production, and this is examined later in our discussion of the production monitoring problem. If the exercise of control rights is costly, it may be rational for the residual claimant to opt for a more limited but more certain income by selling fishing rights. We know from case studies that fee-based entry systems where the original lessee allows fishermen to enter for a fee or for a share of the catch do retain some rents in semi-closed waterbodies by constraining the level of fishing to some extent (Toufique 1998). Theory also tells us that full rent dissipation is unlikely with some level of entry costs being set by the original residual claimant but it also tells us that to maximize the net output we require a residual claimant who is able to exercise residual control rights. To achieve this, more significant social and political enforcement capabilities are required of the residual claimant, including the capability of exercising control rights in the production process.

The Investment-Enabling Appropriation Problem

This problem is both more difficult to solve and more important in terms of maximizing net output, given the physical characteristics of Bangladeshi waterbodies, than the previous one. One of the paradoxes of Bangladeshi fisheries is that even when the property rights regime is able to retain some rents by partially solving the fixed-technology appropriation problem, fishermen remain abjectly poor and the net output of fish is relatively low. The paradox can be resolved by observing that most waterbodies are open or semi-closed and significant gains in net output are unlikely in such waterbodies just by controlling the rate of catch. Significant investments are required in infrastructure that make parts of these waterbodies more like seasonally closed waterbodies where intensive fish stocking and feeding can take place. Once this infrastructure exists, further investments are required in stocking and feeding the fish to grow the biomass rapidly, and under these conditions, significant increases in net output are possible. Investments in fingerlings and feed can be significant, and even more so investments in the appropriate infrastructure to achieve characteristics of a waterbody that is closed over at least a harvest cycle. This is the investment-enabling appropriation problem, which faces more significant problems in defining the appropriate rights and ensuring their enforcement. Here, we want the residual claimant(s) to make and implement decisions about the level of investment in building infrastructure, stocking and feeding fish and managing the rate of catch over time so that the net present value of benefits is maximized. The configuration of rights has to fulfil more restrictive conditions because investors have to be assured of longer term property right stability, particularly in cases where significant investments in infrastructure are required to

convert parts of open waterbodies into areas suitable for aquaculture.

The more significant the investment, the more durable and better defined the rights of investors have to be to make the investments feasible. Of course, in many open waterbodies, aquaculture may not be economically feasible at all. Apart from the durability of the rights of the investor, the enforcement capabilities of the residual claimant(s) also have to be considerable to enforce the restrictions on fishing on the waterbody, to control water flows from the waterbody, and also to prevent theft and pilferage of the fish. As the value of the fish in a waterbody goes up, threats of capture and pilferage go up too. This is not just a question of hiring guards but of having the social power to enforce exclusion. Some of the most damaging types of theft in developing country fisheries involve organized gangs connected to or protected by local power brokers and politicians who can therefore capture fish with impunity unless their actions are countered by guards protected by equivalent political and social forces.

The creation and allocation of rights that could sustain significant investments in fisheries therefore not only have to define exclusion and enforcement rights more strictly but also allocate residual claimant rights to individuals or organizations who combine a) considerable local enforcement capabilities and b) have access to significant finances. The first could be achieved if the residual claimants were close to or part of the political organizations that currently wield political power. But even if rights allocations to relatively powerful residual claimants were possible, this is not sufficient. The problem is that given the nature of competitive clientelism in Bangladesh, the identity of politically powerful organizations are continuously changing as they rotate in and out of power. The powerful individuals of today may not remain so in four or five years (Khan 2010b, 2011). But to make large investments viable, we require significant enforcement capabilities over several governments. That is why, even if long leases are on offer, it may be difficult to make credible the promise that the leases will be honoured and the exclusions on which profitability depends will be enforced. The financing condition is also important because in the context of inefficient financial institutions, many viable investors may not be able to raise sufficient financing at a reasonable price to make investments on the scale that may be required. The financing problem and the political settlement explain why even in the presence of apparently sufficient formal rights, long-term private investments in open or semi-closed waterbodies are almost unknown. We exclude from this analysis the relatively small ponds and lakes that are entirely privately owned, in which much more significant private investments in aquaculture are indeed sometimes observed. But even in the latter, the production monitoring problem can act as a constraint preventing the emergence of true residual claimants with residual control rights.

The Production Monitoring Problem

The *production monitoring problem* was identified by Alchian and Demsetz (1972). The problem emerges because most production activities involve team work characterized by inter-personal externalities because the inputs and outputs of each member of the team are difficult to observe. The result is that when team production takes place, free riders within the team can *reduce* their inputs into the joint activity and net output can be low. Alchian and Demsetz argued that the residual claimant emerges to solve this problem. In theory, the emergence of a residual claimant solves the problem of monitoring the team because the residual claimant has both the incentive and the formal right to monitor, and therefore to exclude those who free ride by putting in low effort. But this assumes that the monitoring task is feasible and the formal control rights are capable of enforcement. Note that in the free access problem the residual claimant emerges to solve the problem of over-use and *too much* effort being expended in extraction by individuals who are not part of a team. In Alchian and Demsetz, the task of the residual claimant is to monitor an already existing team to ensure that *too little* effort is not being put in by individuals. The two arguments are related because actually the creation of an effective residual claimant to solve the fixed-technology appropriation problem implies a change in the organization of production to some form of team work, and the residual claimant then has to solve the team monitoring problem identified by Alchian and Demzetz. However, the enforcement problems that may prevent a residual claimant from enforcing a reduction in fishing may also prevent the organization of team work in ways that prevent too little effort by individual fishermen to sustain the organization or the investments it has to make.

A residual claimant in fisheries has to monitor many individual fishermen and the cost of monitoring increases with the labour-intensity of production. As a result, the monitoring of effort and catch levels, as well as the monitoring of pilferage and theft may pose a significant challenge. In a large waterbody this may not be feasible without significant additional investments in technology that reduces the costs of monitoring. Here the investments required are not directly to raise the productivity of the waterbody but may be necessary to provide effective control rights to the residual claimant or to prevent theft. For many technologies, (such as mechanization) investments that are productivity-enhancing also save on monitoring costs by making the production process easier to monitor. But other investments such as fences and monitoring equipment to control theft may have no direct productivity implications. Hence the analytical distinction is useful.

The same argument applies to labour-intensive agriculture in developing countries more generally. For instance, it is frequently observed that large farms operating with labour-intensive technologies face a more serious monitoring problem

compared to smaller farms and indeed often display lower yields (Boyce 1987). Investments in agriculture in these cases can face a problem of discontinuity. For a large farm to become more efficient than a small farm it is not sufficient to invest in buying land and expanding the scale of operations to save on fixed costs. The large farm typically has to make a step jump in its technology to become more mechanized or to invest in other technologies of monitoring so that less monitoring is required per acre of operation. This of course requires more investment than would be required simply to expand the scale of operation. But if large farms can make this jump they can usually become more productive than small farms by orders of magnitude, which is why commercial agriculture in advanced countries is on a significantly larger scale compared to the micro-farms observed in countries like Bangladesh. However, without improvements in monitoring technology, increases in scale can result in poorer monitoring per acre. As a result, larger farms can suffer from an inverse size- productivity relationship as long as the organization of production suffers from high monitoring costs.

