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Co-management of Reservoir Fisheries for Sustainable Livelihoods: Insights for Fishery Managers and Extension Professionals from Field Studies in India

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ABSTRACT

Reservoirs hold tremendous potential for inland fisheries development and offer ample scope for fish yield optimization through adoption of appropriate management measures. H owever, there are several socio-economic issues involved in their management as communities displaced due to creation of these reservoirs depend upon them for earning livelihoods.Reservoirs hold tremendous potential for inland fisheries development and offer ample scope for fish yield optimization through adoption of appropriate management measures. Governance and management pattern of these reservoirs varies in different states of India and faces several challenges including the twin pressures, to increase the production and productivity, and ensure sustainable livelihoods for communities dependent upon these resources. The present paper while discussing these issues elaborates upon the co-management approach to address them. Citing synthesized overall summary of the major findings of the field studies done in Northern, Central and Eastern India, the paper elaborates upon the performance of fishing cooperative societies in co-management and conservation of reservoir fishery resources and roles played by various stakeholders and their linkages in this endeavor. The paper is based on review of literature, secondary data from various records, and primary data gathered and detail interactions had with several stakeholders during field studies in four states of India namely, Madhya Pradesh, Himachal Pradesh, Uttar Pradesh and Orissa covering 57 fishing cooperative societies and 875 respondents. The findings indicated that local communities and their organizations (fishing cooperative societies/federations) can play important role in collective management of reservoir fisheries under the situations where some of the facilitating conditions for promoting collective action are present. The paper concludes that governance and management of reservoir fisheries need to be viewed in light of the recent developments and empirical evidences made available by the social scientists in natural resource management. There is tremendous scope for innovation in their governance. Lessons drawn from successes achieved in various forms of co-management fisheries resources, such as reported here and elsewhere across the globe, need to be incorporated in devising policies and programmes for management of reservoir fisheries. The field of fisheries management and conservation presents enormous possibilities for the extension professionals to broaden their canvas and contribute policy oriented studies to help the fisheries managers and policy makers in further improving the sector.

Keywords: Reservoir fisheries, co-management, fishing cooperative societies, sustainable livelihoods

INTRODUCTION

Institutional arrangements play a significant role in determining the efficiency and effectiveness of policy or technological interventions. Therefore, institutional arrangements in natural resource management have been a major focal area of studies for social scientists across the globe in last two decades. The institutional arrangements mean the set of rights and rules by which a group of resource users and government organises governance, management and use of resources in collective action situations. If we scan global literature on management of natural resources across different geographies, socio-economic conditions and ecosystems diversity, we find that a variety of approaches and combinations have been tried at various places for improving the management of various natural resources like forests, mangroves, coral reefs, wetlands, fisheries, etc. There have been increasing efforts towards conceptualization, experimentation, analysis and evaluation of different forms of resource management approaches with varying degrees of stakeholders' participation in decision making. In general, user groups and local organizations are now increasingly considered as a valuable asset in improving the natural resource management and their sustainable use for posterity. Several studies have shown that when people are well connected in groups and networks, organizations, and when their knowledge is sought, incorporated and built upon during planning and implementation of conservation and development activities, then they are more likely to sustain stewardship and protection over the long term (Cernea, 1991; Pretty 1995; Singh and Ballabh, 1997; Krishna, 2002; Uphoff, 2002; McNeely and Scherr, 2003).

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Challenges in Management of Fisheries Resources for Sustainable Utilization

Fisheries resources are under strong and increasing pressure due to several natural and anthropogenic stresses. The depletion of natural resources has become a universal phenomenon, irrespective of the region or the type of resource. However, the impact on the aquatic resources has been very severe. Therefore, sustainable utilisation, conservation and development of fishery resources, particularly freshwater fishery resources, have become a priority concern. Fisheries are complex and interdependent ecological and social systems that require integrated management approaches. The actions of one person or group of users affect the availability of the resource for others. Managing such common pool requires conscious efforts by a broad range of stakeholders to organize and craft rules enabling equitable and sustainable use of the resources for everyone's benefit. Some of the key challenges that have emerged for fisheries managers in recent times are: 1. Increasing the production and productivity of fisheries resources, 2. Ensuring sustainable and equitable livelihoods for communities dependent upon fisheries resources, 3. Lack of awareness among users about legislations and rules for sustainable management of fisheries resources, 4. Need of a resource enhancement and resource use monitoring system for sustainable utilization on long-term basis, and 5. Great demand on the limited man-power of the state fisheries agencies

Co-management in Fisheries: The Approach and its Advantages

A realization that centralised fisheries management approaches have proven inadequate to deal with the above issues, has led to the growing attention towards a broader approach that recognizes fishers' participation, local stewardship and shared decision-making in the management of fisheries globally. This approach is known as co-management of fisheries. The co-management concept has gained increasing acceptance among governments, development agencies and researchers as an important aspect of future fisheries management systems. 'Co-management' in fisheries is basically meant to denote the sharing of management responsibility for fisheries by resource users and governments. Co-management has been broadly defined as a partnership arrangement in which the community of local resource users (fishers), government, other stakeholders (boat owners, fish traders, boat builders, business people, etc.) and external agents (non-government organizations, academic and research institutions) share the responsibility and authority for the management of the fishery. The basic concern in co-management is with reshaping state interventions so as to institutionalize collaboration between administration and resource users (Baland and Platteau 1996).

