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Adoption of Pen Culture Technology in the Wetlands of West Bengal, India

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Abstract

A participatory study was carried out in a representative wetland of West Bengal to understand the reasons behind limited adoption of pen culture technology by the fishers of West Bengal. Six major constraints were identified in the process of adoption of pen culture. Preferential ranking technique was employed to identify the problems faced and also the Average Extent of Damage (AEOD), as perceived by the fishers. Based on the Rank Based Quotient (RBQ) and AEOD, the final rank of the identified constraints was calculated. The study revealed that most of the fishers were not aware about the importance, economic viability and technological feasibility of pen culture technology and as a result, they were not interested in adopting pen culture. Ownership of wetland is the second important issue regarding adoption of pen culture technology while management of pens in the wetland was identified as the third problem. Suggestive measures like mass awareness campaigns, result demonstrations, formation of Fishers Interest Groups or Common Interest Groups and organizing monthly workshops can trim down the inhibiting factors in non-adoption of pen culture technology.

Keywords: Penculture, problem identification**,** average extent of damage, Rank Based Quotient

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Introduction

Extensive floodplain wetlands in the form of ox-bow lakes (*mauns, chaurs, jheels, beels*-as they are locally called), especially in the states of Assam, West Bengal, Bihar and Eastern Uttar Pradesh, bear special significance in the inland fisheries of India because of their magnitude and support to livelihoods of millions. But, the fish yield from wetland resources is generally much lower than their potential. Average fish yield from floodplain wetlands is around 200 kg ha^{-1} yr^{-1} (Sharma, 2010). Stock enhancement is the technological intervention to increase the productivity of these resources, which require constant supply of quality seed of appropriate size. Therefore, the pen culture technology for *in-situ* production of seed of required size has been developed, field tested, demonstrated and disseminated in various parts of India. Pen culture was proved to be successful technical intervention in carp seed production across different aquatic resources *viz.*, oxbow lakes of Bihar (Banerjee & Pandey, 1978), Assam (Gorai et al., 2006), West Bengal (Kumar, 1999), swampy tanks at Bhavanisagar (Abraham, 1980), in Odathurai reservoir in Tamil Nadu (Murgusan et al., 2005) and in Tungabhadra reservoir, Karnataka (Swaminathan & Singit, 1982).

The pen culture is economically viable and technologically feasible for in-situ raising of desired stocking material, offers many advantages besides sparing precious land for other purposes. The fingerlings raised in pens have shown better survivability and growth, when released in open water. The materials required for fabrication are cheaper, readily available and even unskilled personnel can install them without involving engineering skill. Despite all these advantages and feasibility, there appears poor adoption of this technique in West Bengal. Hence, a participatory study was undertaken in a representative wetland of West Bengal to understand the reasons for the limited adoption of pen culture for seed production.

Materials and Methods

Bhomra beel, a 42 ha shallow ox-bow lake (22°58.450' N; 88° 37.819' E) in Kastodanga village, which falls

under the jurisdiction of the Developmental Block Haringhata, District Nadia, West Bengal was the study location. This village was inhabited by a mixed population of various communities, castes and sub-castes of different economic status. Majority of the fishers were migrants from Bangladesh who were rehabilitated by giving fishing right in this lake during 1971. Both agriculturists and fishers were the beneficiaries of the lake. The Bhomra Fishermen Cooperative Society with 256 members exploited the lake for fisheries purpose. The fishers' society, as a measure of enhancement, stock the lake with pond reared advanced fingerlings of Indian major carps (IMC) and other high value fishes. Besides fisheries exploitation, the lake water is abstracted by agriculturists for irrigating the summer paddy crop. A participatory study was conducted to identify the problems for limited adoption of pen culture in this area.

Participatory Rural Appraisal (PRA) has emerged as the best method to study and identify the problems faced by rural people (Van Veldhuizen et al., 1995). The problems identified in adopting pen culture technique were analyzed by subjecting the information collected through surveys and verified by triangulation to standard treatments (Mishra, 1996).