Fisheries suffer from a very similar set of problems with labour-intensive technologies. Residual claimants operating bigger waterbodies may find they are actually making less money per unit of investment because of declining yields. This explains why it may be rational to sell access rights for a fee or enter into sharecropping agreements (sharing the catch) with fishermen than to exercise residual control rights to directly determine the aggregate level of fishing, even if in theory that provides a larger surplus. Sharecropping arrangements create incentives for individual fishermen to self-monitor and can be efficient in a second-best sense if there are no better ways of solving the production monitoring problem. But sharecropping generates a lower surplus for the original residual claimant and the latter is therefore less likely to engage in any significant investments in infrastructure. The empirical evidence in agriculture is that for plots that are small enough for the monitoring problem not to matter, the net product is higher under own farming than sharecropping (Quibria and Rashid 1986). This suggests that in addition to transferring a lower surplus to the investor, sharecropping is also inefficient in the sense that the overall net output is lower in the absence of monitoring costs. We know that Bangladeshi waterbodies in general require significant investments to yield higher net output. The production monitoring problem suggests that significant infrastructural investments would be more likely if there was a simultaneous solution of the monitoring problem that would allow the residual claimant to directly monitor and control production processes involving large teams. This would increase the potential profitability of fisheries and make investments to improve technology more viable. The key components of our analysis of the problems that property rights for residual claimants have to solve to enhance net output are summarized in Table 1.

Table 1. Problems Constraining Net Output in Bangladesh Fisheries

	Open Waterbodies	Potentially Closed Waterbodies
Fixed-Technology Appropriation Problem	Restricting catch not very important. Requires coordination to allocate fishing spots to prevent conflicts. Enforcement of national regulations important.	Restricting catch important with varieties of fish that grow over multiple harvesting seasons.
Investment-Enabling Appropriation Problem	Requires significant public investments in dredging and international cooperation to reduce river pollution. Property right solutions unlikely.	Requires significant investments in infrastructure (barriers, sluice gates, cages) and in stocking and feeding. Involves returns over several years.
Production Monitoring Problem	Not critical as maximizing net output through the control over the production process is less important in this case.	Necessary to enable effective control rights for raising surplus of residual claimant and justifying investments.

While the fixed-technology appropriation problem is essentially about excluding outsiders, the production monitoring problem is largely about establishing control over a production process involving a team. Some property rights solutions can result in a partial improvement in fixed technology appropriation even if production monitoring is not fully achieved. However, to justify significant investments, residual claimants have to achieve a longer time horizon and control rights, and in general, this is more likely to be the case if the production monitoring problem has been addressed, thereby assuring profitability over time. A change in the monitoring technology and in the organization of production is likely to be resisted by fishermen who may feel they are losing their control over the production process. Therefore, residual claimants are often unable to bring about significant changes in the monitoring and organization of production. Implementing these changes require significant legitimacy and local enforcement capabilities and a degree of alignment of residual claimants with political power. In addition, the requisite enforcement capabilities have to be sustained over time, particularly for infrastructural investments. In the context of competitive clientelism, this implies that at the very least, residual claimants should be drawn from all major political parties so that promises of property right stability become more credible. All of this also requires a social consensus about the objectives of fisheries reform and an understanding that strategies to raise the net output of fisheries are in the national interest.

Property rights are not just there to ensure efficiency and the maximization of net output, but also to achieve other social objectives. In the long-run there may be no conflict between strategies of increasing the net output of fisheries and poverty reduction. Indeed, the former is a necessary condition for the latter. But in a context where many poor people depend on access to fisheries for their protein intake and livelihoods, changes in property rights that focus on the enhancement of net output can have negative consequences for poverty reduction in the short term. Some poor people, for instance, may lose their access rights to fisheries and it may take some time for the

higher net output to feed into a more vibrant local economy that creates alternative jobs. In the meantime, alternative job creation strategies may not be credible to the poor. This is of course not just a problem for fisheries but for any transformation from crafts-based production technologies to modern higher productivity technologies. In Bangladesh, a compromise approach has been to allocate collective residual claimant rights to the poor in the expectation that this would solve both the efficiency and poverty problems simultaneously. In practice, the investment and monitoring conditions required for net-output maximization are unlikely to be met by organizations of poorer fishermen when they are granted leases to manage fisheries. If the problem was primarily one of solving fixed-technology appropriation problems in open waterbodies, these arrangements may have sufficed. They would still face local enforcement problems but these could be partially met with the assistance of external organizations like NGOs assisting community organizations. But an enforcement solution based on outside assistance may not be sustainable. Moreover, the investment and monitoring problems are much more difficult to fix. Community-based residual claimant rights are therefore unlikely to be a general solution but they may have a role in some open waterbodies and as a poverty reduction strategy in some areas.

A final and very important goal in Bangladesh has been the maintenance of a complex ecological system and its bio-diversity. The conversion of open waterbodies into closed or partially closed ones undoubtedly changes the eco-system and can impede the migration of some varieties of fish. The impediments to the free movement of fish have, however, primarily come from flood protection barriers to save densely populated areas as well as irrigation canals for agriculture and the construction of transport infrastructure. Moreover, other variables such as the increasing pollution of the river systems and the declining flow of water from India have in any case significantly affected the numbers and varieties of fish available in open waterbodies. This is primarily why the share of the catch coming from open waterbodies has been declining in Bangladesh. However, there is an important ecological debate about whether the creation of property rights that promote net output increases will further harm the ecology and bio-diversity by creating incentives for converting open waterbodies into partially closed ones. This is an important debate but the solution to this trade-off cannot be to rule out net output enhancing solutions altogether. There are ecologically more acceptable ways of increasing net output, but they are typically more expensive and require international cooperation, for instance by dredging rivers to improve water flows and cutting back on upstream pollution. As ecologically driven solutions are unlikely to suffice on their own for meeting the anti-poverty and developmental goals of the country, compromises may be required. As with anti-poverty measures, the trade-offs are less intense in the long run because economic development is generally a necessary precondition for sustainable environmental policies. In the medium term a

feasible approach would be to identify the trade-offs that are involved in promoting different objectives. A socially acceptable answer may be to reserve the primacy of bio-diversity and environmental objectives in some critical waterbodies, to pursue anti-poverty measures in areas where rapid increases in alternative employment are unlikely, and to pursue net-output maximizing strategies in other areas, particularly in waterbodies that are most likely to be attractive for the types of investments that are necessary for enhancing net output.