Co-management, has several advantages: a more autonomous, democratic, participatory, accountable and transparent resource management system; more economical then centralized management system, taking of responsibility by fishers for various managerial functions by involvement in management; a sense of ownership over the resource by the fishers improves stewardship of fisheries resources, provides a powerful incentive for fishers to view the resource as a long-term; more localized solutions to local problems in resource use, various interests and stakeholders are brought together to provide a more comprehensive understanding of the resource; higher degree of acceptability, legitimacy and compliance to plans and regulations can be expected, because the community is involved in the formulation and implementation and community members can enforce standards of behavior more effectively than outside officials.

Policy makers need empirical inputs on issues related to the institutional aspects of management of fishery resources, including roles of different stakeholders, so as to formulate policies for optimising their conservation and development. Therefore, several scholars have contributed in reorienting the fisheries governance paradigm over the past two decades (Berkes 1989, 2003; Jentoft 1989; Lawry 1989; Pinkerton 1989; Ostrom 1990; Oakerson 1992; Pomeroy and Williams 1994; Bavinck 1996; Pomeroy and Berks 1997; Jentoft et.al. 1998; Jentoft and McCay 1995; Sen and Nielsen 1996; Nielsen and Vedsmand 1999; Karlsen 2001; Pomeroy 2001; Pomeroy et.al. 2001; Almeida et.al. 2002; Allison and Badjeck 2004; Nielsen et.al. 2004; Jentoft 2004; Pomeroy and Rivera-Guieb 2005; Makino and Matsuda 2005; Bene and Neiland, 2006; Thomson 2006, 2008; Jyotishi and Parthasarathy 2007; Kearney et.al. 2007; Bavinck and Salagrama 2008; Pinkerton and John 2008; Townsend et.al. 2008; Thomson and Gray 2009; Gutiérrez et.al. 2011; Jyotishi 2011; Bavinck et.al. 2012). The policy consensus in favour of fisheries decentralization in the form of co-management or community-based management has now been recognized and accepted not only in large number of developed countries (Denmark, Netherlands, Canada), but also in an increasingly large number of developing countries (Uganda, Mali, Malawi, Mozambique, Senegal, Ghana, Philippines, Malaysia, Fiji Islands) (Sen and Nielsen 1996; Norman et.al. 1998; Sverdrup-Jensen and Nielsen 1998) [Modified and quoted from Bene and Neiland 2006].

Reservoir Fisheries in India: Management Issues for Sustainable Livelihoods

Since independence, harnessing nation's various rivers for power generation and irrigation has been the main focus of development activities in India. This has resulted in emergence of a number of river-valley projects with primary objectives of using river water for irrigation, power generation and other activities. One of the direct results of these projects is the creation of several man-made water bodies in different parts of the country. Such man-made reservoirs hold tremendous potential for inland fisheries development and offer ample scope for fish yield optimisation through adoption of appropriate management measures. There are, however, several socio-economic and governance issues involved in the management of these reservoirs.

A large number of villages were submerged and communities displaced due to creation of these reservoirs. This created huge challenges to the state agencies for settlement of these communities and provide livelihood to families uprooted due to the impoundment. Earlier majority of these families were engaged in agriculture, however, with their lands being submerged in the reservoir, they had no option but to depend upon these reservoirs for earning their livelihoods. Prior to the impoundment of the rivers a subsistence fishery existed in the rivers and streams and the average catches per fishermen per day were very low, but with the formation of reservoir, a lucrative fishery started attracting large number of fishermen and the dam displaced oustees who had no other viable means of livelihood. This, however, was not easy as it needed to inspire a large number of oustees of various communities, mainly agriculturists and tribals depending upon forest produce, to adopt fishing as a profession. Even the local fishermen who used to fish in shallow rivers and streams with primitive gears, prior to formation of these reservoirs, found them ineffective in the deeper waters of the reservoir.

Recognising the need for development of these reservoirs as potential fish producing centres for providing livelihood to dam displaced communities, thus, came as a by-product of these river-valley projects. Governance and management pattern of these reservoirs varies in different states of India and a variety of management arrangements can be seen ranging from auctioning to contractors, giving on lease to fishing cooperative organizations, giving licences for fishing to registered fishermen, etc. Various policies and rules have been framed and mechanisms for implementation put in place by different states with varying degree of success. The state agencies earn revenue from fishing activities in these reservoirs by way of royalty from lease, license fees, fines collected from defaulters/ or those violating rules.

Maintaining a high sustained yield is, however, the backbone of the reservoir fisheries management which requires continuous efforts for sustainable utilization and resource enhancement. Thus, the state agencies are facing twin challenges of increasing the production and productivity of these reservoirs, and ensuring sustainable and equitable livelihoods for communities dependent upon these resources. This needs a resource development monitoring and surveillance system of the reservoir and places a great demand on the limited man-power of the state agencies. There are other related functions like record keeping, assuring best price of the fish to the fishing communities dependent upon these resources, *etc*.

There are several roles to be played in management of fisheries resources in the reservoirs including production-oriented and regulatory functions, educational roles and organizational roles, and there are challenges on each front which the state agencies alone are not adequately equipped to meet all. It is here that the idea of co-management of reservoir fisheries by active involvement of stakeholders and their organizations who depend upon these resources for their livelihood comes into picture.

