Wastewater aquaculture and livelihoods in peri-urban Kolkata

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Kolkata's wastewater has been used in fish farming for many years, providing cheap food, livelihoods for the farm workers and protection from unregulated wastewater discharges downstream. A number of problems face the industry and this article describes an action-planning approach involving local stakeholders to confront these difficulties.

Wastewater aquaculture – the culture of fish and aquatic plants in sewerage and drainage water – is widespread throughout Asia. Direct reuse, the planned and deliberate use of wastewater as a nutrient and water resource, has been observed in peri-urban areas around Hanoi and Ho Chi Minh City in Vietnam, Kolkata (Calcutta) in India and Phnom Penh in Cambodia.[1] Indirect reuse – the use of water from channels contaminated with wastewater, without recognition of its condition – is probably more widespread, but rarely recorded. The 'Hyderabad declaration on wastewater reuse in agriculture' also highlighted the fact that 'Wastewater (raw, diluted or treated) is a resource of increasing global importance, particularly in urban and peri-urban agriculture'.[2]

Considering the benefits, particularly to poor communities, it was apparent that new knowledge on the direct and indirect benefits of peri-urban farming was required, and that strategies to safeguard and enhance poor people's livelihoods were vital. Between October 2000 and December 2002 the Natural Resources Systems Programme (NRSP) funded by the UK Department for International Development (DFID) supported a research project that explored these issues.

Wastewater aquaculture in peri-urban Kolkata

Aquaculture exploiting wastewater resources has been developed and refined by farmers in peri-urban Kolkata since the 1920s.[3] Past estimates suggested that 550 000 m^3 of untreated wastewater per day is pumped from Kolkata into a series of secondary canals that convey it to several hundred fishponds.[4] Currently, the pond area used for wastewater aquaculture covers nearly 3500 ha, with individual fisheries ranging in size from less than 1 ha to over 70 ha.

Various historical reasons and government interventions have contributed to the scale and distribution of land holdings in the area. The fisheries are usually owned by absentee landlords and their management is largely undertaken by leaseholders; other fisheries are operated by fishermen's co-operatives and groups, and a small number are under government control.

Labour unions in the region are influential and have largely dictated how wastewater aquaculture ponds are operated. They set the terms and conditions of employment and these are responsible for the widespread strategy of frequent stocking and almost daily harvesting, which in turn results in year-round supplies of relatively small, affordable fish to local and urban markets.

The most common fish produced are small exotic tilapia and Indian major carp, weighing less than 200g.[5] Fish are harvested early in the morning and sold live in wholesale markets located in the peri-urban wetlands, and then to traders who in turn sell them to consumers in urban retail markets later the same morning. Recently it was estimated that ponds managed for wastewater aquaculture produce more than 18 000 tonnes per year of fish for sale in local urban markets, many of which service poor communities.[5]

These farms provide direct and indirect employment for several thousand people

Untreated wastewater is pumped from Kolkata via a series of secondary canals like this one to several hundred fishponds

As well as producing fresh food for urban and peri-urban markets, these farms provide direct and indirect employment for several thousand people. In addition, if managed properly, the wastewater reuse is a valuable service to society, reducing health risks from unregulated discharges and protecting downstream environments.

Livelihood opportunities

Producers face several threats to the continued operation of their farms; moreover, a reluctance to invest time and money in maintaining and enhancing their farms due to growing insecurity makes them more vulnerable to emerging constraints.

Many poor households and individuals in peri-urban Kolkata who are engaged in fish farming experience seasonal vulnerability. There is insufficient access to water during the dry winter months, despite the continuous discharge of wastewater from municipal Kolkata. Siltation in the primary and secondary feeder canals and the inappropriate management of sluice gates regulating the distribution and flow of wastewater to fishponds are the main reasons why producers are unable to access sufficient wastewater to support their traditional farming practices. Co-ordinated action on behalf of all stakeholder groups, including rural and urban government agencies and poor communities themselves, is urgently required for both issues.

Several other technical constraints to sustained or enhanced production were identified during the research project, in particular a dependence on externally sourced high-cost inputs – most significantly fish fry – recurring fish disease problems, contamination of wastewater supplies by industrial effluents, and limited access to appropriate credit arrangements to fund the desilting of the fishponds and feeder canals.