A Brief History of Community-Based Fisheries Management in Bangladesh

Prior to the abolition of *zamindari* in 1950, the waterbodies of Bengal were largely under the control of a class of revenue-collecting landlords called *zamindars*. The Permanent Settlement legislated by the British in 1793 declared that the *zamindars* of Bengal were "proprietors of the soil" and granted them formal tradable rights to collect revenue (Chaudhuri 1983, 88). In fact, the act only gave *zamindars* the formal right to buy and sell their *revenue collecting rights* in exchange for a perpetually fixed money rental paid to the state. They generally lacked the legal power to control or change the organization of production at the village level, which remained in the hands of peasants and village-level landlords. Though the rental fee was fixed at a high level, it was priced in perpetuity in nominal terms so the intention was clearly to create incentives for *zamindars* to improve the land as residual claimants. At the same time, failure to pay the revenue to the state would lead to the *zamindari* being auctioned. Historical consensus has now shifted away from the opinion that the Permanent Settlement created "capitalist" property rights in land (Mukherjee 1974; Alavi 1975), to the more tenable position that it attempted to make the pre-existing Mughal revenue structure more efficient by ensuring that *zamindars* had strong incentives to make the revenue payment on time and to encourage improvements in the productivity of land (Ray and Ray 1973; Ray 1974; Ray and Ray 1975; Ray 1979). But whether improvements were possible depended on whether the *zamindar* had adequate rights to change the organization of production at the level of the peasant farm or individual waterbody.

The fatal flaw in the Permanent Settlement was that it did not give *zamindars* the requisite rights to change the organization of production although they did have the power to inflict substantial informal harassment and rent increases on poorer peasants. In a sense this was the worst possible combination of rights and capabilities from the perspective of increasing net output. Even if an individual *zamindar* had wanted to, they could not control the production process on the waterbody and so the *jolmohols* (waterbodies) within the territory of particular *zamindars* were leased by them to local rich peasants or landlords. To the extent that the leaseholders were now residual

claimants and were in addition locally powerful, the system achieved a degree of incentive alignment for the efficient use of village level waterbodies. But significant investments in improvement did not take place because the lower-level lessees also lacked the power to change the organization of production and were in addition much poorer in terms of their investment capability. The *zamindari* experience is a good demonstration of the proposition that property rights describe a complex configuration of rules that are not equally defined or enforced along all dimensions (Barzel 1989). The *zamindars* had the right to collect revenue and to buy and sell this right, but their rights were constrained when it came to changing the organization of production at the farm level.

The pressure to pay rents may have forced tenants on the land and lessees of waterbodies to raise output as in the case of the English tenant farmers of the eighteenth century (Wood 2002), but Bengal's "rich peasants" were in general too poor to make the appropriate investments and could in any case not force changes in the organization of production, for instance by expelling poorer peasants and reemploying them as workers, as happened in England through the enclosures. In fact, colonial law responded by implementing legislation protecting peasants from precipitate bankruptcies and expulsions to maintain political stability at the village level. The *zamindars* who did have the resources to invest in the land did not want to do so, because they lacked the rights or capabilities to ensure that they could control production sufficiently to deliver returns from these investments. The evolution of property rights in Bengal and indeed across India under the British, therefore, did *not* lead to the emergence of clearly defined rights over land and natural resources where the residual claimant had residual control rights in ways that could be described as modern or "capitalist"' property rights (Khan 2009). This background is important for understanding the subsequent evolution of property rights in post-independence East Pakistan and Bangladesh, where revenue collection and allocation goals appear to dominate other production-oriented goals.

In 1947, East Bengal became the eastern wing of Pakistan. The mobilization of the Muslim rich peasants of East Bengal against the largely Hindu *zamindars* had been an important component of the Pakistan movement in Bengal. Not surprisingly, shortly after independence, the East Bengal Tenancy Act of 1950 abolished *zamindari* and converted *jalmahols* into *khas* or state-owned assets. As far as the waterbodies were concerned, the state, in effect, replaced the *zamindars* and simply leased the waterbodies to the same leaseholders at rents which in real terms had by now become quite low. The main beneficiaries of the continuation of these arrangements were the rural intermediate classes, the locally powerful village-level rich peasants and landlords, who continued to play an important role in the political structures of East Pakistan. These lessees continued to lack the institutional and political capability to change the organization of production, and in general they were too poor in absolute terms to drive significant

investments in infrastructure, but they could effectively solve a limited set of fixed-technology appropriation problems. However, their relative power in rural society also meant that fishermen often got a raw deal and coordination was not necessarily efficient. By the mid-1960s, fishermen's cooperatives representing village elites who had failed to get leases and the fishermen who actually did the fishing began to protest against the public auction system and the way in which this effectively transferred the rents in the waterbodies to a narrow group of elites. The government "conceded" that cooperative societies should have preference in getting leases provided they could bid as high as the current beneficiaries (Huda 2003, 30). However, this statement had little effect in general as cooperatives had limited resources for bidding and powerful leaseholders simply operated through proxy cooperatives in some case.

The second partition of 1971 that created Bangladesh out of East Pakistan eventually changed the anti-poverty politics at play in the country to a significant extent. The rich peasants were still the politically dominant group in village life. These intermediate classes were at the heart of the social mobilizations that led to the election victory of the Awami League in 1970, which in turn precipitated the crisis that led to independence. But the war and its aftermath also mobilized large sections of the poorer subaltern classes. Not surprisingly, after independence there were pressures for social policy to respond to the expectations of the poorer sections of the population. The aspirations of the poor had genuinely increased, and there were many political activists who continued to mobilize the poor in political movements or in NGOs to demand improvements in their rights. In this context, leasing policies began to adopt an increasing pro-poor bias at least in official policy announcements. All waterbodies with the exception of flooded land, man-made ponds and shrimp farms remained state property administered by the Ministry of Land (MOL) which leased these waterbodies (*jalmohals*) for fixed terms. In 1974, it was decreed that only registered fishermen's cooperatives could bid for waterbodies in the first round. If they could not meet the base price set by the district administration, the auction would be open to other bidders. In practice, cooperatives could rarely meet this bidding requirement and local elites remained the most important beneficiaries of leasing policy. In addition to waiting for cooperative bids to fail, elites used a number of other measures, including setting up fake cooperatives or co-opting existing cooperatives to bid for the waterbodies they wanted (Toufique 2005).

Once they got the leases, the lessees did not, in general, invest in the waterbodies or even attempt to discover through trial and error what the optimal level of fishing was. This is not surprising given our analysis of the types of rights they had. Rather, their strategy was to maximize their revenue by collecting tolls or granting fishing rights

to fishermen on a sharecropping basis. In practice, the open nature of most Bangladeshi fisheries meant that regulating the rate of fishing was not critical. Rather the coordination of fishermen activities together with a partial enforcement of national regulations sufficed to protect some rents in fisheries (Toufique 1998).