Field studies in Northern, Central and Eastern India

In this perspective, case studies were undertaken in selected reservoirs of four states of India namely, Himachal Pradesh (H.P.), Madhya Pradesh (M.P.), Uttar Pradesh (U.P.) and Orissa. Some aspects of these studies were published in details as individual papers during 2007-2014 (Tyagi et.al. 2007, 2008[1], 2008[2], 2009, 2011, 2013, 2014). However, in this paper, a synthesised overall summary of the major findings of these studies is presented, in view of the issues and challenges mentioned above, with a focus on drawing insights and implications for extension professionals and fisheries managers in the country. In these studies, the institutions of collective action participating in co-management of fisheries resources are represented by the fishing cooperative societies a village level primary institution of the rural people displaced due to construction of dam on rivers and their federations. In India, fishing cooperative societies have been viewed in a narrow perspective of production-oriented and/or political organizations limited to and interested in only furthering their economic/commercial interests. The possibility of these organizations becoming important partners in resource enhancement and effective and efficient co-management of resources, have not been adequately explored. Policy makers, however, need empirical inputs on issues related to the organisational

and institutional aspects of management of fishery resources, including roles of different stakeholders, so as to formulate policies for optimising their conservation and development. Therefore, these field studies were undertaken to study the performance of fishing cooperative societies in co-management and conservation of reservoir fishery resources.

METHODOLOGY

The studies were undertaken at two sites each in H.P (a. Gobind Sagar and b. Pong reservoirs); M.P. (a. Tawa and b. Bergi reservoirs), Orissa (a. Hirakud and b. Surada reservoirs) and U.P (a. Small lakes in Faizabad, Jhansi and Lalitpur districts and b. Matatila reservoir). The studies covered total 57 fishing cooperative societies and 875 respondents represented by members and office bearers of fishing cooperative societies (table 1). A variety of data sources were used.

The methodology included a combination of quantitative and qualitative approaches. Roles played by cooperative societies and their federations were documented through interview schedule qualitatively, where as quantitative indices were prepared to measure the orientation and performance of fishing cooperative societies and their members with respect to conservation and resource management.

Similarly, quantitative indices were also prepared to measure other independent variables including extension contact of respondents, their cosmopolitness, awareness & involvement in government schemes, perceived effectiveness of state fisheries agencies, NGOs and panchayats, internal functioning of cooperative societies and linkages with state agencies. The information collection for the study was enriched by in-depth informal interviews with key informants, office bearers, state fisheries department officials, NGOs. and observations of activities in the selected societies. Finally, a qualitative assessment was done to assess the impact of roles played by cooperative societies on resource management and generation of sustainable livelihoods.

Major findings

Major findings coming from these studies are summarized in tables 2-6. Based on the analysis of data about above variables, a qualitative analysis was done across the locations to assess the roles, awareness, linkages and potential of fishing cooperative societies in co-management of fishery resources.

Management patterns for fisheries resources at selected locations:

A brief mention about the prevalent management pattern for fisheries resources at the selected locations during the time of study is in order here, so as to understand the situation in proper perspective. In Tawa and Bergi reservoirs (M.P.), fisheries was managed by the federations of fishermen cooperative societies for 10 and 6 years, respectively (Tawa reservoir: 19962006 and Bergi reservoir: 1994-2000), which were given on lease to these organizations by the state governments after sustained collective mobilization and agitation by the people displaced by these reservoirs. This lease was discontinued from year 2007 (for Tawa reservoir) and 2001 (for Bergi reservoir) However, in case of Tawa reservoir, the responses about roles played by cooperative institutions in collective management refers to the period when the fisheries in the reservoir were managed by these institutions. A mention need to be made here that in Bergi reservoir, the respondent's opinion and experiences were sought for the two periods separately *i.e.* earlier period when the fishing cooperative societies and their federation were collectively managing the reservoir fisheries, and at the time of study when the reservoir was auctioned to contractor for fishing. The results had come out interesting.

In H.P., on the other hand, the state fisheries department acts as the major regulatory authority and cooperative societies work closely under the supervision and control of the state department in management and utilization of the reservoirs and lakes on lease to the fishing cooperative societies for fisheries management. In U.P., state fisheries department gives small reservoirs and lakes on lease to the fishing cooperative societies for fisheries management, whereas, large reservoirs are managed by the state fisheries development corporation by auctioning to contractors through open biding. In Odisha, both the reservoirs were given to the fishing cooperative societies (Hirakud - five societies and Surada - one society) on lease.

Table 1: Sample of the study

State	Location	No. of fishing cooperative societies studied	No. of respondents
HP	Gobind Sagar reservoir	11	110
	Pong reservoir	9	90
MP	Tawa reservoir	10	100
	Bergi reservoir	15	150
Odisha	Hirakud reservoir	2	200
	Surada reservoir	1	100
UP	Small reservoirs/ Lakes	9	90
	Matatila reservoir (Open auctioning to contractor)	No society functioning	35
	Total	57	875

Profile of fisherfolk members and other independent variables:

Majority of fisherfolk members were middle aged and had very low level of education (Table 2). Socio-economic status of fisherfolk members was medium in reservoirs studied in H.P. whereas; it was low at studied sites in M.P. and U.P. and Odisha. Similarly, respondents from H.P. sites had high level of contacts with extension agencies, their cosmopoliteness level and awareness & involvement in government schemes was high and they had high perceived effectiveness of state fisheries agencies. On the other hand, respondents from M.P. and U.P. sites and Hirakud reservoir of Odisha, scored from very low to medium on these aspects where as at Surada reservoir, respondents had medium level on these parameters. Perceived effectiveness of NGOs was low in H.P. and Odisha, whereas, it was high in M.P. In UP, involvement of NGO with fisherfolk at the studied sites was non-existent. Perceived effectiveness of panchayats (a village level democratic body) was medium at majority of the locations. Internal functioning of their own societies was perceived as high by the fisherfolk members at both the reservoirs of H.P., Tawa reservoir of M.P. and Surada reservoir of Odisha. At Bergi reservoir of M.P., members expressed that societies functioning was very effective during the period when they had lease of the reservoir and were managing the fisheries, however, now it is low. Discontinuation of their active involvement in management of the reservoir fisheries has led to the lack of interest and incentive among members to take part in functioning of the societies. On the other hand, in U.P, functioning of fishing cooperative societies was very low, even where they were existing. Interestingly, linkages with state agencies were perceived as high in H.P. and Surada reservoir, Odisha where as in M.P., U.P. and at Hirakud reservoir, Odisha, linkages were perceived to be low.