Ten key informants (KI) belonging to heterogeneous groups were identified. The major problems related to pen culture as perceived by the Kls were listed. A group of 30 farmers were later selected with the help of KIs (snowball technique) and similar procedure of interviewing was repeated to collect data. They were asked about the problems they faced according to their own perception and enlisted the problems in a piece of paper and were asked to rank it according to their importance adopting the Rank Based Quotient (RBQ) procedure developed by Sabaratnam (1988).

Spearman's Rank Correlation coefficient (r) was applied to the ranks of RBQ for key informants and group of farmers to find out the significant difference among ranks.

$$r = \frac{1- 6(\Sigma d^2)}{n\ (n^2 -1)}$$

Where, d = the difference in the ranks between the KIs and farmers, and n= number of problems

The magnitude value of the problem (MVP) was not calculated as the pen culture technology was not widely practiced in the area. So, based on the RBQ and Average Extent of Damage (AEOD), the final rank was calculated.

Results and Discussion

The problems hindering the adoption of pen culture identified as important in the process of technology adoption were ownership issue among the fishermen, conflict with agriculture sector, management issue of the pen culture, awareness level of fishers, technological issues and risk of poaching (Table 1).

The ranking given to these problems by Key Informants and fishers are outlined in Table 1. It could be observed that the calculated RBQ values ranged from 85 to 63.3 in case of Key Informants and 86.5 to 52.7 in case of farmers. It could be inferred on the basis of high value of r (r = 0.9) that there was no significant difference in the ranks of the problems as reported by KIs and farmers (Table 2). However, the highest values in both correspond to lack of awareness as most serious problem regarding adoption of pen culture technology in wetland. Most of the fishers were not aware of the pen culture technology for fish seed production, its economic viability and technological feasibility. As a result, they were not interested in adopting pen culture. Poor access to training and extension (Israel, 2008) is one of the major problem of adopting pen culture technology. In the light of the finding, it is essential that the fisheries department should initiate efforts to demonstrate the pen culture technology in the study area to build their technical capacity and confidence.

From Table 2, it is clear that ownership of wetland was the second important constraint regarding adoption of pen culture technology. As the wetland has been managed by fishermen cooperative society, the decisions were taken by the management committee of the society. Sometimes, it becomes a matter of divergence in the event of any member of the cooperative society getting better opportunity. Therefore, no member comes forward to take initiative for betterment of the wetland. This has necessitated a strong institutional framework for wetland management and the fisheries development agencies have to devote considerable effort in developing such a framework at national and regional levels.

Pen culture technology is a semi-intensive form of farming that requires timely input of materials and

Table 1. Rank Based Quotient (RBQ) and Rank of the problems from triangulation

Problems	Ranks of problems by 10 key informants							Ranks of problems by 30 farmers						
	I	II	III	IV	V	RBQ (%)	AEOD (%)	I	II	III	IV	V	RBQ (%)	AEOD (%)
Ownership issue among the fishermen	4	3	3	0	0	85	35	11	8	3	8	0	78.7	29
Conflict with agricultural sector	3	0	4	3	0	71.3	25	4	7	6	8	5	64.84	22
Management of pen in the wetland	4	2	4	0	0	83.2	30	5	12	7	3	3	72.62	26
Lack of awareness	5	4	1	0	0	89.3	39	18	6	3	0	3	86.5	41
Technological feasibility	0	3	2	5	0	63.3	17	7	3	6	8	6	60.97	21
Risk of theft/ poaching	1	2	3	4	0	66.6	20	0	4	6	11	9	52.7	15

RBQ: Rank Based Quotient; AEOD: Average Extent of Damage

Table 2. RBQ and Rank of various problems perceived in triangulation

Problems	RBQ of KI	RBQ of Farmers	di^2	r	Av. RBQ (%)	AEOD (%) of KI	AEOD (%) of Farmers	di^2	Av. AEOD (%)	Final rank of the problems
Ownership issue among the fishermen	85(2)	78.7(2)	0	0.9	81.8	35	29	0.9	32	2
Conflict with agricultural sector	71.3(4)	64.84(4)	0		68	25	22		23.5	4
Management of pen in the wetland	83.2(3)	72.62(3)	0		77.6	30	26		28	3
Lack of awareness	89.3(1)	86.5(1)	0		87.9	39	41		40	1
Technological feasibility	63.3(6)	60.97(5)	1		62.1	17	21		19	5
Risk of theft/ poaching	66.6(5)	52.7(6)	1		59.6	20	15		17.5	6