In most waterbodies in Bangladesh, the recruitment or restocking of fish every season happens at least partly through the mobility of fish across an integrated waterbody system. The problem is of restocking and maintaining the fish till the biomass is maximized over each season in the waterbodies where this is technically feasible. But once the seasonal harvest time arrives, there is very little merit in leaving a significant amount of fish in the waterbody for breeding into the next season. The failure was that there was insufficient investment in improving waterbodies and changing the organization of production to enable the waterbodies to be stocked more intensively. The contribution of the leaseholder was mainly to collect revenue, and indirectly to allocate fishing rights and to help in the enforcement of the ban on off-season fishing, enforce the areas designated as sanctuaries where fish were allowed to grow and to enforce bans on particular kinds of gear. The legal framework for preventing rent dissipation at the global level was set by the Protection and Conservation of Fish Act 1950 applied to inland capture fisheries. This act prohibited the harvesting of fish that were too small, the use of certain gear and mesh sizes, the use of explosives and dewatering, and the placement of barriers on the migration routes of fish. Leaseholders helped magistrates in the enforcement of this law and resolved conflicts over the allocation of fishing spots and times to fishermen who were entitled to fish. The most important negative effect was that the leaseholders extracted a significant part of the rents from the fishermen without contributing significantly to any investments that increased the volume of the catch.

The leasing system therefore did not address the most important problems facing the expansion of the fisheries sector, but did create significant conflicts between powerful groups to capture the leases which were relatively lucrative in the context of rural Bengal. It also generated resistance from fishermen who were being squeezed. Pressure to change the system emerged in the 1980s, ironically under the authoritarian regime of General Ershad who sought to counter his low political legitimacy by adopting populist measures to bring in new constituencies to support him. The significant break came in 1986 with the New Fisheries Management Policy (NFMP). This policy attempted to tackle the problem of fake cooperatives by abolishing the leasing system and establishing fishing rights for "genuine" fishermen by allocating fishing licenses for a fee. The licensing system intended to maintain revenue collection and effectively cut out the lessee as a middleman controlling access to the waterbodies. If rent dissipation through overfishing was a problem, this would be an inferior solution to a properly constituted leasing system because there was no longer a residual claimant (not even a collective one) and

the restriction of over-fishing depended on restricting the number of fishermen, not how much they fished. Moreover, it was not clear who would enforce the ban on off-season fishing, maintain fish sanctuaries or prevent the use of inappropriate gear in this system. The real problem of increasing investments in the waterbodies was even less likely to be solved in the absence of any clearly defined residual claimant.

The populist aim of the licensing policy was to increase the share of the surplus going to poor fishermen, but the problem was that genuine fishermen were not easy to identify. Traders who made their money trading fish could, for instance, qualify according to the definition because most of their income came from the business of fishing. The National Fishermen's Committee, the *Jatiyo Motshojibi Shomiti*, was supposed to identify genuine fishermen, but this body like most other organizations in Bangladesh was dominated by members of the intermediate classes. Not surprisingly, many individuals who were licensed were not actually fishermen, and the fishermen who were licensed often had to pay an economic or political price to be certified as such. Non-fishermen license holders could then sub-lease their licenses to extract revenue in the same way that powerful waterlords operating behind fake cooperatives did in the past. The new licensing arrangement had higher transaction costs because it was much more difficult to license fishermen individually instead of leasing the entire waterbody to an individual or a cooperative. It was also more risky for fishermen to pay advance fees to fish (as opposed to a share of the catch) because the catch depended on the individual's success in excluding non-fee-paying fishermen, an impossible task for the poor (Toufique 1996: Ch. 5). Indeed, a closer look at the politics shows that the adoption of the NFMP was not driven by pressure from poor fishermen, but rather from the *Jatiyo Motshojibi Shomiti*, an organization that included many intermediate class power brokers who happened to be excluded from the previous leasing system.

The high transaction costs of the licensing system meant that by 1994 only 257 jalmohals were under the NFMP, out of a total of between twelve and thirteen thousand. Further ad hoc changes driven by political considerations significantly limited the efficacy of the licensing approach. In 1995 both leasing and licensing of fishing in open *jolmohols* like rivers was abandoned and replaced by an official Open Access policy. This was pushed through as a result of complaints by boat owners who objected to tolls being charged by leaseholders of rivers (Huda 2003). Furthermore, in 1996, leasing responsibilities for waterbodies of less than 20 acres were passed to the Ministry of Youth, clearly to satisfy the demands from powerful individuals within the youth organizations of the party in power. This simply changed the identity of some of the beneficiaries of rents generated by the leasing policy. Members of party youth organizations were not likely to be particularly capable as managers or investors, nor were they likely to be particularly poor. These changes were therefore entirely politically motivated and did

not promote either the efficiency or poverty objectives of policy.

The Ministry of Land remained responsible for managing the leases of waterbodies above 20 acres (8 hectare) and here the traditional elites continued to dominate. Most of these were semi-closed waterbodies and even the ones that were formally closed in fact needed significant investments in infrastructure to protect fish from pilferage and theft if an intensive stocking strategy was to be followed. The lease policy was to give priority to registered fishermen's cooperatives but if these did not make a high enough bid, the waterbody would be offered in an open auction. Lease periods were for three years. The minimum bid value had to be at least 25 per cent higher than the average of the last three lease values with a 10 per cent increase every year. To complicate matters, in 1998, the NFMP was partially revived by the *Jatiyo Motshojibi Shomiti* and by 2001 some 31 *jolmohols* were managed under NFMP.

The emergence and evolution of the community management of fisheries in Bangladesh has to be evaluated in the context of this experience and draw on many of the lessons learned. The really difficult questions of investment-enabling appropriation and production monitoring were not addressed because even the richer leaseholders had failed to make significant progress in this area in the past. The main task of leaseholders had turned out to be to allocate fishing rights and enforce bans on out-of-season fishing, the use of inappropriate gear and the maintenance of sanctuaries. The claim was that if the community could organize these tasks, the justification for a significant transfer of rents to leaseholders would disappear. Even this limited claim turned out to require substantial assistance for the community-based organizations (CBOs) to engage in effective coordination and enforcement, and this required sustained outside assistance from NGOs. This was essentially a re-allocation of leased rights to a new group, the CBOs, rather than a fundamental modification of property rights with the aim of achieving a significant improvement in the net output of fisheries. At best, the community-based management schemes could address the fixed-technology appropriation problems more effectively than the previous leasing outcomes, but there are no theoretical reasons for expecting better outcomes in terms of the more significant investment-enabling appropriation or new ways of addressing production monitoring problems.