Table 2: Profile of fisherfolk members and other variables

Variables	Gobind Sagar, HP	Pong, HP	Tawa, MP	Bergi, MP	Hirakud, Odisha	Surada, Odisha	Small lakes UP	Matatila reservoir UP
Age	Majority Middle aged	Majority middle aged	Majority middle aged	Majority middle aged	Majority middle aged	Majority middle aged	Majority middle aged	Majority middle aged
Education	L	L	VL	L	L	L	VL	VL
Socio-economic status	M	M	L	L	L	L	L	L
Extension contact	H	H	L	L	L	M	L	VL
Cosmopoliteness	H	H	L	L	L	M	H	VL
Awareness & involvement in Govt. schemes	H	H	L	M	L	M	L	VL
Perceived effectiveness of state fisheries agencies	H	H	L	L	L	M	M	VL
Perceived effectiveness of NGOs	L	L	H	M	L	L	NONE	NONE
Perceived effectiveness of Panchayats	M	M	M	M	L	M	M	L
Internal functioning of societies	H	H	H	(Earlier) H (Now) L	L	H	L	No society
Linkages with state agencies	H	H	VL	(Earlier) L (Now) M	M	M	L	L

H = High;M = Medium;L = Low;VL = Very Low

Roles played by fishing cooperative societies in collective management of reservoir fisheries:

Roles played by fishing cooperative societies and their federations documented through interview schedule qualitatively are presented in table 3.

It is clear from the data that fishing cooperative societies in H.P. and M.P., and Surada reservoir of Odisha, besides playing routine production-marketing oriented and regulatory functions like coordinating and regulating the collection and marketing of fishery of their members, providing a structural base for state agencies to collect royalty form fish production, facilitating equitable sharing of benefits among their members, maintaining proper records, etc; also played a number of socio-organisational, educational roles and. resources enhancement roles.

These roles included: providing an organizational base at grass- root level for state fish agencies to implement resource enhancement measures, Facilitate equitable sharing of benefits among its members, Provide moral support to their members, Serve as a social & organizational force for making members to abide by conservation rules, Offer suggestions to state agencies and eager to innovate for improving resource, Undertake resource enhancement measures, taking innovative steps (like developing low cost fish seed rearing by society members) as local solutions in resource management.

In Hirakud reservoir, fishing cooperative societies were just the subject of facilitating implementation of state welfare schemes, and were not playing other important socio-organisational, educational roles and. resources enhancement roles.

In U.P., however, the situation was altogether different. The cooperative institutions were mostly dormant, controlled by influential people without much involvement of members. They were formed for taking advantage of government schemes.

The element of social & organizational force for members was not there in fishing cooperative societies of U.P. Therefore, they were not found playing active role even in production-oriented regulatory functions. Similarly, no educational and organizational roles in resource management were played by such institutions in U.P.

Table 3: Roles played by the cooperative institutions in co-management of resources

Type of role	Role played	Gobind Sagar, HP	Pong, HP	Tawa, MP	Bergi, MP (Earlier)	Hirakud, Odisha	Surada, Odisha	Small lakes, UP	Matatila UP
Production and marketing management	Devise mechanisms & procedure, and coordinate the fishing efforts of their members	√	√	√	√	x	√	x	
	Manage the marketing of fishes of the members	√	√	√	√	x	√	x	
	Maintain proper records	√	√	√	√	√	√	x	
Subject of state schemes	Provide an organizational base at grass - root level for state fish agencies to implement revenue collection	√	√	√	√	√	√	√	Societies were not functioning as the reservoir was given on lease to the contractor
	Facilitate implementation of state welfare schemes	√	√	√	√	√	√	√	
Socio - organisational and educational	Provide moral s upport to their members	√	√	√	√	√	√	x	
	Organise collective action to get the fishing rights	x	x	√	√	x	x	x	
	Facilitate equitable sharing of benefits among its members	√	√	√	√	x	√	x	
	Serve as a social & organizational force for making members to abide by the conservation rules	√	√	√	√	x	√	x	
Resource enhancement/ conservation	Offer suggestions to state agencies & eager to innovate for improving resource	√	√	√	√	x	√	x	
	Undertake resource enhancement measu res (e.g. stocking of fish seed)	√	√	√	√	x	√	x	
	Take innovative steps as solutions for local limitations in resource management	x	x	√	√	x	x	x	

Qualitative analysis of roles and linkages in collective management of fishery resources

Based on the documentation of roles played by fishing cooperative societies and state fisheries agencies, and detailed interactions had with key informants during field work, a qualitative analysis of roles and linkages between these two important stakeholders in co-management of fishery resources was carried out and is summarized in table 4. At both the reservoirs of H.P. and Surada reservoir of Odisha, the state fisheries agencies and fishing cooperative societies, both played active role in management of fisheries resources and their mutual linkage was well understood and accepted by each other. However, at Hirakud reservoir of Odisha, fishing cooperative societies and state fisheries agencies both were passive and there was lack of effective functional linkages between them.