RBQ: Rank Based Quotient; KI: Key Informants

managerial skills. Seed stocking in pens is done with proper care and they are given supplementary feed in the form of pellet at an estimated rate of body weight. Management of pens in the wetland was identified as the third important problem. In most of the cases, the farmers were not well informed or trained about pen culture technology. As a result, they were not getting desirable production from pens. Fishpen and fishcage culture in Laguna de Bay has been facing various problems classified as

technical, production, economic, social, environmental and institutional that hinder its development (Israel, 2008).

Conflict with agriculture sector was perceived as a significant problem in adopting pen culture (Table 2). The water from this particular wetland is used for irrigation as well as for jute retting. The first practice is consumptive and the other is abusive or deteriorative and both were detrimental to wetland fisheries in general and pen culture in particular. Using two lift irrigation pumps, water was drawn from the wetland for irrigating Boro paddy (summer paddy) in the adjacent land. As a result, during summer season, when the water level goes down considerably, the water quality deteriorates. Therefore, the fishers consider the period between onset of summer (March) till the arrival of monsoon (August) as the 'fallow period' because of the resulting adverse environmental conditions like alarmingly low water depth and corresponding poor water quality, which synergistically affects wetland fishery. As a result, fishers lose their interest and enthusiasm during this period for fisheries activity including pen culture in the wetland. Further, with the onset of monsoon, harvesting of jute starts and wetland is commonly used for jute retting. The practice of jute retting deteriorates water quality considerably because of the release of obnoxious gases and sudden rise in organic load, which render the place unsuitable for pen culture. Mondal & Kaviraj (2008) reported sharp increase in BOD (>1,000 times) and COD (>25 times), free CO_2, total ammonia and nitrate nitrogen of the water, along with a sharp decrease in dissolved oxygen (DO), as a result of jute retting. Both water abstraction and deterioration due to agricultural practices were the reasons for conflict with agriculture sector, which acted as inhibiting factor for non adoption of pen culture technology in the wetland. On the other hand, the catchment of the wetland was very fertile and used for multiple crops where demand for labourer persists perennially. The fishers switch over to agriculture as a labourer as they feel that fisheries have become low remunerative during this period of the year and resorting to pen culture will be wastage of time, money and energy.

Technological feasibility related to pen culture was ranked as fifth problem with RBQ 63.3 of KIs and 60.97 of farmers (Table 1). With the onset of rainy season, water from catchment or link channel gushes in/out of the wetland turning the lentic water body into fluviatile condition, sometimes flooding the low lying catchment areas, transforming the lake into a vast sheet of water. This ecological transformation generates doubts in fishers mind and forms apprehension that the low cost material used for construction of pen may not withstand the force generated due to flood current. In addition, farmers also had a reservation that crabs which become active during monsoon may damage the pen wall resulting to crop loss. In fact, they were doubtful about the technological feasibility of the pen culture, as most of the farmers were not exposed to successful demonstration of this technique that could boost their morale and confidence. Therefore, wetland fishers were reluctant to adopt this technology.

In pens, the fishes are kept in smaller confinement, where poaching and thefts can take place more easily than in natural waters. This issue was also restricting the farmers to adopt the pen culture technology and this problem was ranked as sixth. Israel (2008) in his study identified that poaching, the stealing of fish in fish pen and fish cages by poachers reduces the profits of operators and increases the chance of social conflict, and also forces operators to spend on security measures to prevent it.