Through the 1990s a number of projects were implemented by the government with the assistance of development partners and usually with NGO involvement that aimed to develop community-based fisheries management by CBOs. The projects included the Third Fisheries Project (1991-96), the Fourth Fisheries Project (1998-2005), Community Based Fisheries Management (CBFM) Project Phases 1 and 2 (1995-2006), Management of Aquatic Ecosystems through Community Husbandry (MACH 1998-

2003), and the Oxbow Lake Small Scale Fisheries Project Phase 1 and 2 (1989- 1996). Evaluations of these projects show that there was variable success in building viable CBOs, that they typically required sustained levels of support from NGOs to be effective and that the tasks that richer leaseholders were carrying out in the past could be carried out relatively effectively by CBOs with appropriate levels of assistance in management and enforcement (Ali, et al. 2003; Huda 2003; Toufique 2005).

Case Studies

During 2011, we visited ten CBO-managed waterbodies in four different regions of Bangladesh—Tangail, Comilla, Mymensingh, and Kishoregunj—covering a variety of waterbodies, including *beels*, rivers and *haors*. A list of the CBOs and projects is provided in an appendix. Even in this small sample we found significant differences in hydrological and social conditions that resulted in very different structures of community-based fisheries management (CBFM). Some of these variations were related to differences in physical and hydrological conditions but some were unrelated (in other words not all variations had a function). The case studies, together with the secondary literature, strongly suggest that leasing and other property rights matter for economic and social outcomes. We also found strong support for our analytical framework identifying different problems that property rights need to address in Bangladeshi fisheries. There is clearly scope for improving the design of CBFM arrangements by examining existing experiments from the perspective of multiple problems as well as multiple social goals. This requires a more explicit and informed discussion of competing social goals and of trade-offs. It is understandable that equity and anti-poverty goals have implicitly received priority in Bangladesh, but the importance of investment is likely to become more important if the country wants to use fisheries as a driver of economic growth and poverty reduction. It is in this area that answers have to be found and some of our case studies suggest directions in which progress can be made in the future.

Tangail

Five of our CBOs were located in the Tangail region. Two were CBOs managing parts of rivers, which are clearly open waterbodies. Three were managing *beels* that were semi-closed, but with important differences in their underlying property rights. One was a *beel* on *khas* or government land that was leased to the CBO, the others were on *khas* land encroached by private owners and were now in an intermediate stage of de facto privatization. The owners in the latter cases still had to cooperate to set up a management committee to organize fishing when their lands got temporarily flooded every year to become temporary *beels*.

As we would expect in open waterbodies, the two river management committees did not attempt to restrict the rate of catch on the stretch of river that their leases entitled them to manage. The CBOs in both cases provided coordination services and simply charged a share of the catch from fishermen. They claimed their main task was to enforce the non-fishing periods, maintain the fish sanctuaries and to resolve conflicts but their incentive to do this was not very clear. The CBO management committee was relatively small in both cases, and charged 25 per cent of the catch from its members and 50 per cent from non-members. Restricting and regulating the entry of fishermen (rather than their catch) was an important function to resolve conflicts. Prior to the organization of fishing rights by the CBO, poor fishermen particularly from the minority Hindu community had to make informal payments to powerful protectors. They were much happier with a more formal system of "taxation" and protection. The catch was declining in the rivers over time for the reasons discussed earlier, but the fishermen were not worse off because the price of fish was also increasing. The CBOs received significant support from an NGO (the CNRS) when they were being set up and CBO members accept that without its help they would not have been able to sustain their organization.

The first and most successful of the three *beels* in the area is called Charonbeel and is a *khas* (publicly-owned) *beel* of 104 acres leased by the government to the project. This *beel* gets seasonally connected to 850 acres of floodplains surrounding it. The CBO includes 227 members from 6 villages. The management committee was set up with a lot of assistance from an NGO as there was an earlier cooperative in the area which was a front for powerful individuals to lease the *beel*. This was a semi-closed waterbody and as such the CBO's strategy, as expected, was not to restrict fishing but simply to charge for the right to fish. There was no change in the organization of production, and the fishermen operated as individuals. The collection of revenue was subcontracted to a rotating team of three who collect dues for a ten per cent commission. The other main functions of the CBO are to maintain sanctuaries and enforce the restricted seasons. The CBO also carried out a limited amount of fish stocking on a seasonal basis, paid for by the revenues collected.

The members provided a very rational explanation for why further investments to raise net output were not forthcoming. First, they said that a significant increase in net output would attract the attention of more powerful neighbours. The CBO members, being relatively poor, had insufficient power to protect extra incomes from the attention of the rich. Their low current incomes were therefore more secure, and they were even fearful of losing control of the waterbody if there was a significant increase in its net output. Indeed, more powerful landlords around the *beel* area had already tried to encroach on the *khas* land by taking out *pattans* or leases. These were only revoked after the NGO assisted in taking the case to the local land administration office. Secondly, the

members explained that further improvements in net output would require significant investments in building earth mounds and culverts to control the water, together with significantly greater investments in stocking. They simply did not have the financial resources, and their members were too diverse in terms of their incomes to agree on contributions to an investment fund. This is an example of how the organization of production on an individual basis can affect the incentives to invest. The fishermen had an excellent understanding of the constraints that needed to be overcome to solve what we described as the investment-enabling appropriation problem, and they could also explain why their CBO could not solve this problem.

The two other *beels* in the area faced a different set of problems. Katora Beel was a small seasonal *beel* of around 27 acres that formed on land that had effectively become privately owned as a result of encroachment. The encroachment process typically involves individuals taking out *pattans* or leases of *khas* (public) land and with the support of the local administration this effectively allows them to treat the land as private land over time. The land is used for rice farming and also becomes a seasonal *beel* that is semi-closed and connects to a floodplain of 400-450 acres. The CBO, constituted as a cooperative society, owns a small amount of land on which it maintains fish sanctuaries and it enforces seasonal fishing bans. As with other CBOs in the region, it allows individual fishermen entry for a share of the catch. The physical characteristics of this waterbody make the construction of seasonal barriers prohibitively expensive for the CBO members. In addition, there were conflicts within the CBO. The region has depressions called *dobas* where fish congregate and these areas remain inundated even after the flood season. The owners of the land where the *dobas* are located have the sole right to harvest these fish after the *beel* has receded and their incentive is to harvest all the remaining fish, leaving no restocking for the next season. The average income of the CBO members is too low to pay for effective stocking and so the CBO only uses free fingerlings provided by government hatcheries. The members understood the investment problem very well and suggested a solution, which was to pay the *doba* owners a fee for not exhausting the entire fish stock, but they lacked the resources even to do that.

The last *beel,* Poshna Beel was not doing well at all and everyone agreed that the problem here was the absence of investment. The CBO was barely active since the waterbody was not currently lucrative. Ironically, the physical characteristics of the waterbody were such that relatively moderate investments in earthworks and sluice gates could effectively close the waterbody. According to local fishermen, this waterbody was therefore potentially more lucrative than Katora Beel if the investments could be financed. The problem of *dobas* (which also existed here) was, according to the fishermen, potentially easier to solve. Local fishermen suggested a 60-40 split of the net profit of the

fishery between *doba* owners and others as a way of aligning incentives for both types of landowners to conserve the fish for the next season. Since with closure the fish would remain in the waterbody even during the flood season, the *doba* owners would profit from not exhausting the stock entirely, thereby reducing the cost of restocking. Thus, in this example, the fixed-technology appropriation problem would become easier to resolve if the investments in infrastructure to close the waterbody could be organized.