In M.P., state fisheries agencies did not play active role at Tawa and Bergi reservoirs when the reservoir fisheries was actively managed by the fishing cooperative societies. However, when the management of fisheries at Bergi reservoir was taken back from the fishing cooperative societies (due to non-renewal of lease that followed a long legal conflict too), and auctioned to the contractor; the state agencies became the dominant regulator, consequently, involvement of cooperative societies gradually faded away at Bergi reservoir. In M.P., the linkages between fishing cooperative societies and state agencies at the selected reservoirs was very weak and that of mutually antagonistic type wherein each party was contradicting other's claims/views. In U.P., while the state fisheries agencies played passive roles of advisor, regulator and revenue collector; fishing cooperative societies were also not functioning at the studied sites. Thus, there was lack of effective functional linkages between these two stakeholders in management of reservoir fisheries.

Table 4: A qualitative analysis of roles and linkages in Co-management of fishery resources

Variables	Gobind Sagar and Pong, HP	Tawa, MP	Bergi, MP	Hirakud, Orissa	Surada, Orissa	Matatila, UP	Small Lakes, UP
Role played by state agencies	Active	Inactive	*(Earlier)* Passive *(Now)* Dominant	Passive	Active	Passive	Passive
Role played by fishing cooperative societies	Active	Very active	*(Earlier)* Very active *(Now)* Less active	Passive	Very active	Not functional	Very Weak functioning
Strength & Quality of linkages between the two	Mutually understood, accepted & respected	Mutually antagonistic, contradicted	Mutually antagonistic, contradicted	Lack of effective functional relationship	Mutually understood, accepted & respected	Lack of effective functional relationship	Lack of effective functional relationship

Performance of fishing cooperative institutions in co-management of reservoir fisheries resources

The performance of fishing cooperative institutions in co-management and conservation of reservoir fisheries resources was assessed in terms of three variables: orientation of their members towards conservation of fishery resources, involvement of cooperative institutions in implementation and enforcement of management rules, and conservation performance of cooperative societies measured in terms of the degree to which their members followed/abided by conservation rules for utilization of resources. Separate quantitative indices were developed for each variable. It is clear from the data (Table 5) that at the studied locations in H.P., M.P. and Surada reservoir of Odisha; the orientation of the members of fishing cooperative societies towards resource conservation was

high whereas, it was low in U.P. and Hirakud reservoir of Odisha. Involvement of cooperative institutions in implementation and enforcement of management rules was medium in H.P.; and high at Tawa reservoir of M.P. and Surada reservoir, and very high at Bergi reservoir of M.P. (when the societies were managing the reservoir) but, it became low when the lease was taken from them and auctioned to contractor. It was low at Hirakud reservoir and very low in U.P. Similarly, performance of cooperative institutions, in terms of observing/abiding by resource conservation rules as set forth by the state government agencies, was high to very high in Surada reservoir of Odisha, H.P. and M.P. (when the societies were managing the reservoir) but, it became low (at Bergi reservoir) when the lease was taken from them and auctioned to contractor. At Hirakud reservoir, Odisha and in U.P., again it was very low.

Table 5: Comparative assessment of performance of cooperative institutions in co-management of fisheries resources across different locations

Variables	Gobind Sagar, HP	Pong, HP	Tawa, MP	Bergi, MP	Hirakud, Odisha	Surada, Odisha	Matatila, UP	Small Lakes, UP
Conservation orientation of members	H	H	H	H	L	H	VL	L
Rule enforcement by societies	M	M	H	(Earlier) VH (Now) L	VL	H	NA	No
Conservation performance of societies	VH	VH	VH	(Earlier) VH (Now) L	VL	H	L	VL

VH = Very High; H = High;M = Medium;L = Low;VL = Very Low

Discussion and Implications for Fisheries Managers:

Based on the above analysis and further insights added from interactions held during field work, five scenarios of fisheries management were discernible at the studied locations as summarized in table 6.

The findings indicated that local communities and their organizations (fishing cooperative societies/ federations) can play important role in co-management of reservoir fisheries under the situations where some of the facilitating conditions for promoting collective action and taking part in resource management are present. There were some common conditions found at all the sites (both sites of H.P. and M.P. and Surada reservoir of Odisha) where fishing cooperative societies were playing active roles in management of the resources, like high level of orientation of fisherfolks towards resource conservation; effective internal functioning of their organizations and willingness to contribute towards improvement of resource.

There were, however, conditions which varied from site to site depending upon the local circumstances. For example, at both the locations of H.P. these were: effective structural & functional linkages with, and high perceived effectiveness of state fisheries agencies and strong controlling and regulatory powers held and exercised, along with the facilitating role played by the state fisheries department; which could have contributed towards the success of fishing cooperative societies. These conditions, however, were missing at the two sites of M.P. On the other hand, there were effective linkages with, and regular support of NGOs; and strong collective action and mass organization for common good, at M.P. sites which could have been instrumental in making the cooperative societies and their federation an effective partner in co-management.

This study brought out that at locations where cooperative institutions of fishermen were active and effectively played important roles having socio-educational value, they were able to contribute towards resource conservation and management parameters. This could have been possible because of the educational value and the socio-organizational and moral authority that such institutions had over their members, at locations where they were active (H.P. and M.P. and Surada, Odisha).