The research revealed that poor people are often keen primarily to enhance their cash income, although with adequate support this might be achieved outside farming. Whilst enhanced agricultural production might contribute to sustaining the livelihoods of the poor, to move out of poverty these people need to develop alternative livelihoods. For young people, education, training and the knowledge of transaction costs in moving to different livelihood strategies are required to access such opportunities. It was clear that rising expectations, combined with uncertainty regarding the prospects for traditional farming practices in the face of urban growth, are encouraging people to diversify their livelihoods.

From both focus group and household interviews with poor people working in fish farming, it was apparent that improved infrastructure and service provision (e.g. drinking water supplies, sanitation, electricity, roads, healthcare) from the municipal authorities would help improve livelihoods for many in peri-urban Kolkata. At present, even basic services were not reaching many people because of their poverty and the incomplete geographical coverage of services in these urban and peri-urban areas.

Such problems could be addressed through improved planning and resource allocation, including pro-poor policies; however, the formulation and targeting of such initiatives would demand better communication and co-ordination of activities among local government bodies and other key stakeholders.

Studies of market networks showed them to be highly organized and efficient. However, many expressed concern about the possible human health issues of working with wastewater. Epidemiological evidence from fish farms around Kolkata practising wastewater reuse has shown that workers who often come into contact with wastewater experience a range of health problems, notably increased infection with round worm (*Ascaris lumbricodies*), *Giardia lamblia* (causing giardiasis) and pinworm (*Enterobius vermicularis*).[6] Moreover, a survey of consumers at local retail markets revealed that over half had a negative opinion on the use of wastewater to culture fish.[5]

The project consolidated existing information resources and generated new knowledge to fill the identified gaps, most notably on the livelihood strategies of groups and households dependent on access to peri-urban natural resources. It was also recognized that the comprehensive knowledge-base developed during the project should be further exploited to facilitate collective decision making, and to develop appropriate action plans to address those constraints and opportunities identified. Clearly it was important that decision making and action planning should involve collaboration between all key stakeholder groups. However, the divergent interests and agendas of these groups, especially the poor and urban and rural government agencies, suggested further research was required to establish a process of action planning that would foster co-operation, understanding and

collective decision making; the planned approach is outlined below.

Participatory action planning for poor peri-urban communities

Key constraints to sustainable wastewater reuse facing poor people in peri-urban Kolkata have been identified, but to ensure that action is taken to address these issues it will be necessary for all stakeholders to develop plans of how to overcome these problems. Information from the DFID NRSP project has fed into a draft management plan for the Ramsar site of the East Kolkata Wetlands. However, development of an appropriate implementation strategy for this outline plan will demand consensus among, and concerted action on behalf of, all stakeholders.

To help facilitate this process it is intended to develop action plans with the diverse stakeholder groups in peri-urban Kolkata, and these plans should focus on critical aspects of natural resources management with the potential to benefit the poor. Important issues that could be addressed include how to manage and fund desiltation of canals and fishponds and how to help poor people diversify their livelihoods to less vulnerable activities, removing their dependence on the reuse of untreated wastewater for fish farming. Participation of representatives from government agencies, CBOs, NGOs, development-oriented bodies and local communities with a stake in managing natural resources in peri-urban Kolkata will be ensured through building on links and dialogue established during the previous project.

The process of action planning will be observed and new knowledge extracted, in particular on the interaction and roles assumed by stakeholders in participatory decision making. New knowledge on action planning, including reflection from a representative sample of participants, will be documented and summarized; such reflection will enable learning outcomes to be better assessed and opportunities to enhance the action planning process identified.

Fish farming protects downstream environments from unregulated discharges from Kolkata

Conclusion

Although it will not be possible to address all issues covered by the draft Ramsar management plan, the project proposes to develop a detailed understanding of the process underlying the negotiation and agreement required to ensure that stakeholders participate fully in and sign-up to action planning and the resulting outcomes. These action plans will then form a component of the Ramsar management plan and will be promoted with development-oriented agencies with a view to agreement on external support. Lessons learned from the process monitoring of the complex interactions between urban and rural government agencies, non-government and independent stakeholders will be communicated to other parties including the Government of West Bengal, other municipal authorities within the state, and the Ramsar Bureau for use in other negotiations regarding peri-urban natural resources where wastewater reuse may be a critical issue.

About the author

Stuart Bunting is with the Institute of Aquaculture, University of Stirling, Scotland.

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