Comilla and the Enterprise-Based CBO model

The next two projects are variants of a very promising enterprise-based community management model which was developed in the Daudkandi region of Comilla. Shisuk (pronounced Sheeshook), an NGO with a focus on education and health, took the lead in developing this model from the mid-1990s. The enterprise model comes closest to providing a community-based answer to the investment-enabling appropriation problem and over time it is also making some progress in addressing the production organization and monitoring problem. The key feature of the enterprise-based model is that the land underlying the waterbody is privately owned and the owners come together to form a company based on shares. The land is rice-growing land for part of the year and then gets flooded and becomes suitable for aquaculture. Shisuk has evolved a model with a well-worked out structure. Shares are issued to raise capital for infrastructural investments, and additional working capital is borrowed from banks. The model is evolving but at the time of our investigation, 27 per cent of net income went to pay a rent to the landlords proportional to their land holdings, 3 per cent was earmarked for social welfare and 70 per cent was split between the management committee (which gets around 10 per cent), dividends (usually around 50 per cent), and reserves. Landlords with *dobas* are paid extra. Twenty per cent of the initial shares were subscribed by Shisuk and the rest by landholders but there was a limit to the number of shares any particular landholder could buy. In addition, all landlords were only given one vote and only landlords who were local residents could be shareholders. The management committee was elected by the shareholders and decided on investments and fishing times. Guards were hired to monitor theft but the entire community was also engaged in monitoring as their houses lie around the boundaries of the waterbody. The management committee could and did impose fines on unauthorized fishermen or for the use of banned nets. The community aspect of this model is that a significant amount of collective action is required to build the trust and cooperation for this model to work, and this involves landowners of different sizes but also other stakeholders in the region. However, it is also an enterprise model in the sense that rights are structured in ways that make it easier to solve both the investment problem and the production organization problem in consistent ways. For instance, wage labour was used in this model to a much greater extent and any anti-poverty impact was achieved through rising wages and the availability of fish in the local markets rather than through ensuring access to fishing for individual poor fishermen.

Initially, management was the collective responsibility of the management committee, but not surprisingly, this proved to be inefficient, and over time the management responsibility was auctioned, with shareholders bidding to take on this responsibility. In the new arrangement, the winners of the auction become the true residual claimants, with landholders and shareholders getting dividend and rental incomes. In principle this can have a positive impact on the production monitoring problem, but how this affects the investment problem will have to be tracked over time. The enterprise-based CBOs in Daudkandi have achieved a significant yield per acre, reporting a yield of 1850 kg/share in 2008, considerably higher than the average for closed waterbody fisheries (Karim, et al. 2010, 10).

Some special features of the enterprise-based CBO model are important for understanding its relative success in terms of net output enhancement. First, the region benefited from public investments in flood protection that created embankments and culverts and made feasible smaller private investments to create enclosures to control smaller parts of the floodplain as potentially closed waterbodies. This meant that large returns were not necessary to justify the investments, and therefore the production monitoring problem did not have to be immediately solved. The economic and political problems of making the productive transformation were therefore significantly reduced. The first stage of public investments took place in the early 1990s with the construction of the Comilla flood protection barrier. Pankauri Fisheries was the first project that began in 1997 with the assistance of Shisuk and its emergence also coincided with the roll-out of CBFM Phase 2. The land covered 1000 bighas (around 300 acres) in 7 villages. The shareholders raised enough capital to build a six kilometre long 'country road' on an embankment that could be used to close a part of the floodplain into a seasonally closed waterbody. The landlords provided the land because it remained in their ownership and the project paid them a rent for the use of this land. In addition, their other lands went up in value as a result of adjoining the road. Further severe flooding in 2004 led the Local Government Engineering Department (LGED) to undertake the building of further roads and culverts. These, in turn, made additional private investments in developing seasonally closed waterbodies feasible. New enterprise-based CBO projects followed. A second important feature was that the underlying land here was privately owned and was effectively leased to the CBO for flood-season fish harvesting, reverting to private rice agriculture in the dry season. As the shareholders can only be resident landlords, someone selling their land is likely to also sell the shares in the project to the same buyer. The projects effectively had an indefinite lease till the shareholding structure of the company was wound up. As a result, the question of the length and credibility of the leases did not arise. If lease agreements for public land are to support similar long-term investments, the leases would have to be long enough to justify the investments.

Other important features of the Daudkandi model became apparent in discussions with CBO members in the projects. The first of the two projects studied in this area was Chargram Fisheries set up in 2003 as part of Shisuk's enterprise-based CBO model. It is a registered joint stock company based on the shareholding principles described above. The waterbody extends to around 1000 bighas (330 acres) and is effectively closed, controlled by five sluice gates. As the CBO consists mainly of landlords, it includes the most powerful individuals in the locality. The CBO membership and that of the management committee are important for understanding its implementation capability and why it can operate effectively in a clientelist political settlement. As landholders belong to all parties, the CBO includes a cross-section of elites and its membership cuts across all major political parties. This creates a collective interest within the CBO to keep party politics out as they know that the consequence will be a split in the company and a loss of investments. These characteristics ensure both a high level of enforcement capabilities on the part of the CBO and also a long-term credibility that their management arrangements will not be overturned with a change of government. In fact, the Daudkandi CBOs have been patronized and recognized by both major parties. The fact that the CBO brought together relatively wealthy individuals also meant that its member shareholders could mobilize finances by subscribing shares, and banks were later willing to lend working capital on favourable terms given the balance sheet of the company. Thus, the identity of the residual claimants here met the most important conditions for investment-enabling appropriation problems to be addressed.

The fixed-technology appropriation problem was not particularly important in this case because the harvest is seasonal and the optimal rate of fishing does not have to be discovered by the residual claimants to allow the stock to reproduce. Seasonal restocking with fingerlings is necessary and adequate capital was available for this. However, given the capabilities and incentives of the management committee, it is likely that it would be able to exercise effective control rights to regulate and restrict the catch if it was necessary. Sanctuaries and fishing restrictions were effectively enforced. However, effective and timely labour management is important for this model. Net output could collapse if there was free-riding behaviour within the production team. This problem was addressed by the use of wage labour or catch-sharing arrangements negotiated by a team management which had both incentives and capabilities to determine who can fish and on what terms. Not surprisingly, team monitoring was more effective in this enterprise-based model, sustaining the net output required by investors. Interestingly, despite the landlord base of the residual claimants, the NGO Shisuk was critical for setting up the CBO. This is because there were many internal conflicts and suspicions that needed to be resolved and the presence of an external arbiter was vital to set up the critical institutional arrangements and to oversee their functioning. The conjuncture of prior public

investments in barriers and flood prevention, the presence of private landholders who could pool their lands and invest to construct a potentially closed waterbody, an effective and committed NGO that could act as a neutral arbiter and catalyst combine to explain why this was a relatively successful CBO model. But this also means that the model may not be relevant for all types of waterbodies in Bangladesh.