The studies give enough pointers to view cooperative institutions of fisherfolks as social organizations having dormant capabilities (beyond production motives), which could be sincerely and effectively identified, promoted and utilized for resource conservation and management goals in fishery resources. However, mere existence of cooperative institutions is no guarantee (as the case of U.P. and Hirakud reservoir make it clear) that these will serve educational and managerial purposes among the fisherfolks. Their effectiveness and vibrancy may be determined by the dynamics of several location-specific socio-economic and political factors.

The study also reaffirms that involvement of resource users through their organizations and institutions not only supplements the managerial efforts of the state agencies, but, also improves the prospects of sustainable utilization of the resource due to dynamic impact of users' organizations on the resource-use behavior of their members and a sense of ownership of the resource among the users. However, when such a 'system' of collective or co-management collapses, the sustainability of the resource suffers as users revert back to their unsustainable practices (as the case of Bergi reservoir clearly indicates) because they no longer feel the ownership of the resource

coupled by the absence of the social & organizational force for making members to abide by conservation rules.

The policy makers, fishery administrators and conservation professionals can utilize these findings towards formulating strategies for harnessing and promoting organizational and institutional support for promoting sustainable management of reservoir fisheries at the grass roots level. There is tremendous scope for innovation in their governance of reservoir fisheries. Lessons drawn from successes achieved in various forms of co-management fisheries resources, such as reported here and elsewhere across the globe, need to be incorporated in devising policies and programmes for management of reservoir fisheries.

Research Priorities for Extension Professionals

These studies were preliminary attempts to look at the fishing cooperative societies as a potential partner, alongwith the state agencies, in co-management of fisheries resources, with special focus on their roles in implementation of resources enhancement and conservation measures. The studies have succeeded in highlighting this line of study in Indian context and the potential contributions these institutions can make under certain conditions. However, these findings, coming out of such preliminary work need to be considered mere trends of few specific case studies which need further more rigorous investigations in detail at other locations.

Success and failures of attempts to co-manage different types of fisheries resources under various circumstances, both need to be studied in detail by extension professionals and accordingly awareness creation strategies and capability development programmes can then be planned, implemented and evaluated.

There are several aspects which need detailed empirical investigations by extension scientists. Some of these could be: analysis of constraints in effective functioning of fishing cooperative societies/federations/ self-help groups/associations, etc.; estimation of the impact of fishing cooperative societies on fishing communities and fishery resources; assessment of the adequacy and preparedness of the selected fishing cooperative societies to include conservation in their agenda; identification of interventions necessary to strengthen and utilize fishing cooperative societies and other forms of fisherfolk organizations for resource management and conservation purposes, etc.

Table 6: Five scenarios depicting varying degree of co-management of reservoir fisheries at different locations

Scenario	Major factors	Represented by
• High orientation of fisherfolks towards resource conservation • High degree of compliance towards conservation rules • Effective sharing (complementing) of responsibilities between state and fisherfolks • Equitable sharing of benefits • Willingness to contribute towards improvement of resource	• High level of extension contacts, cosmopoliteness and involvement in government schemes by fisherfolks; • Effective internal functioning of societies • Effective structural & functional linkages with, and high perceived effectiveness of, state fisheries agencies • Strong controlling and regulatory powers held and exercised, and facilitating role played by the state fisheries deptt.	Pong and Gobind sagar reservoirs, HP
• High orientation of fisherfolks towards resource conservation • High degree of compliance towards conservation rules • Equitable sharing of benefits • Management of fishery resources by cooperative federation • Willingness to contribute towards improvement of resource. • Own efforts to improve production and productivity	• Low level of extension contacts, cosmopoliteness and involvement in government schemes by fisherfolks; • Effective internal functioning of societies • Large catches, regular income to support organization • Weak and antagonistic linkages with state fisheries agencies • Effective linkages with, and regular support of, NGOs • Strong collective action and mass organization for common good	Tawa reservoir, MP
• High orientation of fisherfolks towards resource conservation (Earlier, as well as, now) • (Earlier) High degree of compliance towards conservation rules (Now) Low degree of compliance • Equitable sharing of benefits • (Earlier) Management of fishery resources by coop. fed. (Now) By state agencies • (Earlier) High willingness to contribute towards improvement of resources (Now) Very low willingness to contribute	(Earlier) • Initial motivation, collective action, mass organization • Large catches, regular income to support organization • Strong support of a NGO (Narmada Bachao Andolan) activists • Effective control of federation • Effective functioning of societies (Now) • Declining catches, low income, declining interest of NGO • Declining authority/ control of federation • More temptations for fishermen to violate the rules • Declining social & moral control of societies • Antagonistic attitude between state agencies & fishers	Bergi reservoir, MP
• High orientation of fisherfolks towards resource conservation • High degree of compliance towards conservation rules • Equitable sharing of benefits • Management of fishery resources by cooperative society • Willingness to contribute towards improvement of resource. • Own efforts to improve production and productivity	• Medium level of extension contacts, cosmopoliteness and involvement in government schemes by fisherfolks; • Effective internal functioning of societies • Regular catches and regular income to support organization • Strong linkages with state fisheries agencies	Surada reservoir, Orissa
• Low orientation of fisherfolks towards resource conservation • Low awareness and compliance towards conservation rules • Inequitable sharing of benefits • No efforts to contribute towards management and improvement of resources	• Low level of extension contacts and involvement in government schemes by fisherfolks; • Poor/ low internal functioning of societies • Passive & ineffective linkages with state fisheries agencies • No linkage with NGOs	Small lakes and Matatila reservoir, UP Hirakud reservoir, Orissa