The PRA conducted in village Kastodanga, West Bengal was found effective in identifying the problems faced by the fishers in adopting the pen culture technique. The present study thus helped to churn out important and useful clues which can be considered in formulating guidelines for effective adoption of this technology for enhancing fish production from the resources remained so far underexploited. Ownership issue was ranked as second major constraint in the study and to resolve the problem of ownership, people's participation can be promoted. Even group approach can also provide answer to mitigate the problem of management of pen in wetland. Common Interest Groups or Fishers' Interest Group can be formed to solve the conflicts through collective leadership and mutual discussion. Result demonstration is very much needed to provide practical solution to management and technical issues related to pen culture. As lack of awareness was ranked as the first major constraint, demonstration can bridge the knowledge gap of the farmers at field level. The sectoral conflict can be reduced or resolved by organizing regular

meetings, frequent inspections and guidance by the agriculture, irrigation and fishery experts to improve the situation. Adoption of water conserving irrigation methods, such as drip and sprinkler irrigation and farming of low water consumptive crops can reduce pressure on water reserve. Involvement of local government in confidence building and for adopting a mutually agreed water budgeting can resolve the conflict to a great extent.

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References

Abraham, M. (1980) Rearing of spawn in pens. J. Inland Fish. Soc. India. 12 (2): 97-100

Banerjee, S.R. and Pandey, K.K. (1978) Carp seed stocking in an oxbow lake of Champaran (Bihar) through rearing enclosure. J. Inland Fish. Soc. India. 10: 129-134

Coughnevour, C.M. (1965) Technology diffusion and theory of action. Indian J. Extn. Education. 1 (3): 159-182

Gorai, B.K., Sugunan, V.V. and Jha, B.C. (2006) Raising of stocking materials of Indian major carps in pen enclosures in selected floodplain wetlands of Assam, India. Asian Fish. Sci. 19: 185-197

Israel, Danilo, C.(2008) Fishpen and fishcage culture in Laguna de Bay: status, economic importance, and the relative severity of problems affecting its practice. Philippine J. Develop. 64: 35

Kumar, A. (1999) Pen culture prospects in reservoirs and beels: success and constraints with particular reference to Akaipur beel of 24 Parganas, West Bengal. J Freshwater Biol. 11: 47-52

Mascarenhas, J., Shah, P., Joseph, S., Jayakaran,R., Devaram, J., Ramachandran,V., Fernandez, A.A., Chambers, R. and Pretty, J. (Eds) (1991) Participatory Rural Appraisal, PRA Notes No.13, Proc. of the PRA Trainees Workshop Bangalore, Feb., 1991

Mishra, A.K. (1996) Studies on Socio-economic aspects of Village Pithla, Faizabad U.P. using PRA Techniques. Individual Perception and Problem Identification Report (Unpub), 23 p, 54th FOCARS, NAARM, Hyderabad

Mondal, D.K. and Kaviraj, A. (2008) Ecotoxicological effects of jute retting on the survival of two freshwater fish and two invertebrates. Ecotoxicol. 17 (3): 207-211

Murgusan, V.K., Monoharan, S. and Palaniswamy, R. (2005) Pen fish culture in reservoir-and alternative to land based nurseries. NAGA-World Fish Centre Newsletter. 22 (1&2): 49-52

Sabarathnam, V.E. (1988) Manual on Field Experience Training for ARS Scientists. National Academy of Agricultural Research Management, Rajendranagar, Hyderabad

Sharma, A.P. (2010) Potentiality of enclosed fish farming in inland waters. In: Training Manual on Pen and Cage Culture in Inland Waters, (Bandopadhyay, M.K., Hassan, M.A and Roy, A., Eds), pp 85-90, CIFRI, Barrackpore

Swaminathan, V. and Singit, G.S. (1982) Massive fish seed production in pens, major experiment underway at Tungabhadra dam. Fishing Chimes. 2 (7): 42-45

Van Veldhuizen, L., Water-Baye, A. and de Zeeuw, H. (1995) Learning for Participatory Technology Development- A Training Guide. 389 p, ETC Foundation, The Netherlands

Yadava, Y.S., Choudhury, M., Kolekar, V and Singh, R.K. (1983) Pen farming utilizing marginal areas of beels in Assam for carp culture. Proc. Natl. Sem. Cage Pen Culture. pp 55-58. Fisheries College and Research Institute, Tuticorin