The enterprise-based model clearly has features that are able to address aspects of the investment-enabling appropriation problem and the production monitoring problem to achieve significant investments and increases in net output. However, the investments required to achieve closed waterbody conditions were fortuitously reduced as a result of public investments in flood prevention. Further investments are likely to require more effective control over production so that monitoring costs are reduced. This is likely to be necessary to assure adequate returns on further investments. Introducing labour- saving or production monitoring technologies will undoubtedly be criticized and indeed the enterprise model has already been criticized for excluding the poor from free access fishing and for damaging bio-diversity. Shisuk as the advocate of the enterprise model strongly contests these charges, pointing out the rising wages and labour shortages in the area as proof of the poverty reduction that has come from the wealth generation in its fishery projects. It denies that temporarily closed-waterbody aquaculture of the type it practices has significantly reduced the varieties of fish in the region. Indeed while both sides of the argument may have some factual merit, and even if there are some immediate trade-offs along these lines, the enterprise-based CBO model still needs to be seriously considered as a way of making a significant impact on the constraints on raising net output in Bangladesh fisheries.

Variants of the enterprise-based model have been imitated by a number of fisheries in the area which have not followed the formal company structure that Shisuk advocates. The second project we visited in the area was Bashora Fisheries, which was set up as an informal adaptation of the Shisuk enterprise model. The waterbody here was around 300 bighas (100 acres) with 220 landlord- shareholders, but the organization was informal and a registered company was not set up. The management committee was not elected. It was selected by consensus by the landlords to include members of all powerful family groups. Landlords were paid a rent, including extra amounts for *dobas* and the surplus was divided between shareholders. The hydrology here was not based on sluice gates and so this remained a semi-closed waterbody. Smaller fish were preserved in three ponds to assist restocking for the next season. The informality here raised questions about the sustainability of the project in case serious disputes arose between landlords or if outside political players attempted to enter the project. Informality may provide easier ways of solving these problems but the organization may also fall apart.

Organizational informality also meant that the project appeared to have raised less significant amounts for investing in infrastructure, so its relative success in solving the investment-enabling appropriation problems was less clear. If many individuals are to contribute significant but different sums to an investment fund, a formal structure that recognizes their different shares in the project may be necessary to induce long- term investments. Yet despite the informality, the residual claimants in this case certainly had relatively strong enforcement and financial capabilities. As a result, in terms of solving fixed-technology appropriation problems such as managing *dobas* and preserving fish for restocking, the informal enterprise-based CBO performed better than some fishermen-based CBOs in Tangail, even when the latter had significant NGO assistance.

Mymensingh

The waterbody visited here was Kalmeena Beel, a permanent waterbody of about 86 acres that grows to three times this size in the flood season. The permanent part of the waterbody is *khas* but the surrounding land is privately owned with 186 owners. In 1992, a private landlord secured a three-year lease on the *beel* but the project failed because he could not control theft. In 2007, with support from the Department of Fisheries (DOF), a CBO and management committee were organized to manage the waterbody. It was similar to the Daudkandi model in that the management committee of the CBO managed the waterbody and gave returns to the landlords but it was also different because the CBO was not based on share ownership, was not registered, and the rules for dividing benefits were not clearly set out. The absence of share subscriptions meant that it could not raise capital as in the Daudkandi model and internal conflicts led to a breakdown of the CBO in 2009. A new model emerged in 2011 with competing groups of landlords setting up alternative management committees and bidding to get the support of the community by offering higher rents to landlords. The winning bidder would get the chance to form the committee for three years, organize the investments and keep any residual. There is a chance that this model may work but it was too early to tell. The bidder may not be able to deliver the promised rents particularly because investment-based returns are ruled out given the absence of significant investment funds. The local management committee can, however, be expected to be better in managing fixed-technology appropriation compared to private individuals from outside the area who proved unable to control thefts.

Clearly, without landlords forming a shareholding structure their ability to raise money for investments is reduced. The hydrology of Kalmeena also does not allow easy investments. It is a flood prone area and the risk of losing fish stocks to other waterbodies is high. The long-term viability of private investments depends on prior government construction of roads and sluice gates. If this were to happen in the future, the emerging CBO model in Kalmeena would be unable to raise the additional internal

funds for investment. But the incentives under these circumstances are likely to lead the CBO in the direction of the Shisuk-Daudkandi model.

Kishoreganj Haors

The Kishoreganj area is home to many *haors*. These large seasonal open water bodies are based on annual floods and they can easily be mistaken for oceans with waves lapping the shores. The technology of even partially closing these waterbodies for enabling investments is more limited and more expensive. However, as the water is not very deep in all parts of the waterbody, it is possible to create closed areas called *kops* or *kathas* using wood or bamboo, that allow fish to grow in a loosely controlled environment. More serious investments could create large submersible netted cages to allow the effective closure of parts of the waterbody, and also allow intensive feeding. The leasing policy of *haors* does not however seek to identify potential investors nor provide incentives for significant investments. In the two projects we visited in this area, the leasing regime aimed to help poor fishermen but the outcomes were at best moderate to poor even in terms of the anti-poverty objective and rather poor in terms of investment-enabling appropriation.

The first of the two projects was at Nikli where a 278 acre part of a haor was being managed by a CBO set up under the guidelines of the Fourth Fisheries Project (2002-12). The CBO had 368 member families, not all of whom were fishermen, but they were certainly from the middle to poorer sections of the population. The management committee was also allowed to have non-fishermen individuals on it, and the project had a fifteen-person committee, most of whom were connected to the fishery business, but none were actually fishermen. However, in terms of wealth, they were not the biggest landlords in the area. Half were small landlords and the other half were described as effectively landless. The annual lease paid to the government was slightly over a million takas (around $15,000) and the management committee's income was based on the sale of fishing rights to fishermen on a 25-75 split of the catch, the larger share going to the committee. On this basis, a net profit for the committee was achieved that was just a little larger than their investment. This was divided amongst the CBO members proportional to their initial investment in contributing to the leasing fee. In fact, the CBO members were collectively only able to raise 70 per cent of the lease (and this provides an idea of their relative poverty), the rest being borrowed from traders who earned a return by buying all the fish from the *haor* at a discount. In common with all the other cases of CBOs, this one too received significant assistance from an NGO when it was being set up.