CONCLUSION

The policy makers, fishery administrators and conservation professionals can utilize these findings towards formulating strategies for harnessing and promoting organizational and institutional support for promoting sustainable management of reservoir fisheries at the grass roots level. There is tremendous scope for innovation in their governance of reservoir fisheries. Lessons drawn from successes achieved in various forms of co-management fisheries resources, such as reported here and elsewhere across the globe, need to be incorporated in devising policies and programmes for management of reservoir fisheries. The field of fisheries management and conservation presents enormous possibilities for the extension professionals to broaden their canvas and contribute policy oriented studies to help the fisheries managers and policy makers in further improving the sector.

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REFERENCES

Allison, Edward H. and Marie-Caroline Badjeck, 2004. Fisheries Co-Management in Inland Waters: A Review of International Experience. Sustainable Fisheries Livelihoods Programme (SFLP) (GCP/INT/735/UK). FAO/DFID. 116 p.

Almeida, O.T.; K. Lorenzen and D. McGrath. 2002. Impact of co-management agreements on the exploitation and productivity of floodplain lake fisheries in the Lower Amazon. Paper presented at the 9th Biennial Conference of the International Association for Study of Commons (IASCP). Victoria falls, Zimbabwe. June, 17-21.

Baland J. and J. Platteau, 1996. Halting degradation of natural resources: is there a role for communities? Oxford, Eng. Clarendon Press.

Bavinck, M., (1996) Fisher Regulations along the Coromandel Coast: A Case of Collective Control of Common Pool Resources. *Marine Policy*, 20 (6), pp 475-482.

Bavinck, M., and Venkatesh, Salagrama., (2008) Assessing the Governability of Capture Fisheries in the Bay of Bengal A Conceptual Enquiry. The Journal of Transdisciplinary Environmental Studies ,7 (1), pp: 13.

Bavinck, M., Derek Johnson., Oscar Amarsinghe., et.al (2012) From Indifference to Mutual Support A comparative Analysis of Legal Pluralism in the Governing of South Asian Fisheries. European Journal of Development Research, pp: 1-20.

Bene, C. and A.E Neiland. 2006. From Participation to Governance. A critical review of the concepts of governance, co-management and participation and their implementation in small-scale inland fisheries in developing countries. WorldFish Center Studies and Reviews 29, The WorldFish Center, Penang, Malaysia and the CGIAR Challenge Program on Water and Food, Colombo, Sri Lanka 72p.

Berkes, F. (ed.) 1989. Common property resources; ecology and community-based sustainable development. Belhaven Press, London.

Berkes F. 2003. Alternatives to Conventional Management: Lessons from Small-scale Fisheries, Environments, 31 (1): 5-19.

Cernea, M.M. 1991. Putting people first (2nd Ed.) Oxford; Oxford University Press.

Gutiérrez, Nicolás L.; Ray Hilborn and Omar Defeo, 2011. Leadership, social capital and incentives promote successful fisheries. *Nature* 470, 386389.

Jentoft, S. 1989. Fisheries co-management: Delegating government responsibility to fishermen's organizations. *Marine Policy*.13:137-154.

Jentoft, S. 2004. Fisheries co-management as empowerment. *Marine Policy*. 29(1): 1-7.Jentoft, S.; B.J. Mc Cay and D.C. Wilson. 1998. Social theory and fisheries co-management. *Marine Policy*. 22(4-5): 423-436.

Jentoft, S. and B.J. Mc Cay.1995. User participation in fisheries management lessons drawn from international experiences. *Marine Policy*. 19(3): 227-246.

Jyotishi, A. and R. Parthasarathy 2007. Reservoir Fisheries Management: Experiences of Tawa in Madhya Pradesh. *Economic and Political Weekly*. XLII (5): 409-415.

Jyotishi, Amalendu, 2011. Institutionalizing Common Pool Resources: Insights from Tawa Fisheries Cooperative. Paper presented in the Thirteenth Biennial Conference of the International Association for the Study of Commons, Hyderabad India, January 10-14, 2011.

Karlsen, G.R. 2001. Can formalization help? The

introduction of fisheries co-management in the inshore fisheries of Dingle, Co. Kerry, Ireland. *Marine Policy.* 25(1): 83-89.

Kearney, J., F. Berkes, A. Charles, E. Pinkerton and M. Wiber, 2007. The role of participatory governance and community-based management in integrated coastal and ocean management in Canada. *Coastal Management.* **35,** 79104.

Krishna, A. 2002. Active Social Capital: Tracing the roots of development and democracy. Oxford University Press; New Delhi.

Lawry, S.W. 1989. Fisheries co-management: Delegating government responsibility to fishermen's organizations. *Marine Policy*. April: 137-154.

Makino, M. and H. Matsuda, 2005. Co-management in Japanese coastal fisheries: institutional features and transaction costs. *Marine Policy.* 29, 441450.

Mc Neely, J.A. and S.J. Scherr. 2003. Ecoagriculture: strategies to feed the world and save biodiversity. Island Press, Washington, D. C.

Norman, A.K.; J. R. Nielsen and S. Sverdrup-Jensen. (eds.). 1998. Fisheries Co-management in Africa. Proceedings from a Regional Workshop on Fisheries Co-management Research. Fisheries Co-management Research Project ICLARM, IFM. Mangochi, Malawi, 18-20 March 1997.