Apart from collecting the revenue already paid to the government, the core work of the CBO was, as we would expect in an open waterbody, to allocate fishing spots and

rights, prevent theft from non-paying fishermen, and enforce sanctuaries and fishing bans. However, the sanctuary management required investments that the committee could not afford. The committee did not even have the funds to invest in *kops* or *kathas* which cost around 10,000 takas each (around $150), let alone anything more significant. There had been gradual siltation in the haor reducing the effective fishing area to a quarter of the total. The Fourth Fisheries Project had allocated funds for dredging part of the *haor* but towards the end of the project only half the allocated amount had been spent. The benefits to the committee should not be confused with anti-poverty measures because a tiny number of poor people were involved both in the CBO and in the management committee. The net return per person for a group of around 350 families on an annual net profit of around fifteen thousand dollars is less than fifty dollars per family. The number of poor families living around the *haor* is at least another three to four thousand. When CBO members were asked why all the poor families were not included in their CBO they quite truthfully pointed out that their inclusion would make the individual returns negligible.

It is clear that significant anti-poverty measures require a substantial increase in the net output of fisheries assets. Not only is the rent that is earned by the CBO relatively small, the CBO is vulnerable to political takeover and interference, despite the support of NGOs. A previous leaseholder of the *haor* was allegedly involved in thefts of fish to intimidate the community leaseholders, but he was stopped by the NGO who took legal action. More recently, the Awami League government interfered by appointing the entire management committee using the local government administration instead of allowing an election. As we were talking to this management committee, no further details were available but they themselves described in broad terms what had taken place. They also told us that Awami League youth were trying to directly get leases on linked waterbodies through the Land Ministry. As we would expect, management committees composed of poorer individuals are likely to be very vulnerable to political takeover and capture, despite the active resistance of NGOs. In any case, the presence of an NGO cannot be a sustainable long-term strategy. In the end, instead of being anti- poverty measures, these arrangements are more likely to sustain relatively small rent distributions to party supporters of the ruling party in a clientelist political structure.

The last project visited was the most depressing, but is reported because here an effective CBO had even failed to form, and this must be true for many waterbodies. The waterbody at Kothiadi is a system of interconnected *haors* of 50, 400 and 28 acres each. Initially under the CBFM-2 project, there was a DFID-financed attempt to set up a fishermen-only CBO, initially with BRAC assistance. By the time we visited, everyone appeared to have given up on this area. The fishermen were almost all from the minority Hindu community and very poor, but were deeply divided amongst themselves with many

factions. When the project began in 2002 a management committee was set up entirely composed of fishermen and they paid the lease amount, but their legality was immediately contested by excluded fishermen. The management committee made the mistake of illegally sub-leasing part of the waterbody and when the local administration was informed of this, the lease was terminated and allocated to a powerful local group. The management's tasks were as in any other open *haor*, selling fishing rights on a 75-25 share and earning a return on the lease investment. This was not the end of the story as three competing committees were set up (but accounting between them for only 120-130 poor fishermen in a densely populated area). The competing committees were clearly composed of the more entrepreneurial and ambitious of the poor fishermen, and they apparently spent large sums of money bribing the district commissioner to keep changing the allocation of the leases between themselves. In the end, of course, the fishermen did not benefit at all and even fixed- technology appropriation problems could not be solved.

This was obviously an extreme example of conflicts between rival groups of the very poor failing to achieve coordination. Indeed this is to be expected because these types of CBOs and their management committees only generate relatively small rents by selling access rights. These rents cannot possibly generate a return to *all* the poor. The effective CBOs are ones where excluded groups accept as legitimate the current management committee's first mover advantage. In the Kothiadi case, these conditions were not met and the conflicts between the poor benefited the local administration and more powerful groups. At the time of our visit, NGOs and donors had abandoned the area to find its own solutions. We suspect that in the many waterbodies where there is no NGO presence, the allocation of leases is heavily politicized. Even where poor fishermen's organizations get the lease, in the absence of strong and persistent external assistance from NGOs, the bulk of these relatively small rents are likely to be captured by the powerful in the form of bribes and protection money. The low enforcement capabilities of the poor make these unfortunate observations entirely explicable. The policy conclusion is that even as an immediate anti-poverty measure, some or many of these CBOs are failing because a) they cannot deliver any rents to most of the poor, b) the rents delivered to some of the poor in the successful CBOs are very small and c) in many cases the poor fail to set up CBOs or protect their rents from indirect extraction by the powerful.

Conclusions

Bangladeshi inland delta fisheries have specific physical characteristics in that they are largely open, with a declining flow of fish, and require extensive investments to

effectively close them on a seasonal basis in ways that are suitable for raising net output. Community-based fisheries management in Bangladesh has attempted to find property rights solutions to improve the management of fisheries while providing poor fishermen with improved livelihoods. Though community-management is often justified in terms of greater inclusion of the latter, in the context of the Bangladeshi political settlement, the delivery of rents to the poor has not been very successful. Net output has been persistently poor. The most important contribution of many CBOs is to collect revenue for the government and for groups of the poor, from fishermen who continue to fish using existing technologies. The 'property rights' thus created often do not address any of the substantive issues identified earlier.

The economic problem of improving net output in fisheries has at least three dimensions: a fixed-technology appropriation problem of coordinating and regulating the catch rate to maximize net output over time with fixed technologies, an investment-enabling appropriation problem of ensuring the alignment of incentives of investors to allow investment in infrastructure and stocking, and a production monitoring problem of changing the organization of production to reduce high team monitoring costs, a problem which arises in labour-intensive industries like agriculture and fisheries. Property rights solutions that address these issues need to be enforceable in the context of the specific political settlement that describes the relative power of the stakeholders. In addition, society may have equity and environmental objectives. In terms of overall policy greater clarity about objectives and instruments is required. Anti-poverty and environmental protection *can* have short-term trade-offs with the expansion of net output. In vulnerable areas, pro-poor property rights can be justified even if they do not raise net output, in other areas vulnerable to environmental degradation, environmental issues should get priority. But in many other areas where there are prospects of raising net output, property rights that enable this should be the policy priority.

The case studies point out the importance of distinguishing fixed-technology appropriation problems from investment-enabling appropriation and the production monitoring problems that need to be solved in both cases. The dominant property rights solutions have, at best, addressed the fixed-technology appropriation problem but most do not yet support investment- enabling appropriation and production reorganization to improve production monitoring, both of which are essential for sustained improvements in net output. One intriguing exception in terms of addressing the problem of investment-enabling appropriation and aspects of production monitoring as well is the Comilla-Daudkandi enterprise-based model. It is a very promising model as a starting point for thinking about the conditions that would need to be satisfied in the design of public lease rights to achieve similar results in publicly owned waterbodies, where the underlying conditions are different. However, even as an objective this may not be suitable

everywhere, and therefore, it is argued that a multi- pronged approach is necessary, stressing immediate anti-poverty objectives in some places, environmental objectives in others, but with a clear focus on net-output enhancing strategies in areas where this is feasible.

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