Nielsen, Raakjær, J. and T. Vedsmand, 1999. User participation and institutional change in fisheries management: a viable alternative to the failures of 'top-down' driven control? *Ocean Coastal Management*. **42**, 1937.

Nielson, J.R.; P. Degnbol; K.K. Viswanathan; M. Ahmed; M. Hara and N.M.R. Abdullah. 2004. Fisheries co-management an institutional innovation? Lessons from South East Asia and Southern Africa. *Marine Policy*. 28(2): 151-160.

Ostrom, E. 1990. Governing the Commons. The Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge.

Oakerson, R.J .1992. Analysing the commons: A framework. *In*: Bromley, D.W. (Ed.). 1992. Making the Commons Work. Theory, Practice and Policy. ICS Press, San Francisco,CA.

Pomeroy, R.S. and M.J. Williams. 1994. Fisheries co-management and small-scale fisheries: A policy brief, 1-15. ICLARM, Manila.

Pomeroy, R.S.; B.M. Katon and I. Harkes. 2001. Conditions affecting the success of fisheries co-management: Lessons from Asia. *Marine Policy*. 25(3): 197-208.

Pomeroy, R. and F. Berkes. 1997. Two to tango: The role of government in fisheries co-management. *Marine Policy* 21(5): 465-480.

Pomeroy R.S. and Rivera-Guieb R. 2005. Fishery co-management: a practical handbook. CAB International, in association with the International Development Research Centre. 264p.

Pretty, Jules 1995. Participatory learning for sustainable agriculture. *World Development*. 23 (8) 1247-1263.

Pinkerton, E. (ed.) 1989. Cooperative Management of Local Fisheries. NewDirections for Improved Management and Community Development. University of British Columbia Press, Vancouver.

Pinkerton, E. and L. John, 2008. Creating local management legitimacy. *Marine Policy.* **32**, 680691.

Sen, S. and J.R. Nielsen. 1996. Fisheries co-management: A comparative analysis. *Marine Policy* 20(5):405-418.

Singh, K. and V. Ballabh. 1997. Cooperative management of natural resources. Sage, New Delhi.

Sverdrup-Jansen, S. and J.R. Nielsen. 1998. Co-management in Small-scale Fisheries: A Synthesis of Southern and West African Experiences.

Thomson, K.T. 2006. The role of public-private cooperation in the management of estuarine fisheries: Learning from the Kerala model of co-management. Paper presented at the 11th biennial conference of the International Association for the Study of Common Property, Bali, Indonesia, June 19-23.

Thomson, K. 2008. Management anarchy in complex commons: a study of Cochin Lagoon fisheries in Kerala, India. Paper presented at the IASC Conference, Cheltenham, England, 18 July.

Thomson, K. and T. Gray, 2009. From community-based to co-management: improvement or deterioration in

fisheries governance in the Cherai Poyil fishery in the Cochin Estuary, Kerala, India? *Marine Policy*. 33, 537543.

Townsend, R., R. Shotton and H. Uchida (eds.), 2008. *Case Studies in Fisheries Self-governance* FAO Fisheries Technical Paper No 504, FAO Rome.

Tyagi, L.K., Amar Pal and W.S. Lakra. 2007. Mobilization of collective action for fishing rights and management of fishery resources: A case study. *Indian Research J. of Extension Education*, 7 (2&3), pp 26-29.

Tyagi, L.K., Amar Pal; A.S. Bisht and W.S. Lakra. 2008. Conservation orientation about fishes in Northern India. *Indian Research J. of Extension Education*, 8 (2&3): 46-50.

Tyagi, Lalit Kumar; Amar Pal, S.K. Paul, A.S. Bisht and W.S. Lakra. 2008. Development of Sustainable Fisheries in Himachal Pradesh through Fishing Cooperative Societies (*Himachal Pradesh mein matsya jeevi sahkari samitiyon ke madhyam se tikaau matsyiki ka vikas*) (in Hindi). *In: Uttar Parvatiya Rajyon Ki Matsya Vividhata: Sanrakshan evam Prabandhan.* Published by NBFGR, Lucknow, India, pp. 236-244.

Tyagi, Lalit Kumar, 2009. Role and potential of fisherfolk/ community organizations in conservation and management of fishery resources. *In*: De, H.K., M. Kumaran and G.S. Saha. New Initiatives in Aquaculture Extension. Narendra Publishing, New Delhi, 2009. pp 161-176

Tyagi, L.K, Amar Pal and W.S. Lakra. 2011. Capacity building of local groups for fish seed rearing An institutional innovation of tribal fisherfolks at Tawa reservoir, M.P., India. *Indian J. of Extension Education*, 46 (1&2), pp 46-49.

Tyagi, L.K.; A.S. Bisht; Amar Pal and K.K. Lal. 2013. Functioning of Fishing Cooperative Societies in Selected States of India. *J. Community Mobilization and Sustainable Development*, 8(1), 90-93.

Tyagi, L.K.; A.S. Bisht and Amar Pal. 2014. Performance of Fishing Cooperative Societies in Implementing Fish Conservation Measures: Case Studies from Two Reservoirs of Orissa. *J. Community Mobilization and Sustainable Development*, 9(1), 48-51.

Uphoff, N. (ed.).2002. Agroecological innovations. Earthscan, London.

World Bank, 1993. Small-scale fisheries: Research needs. Technical paper 152, Fisheries Series, World Bank, Washington DC.