Fishery Management Practices of the Major Reservoirs in Madhya Pradesh

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Madhya Pradesh is a state richly endowed with inland water resources. Impoundments in this state, both natural and artificial, form an important source of freshwater fish production. The major reservoirs of Madhya Pradesh have different fishery management practices that are unique in nature. Five major reservoirs in the state viz. Gandhisagar, Bargi, Tawa, Barna and Halali were studied to compare the efficacy of the management measures followed. In the present scenario, ownership of these water bodies by the apex federations of primary fishermen cooperatives seems to be the best option for their management and sustainable exploitation.

Key words : Reservoirs, fisheries management, co-operatives, fisheries conservation, Madhya Pradesh.

In India, the state of Madhya Pradesh had the largest water spread area under reservoirs before the recent formation of the state of Chattisgarh. It had about 3700 reservoirs with a total water spread area of 0.46 million ha. These impoundments contributes about 84.6% of the total fish production of the state (Anon, 1995a). Fish production and total water spread area of inland water bodies of the state is given in Table 1. Gandhisagar, Bargi, Tawa, and Barna and Halali are the major reservoirs in the state. Fishery management practices followed in each of these reservoirs are unique in nature. Gandhisagar is the biggest reservoir and it is the second largest reservoir in the country, next only to Hirakud in Orissa. Fishery of this reservoir is under the management of Madhya Pradesh Fisheries Development Corporation (MPFDC). The apex federations of fishermen cooperatives are managing the fishery of Bargi and Tawa. In Barna there is a single cooperative society, which has the rights for fishing, while in Halali it is leased to a contractor. Hence, a comparison of the efficacy of various fishing systems and management practices merits attention of the fishery business managers and research workers.

Materials and Methods

The survey on fishery management practices of six major reservoirs of Madhya Pradesh, *viz.*, Gandhisagar (Mandsaur Dist.; area : 66,000 ha), Bargi (Jabalpur Dist.; area : 27,296 ha), Tawa (Hoshangabad Dist.; area : 20,242 ha), Barna (Raisen Dist.; area : 7,705 ha) and Halalai (Raisen Dist.; area : 7,712 ha) was carried out during December 1998 and

Table 1 : Fish production and total water spread area of the inland water bodies of Madhya Pradesh (1994-95)

Water body	Total water spread area / length	Fish production (t)
Reservoirs	294000 ha	6484
Village ponds & private water bodies	166000 ha	63018
Rivers	20661 km	10681

February1999 by the CIFT Research Centre at Hoshangabad. Besides, data was collected from records of the Apex Federations of Fisheries Cooperatives of Bargi and Tawa and from MPFDC Regional Office at Gandhisagar (Anon, 1995b; 1998). Discussions with the officials of MPFDC and Apex Federations also contributed to the inputs in this paper. To compare the efficiency of the reservoir fishery management systems, six parameters *viz.*, fish production and yield rate, stocking practices, earnings of the reservoir fishermen, conservation measures, post-harvest handling practices, marketing and sales, were selected and analyzed.

Results and Discussion

Fish production and yield rate

The estimated fish yield for large reservoirs in India is 11.43 $kg.ha^{-1}.yr^{-1}$ and the current national fish production rate from the reservoir fishery is 29.13 $kg.ha^{-1}.yr^{-1}$ (Sugunan, 1995). In all the reservoirs under the study the yield rate was above the national average for large reservoirs (Table 2). Gandhisagar topped the list both in terms of production and yield rate (average yield rate 37.3 $kg.ha^{-1}.yr^{-1}$). Various fishing systems have been evolved over the years and some have been tried for the management of the reservoirs. The yield rate showed a constant progress over the period 1990-91 to 1997-98, which could be related to the change in the fishing system and the fishery management. The major groups of fishes landed from these reservoirs under study are major carps, local majors, local minors, minnows and miscellaneous species (Table 3). Catch per unit effort obtained in reservoir fisheries is given in Table 4.

Table 2 : Fish production and yield rate in the major reservoirs

Reservoir		1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	Average
Gandhi-sagar	Production (t)	738.43	679.25	406.01	880.60	3424.33	2986.50	1393.70	1823.09	1541.49
	$kg.ha^{-1}.yr^{-1}$	17.87	16.44	9.82	21.31	82.87	72.27	33.73	44.12	37.30
Bargi	Production (t)	41.96	94.57	175.65	536.04	574.62	582.08	406.02	422.11	354.13
	$kg.ha^{-1}.yr^{-1}$	2.52	5.66	10.55	33.39	34.51	34.96	24.39	25.35	21.42
Tawa	Production (t)	130.69	146.01	88.67	84.42	176.18	NA	93.23*	245.81	124.54
	$kg.ha^{-1}.yr^{-1}$	10.75	12.05	7.30	6.95	15.90	NA	7.68	20.24	11.55
Barna	Production (t)	32.89	79.97	103.26	152.18	102.08	NA	151.43	140.94	108.96
	$kg.ha^{-1}.yr^{-1}$	6.86	16.70	21.55	31.76	31.30	NA	31.61	29.42	24.17
Halali	Production (t)	142.56	114.70	73.47	162.79	224.75	NA	243.51	238.84	171.52
	$kg.ha^{-1}.yr^{-1}$	29.73	23.92	15.32	33.95	46.87	NA	50.78	49.81	35.77

* During 1996-97, there were only three months of fishing in Tawa reservoir.

Table 3 : Group-wise composition of landings (percentage) of the total catch in the major reservoirs

Reservoir	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Gandhisagar								
1. Major carps	85.53	89.17	81.17	89.14	81.02	84.01	87.92	91.64
2. Local majors	7.06	3.92	8.16	3.31	11.75	10.02	5.58	3.12
3. Local minors	6.37	5.56	8.24	5.31	6.97	5.65	6.15	3.72
4. Miscellaneous	1.04	1.35	2.43	2.24	0.26	0.32	0.35	1.52
Bargi								
1. Major carps	91.82	92.05	94.36	80.87	79.92	81.2	82.57	82.48
2. Local majors	3.15	1.93	3.07	11.41	6.76	11.52	10.48	11.26
3. Local minors	2.55	1.92	1.5	7.66	3.57	7.23	6.93	6.23
4. Minnows	-	-	-	-	9.57	-	-	-
5. Miscellaneous	2.48	4.1	1.07	0.06	0.18	0.05	0.02	0.03
Tawa								
1. Major carps	82.94	85.14	85.86	87.33	73.6	-	80.14	82.5
2. Local majors	2.63	3.02	2.3	2.43	7.45	-	14.26	9.65
3. Local minors	6.74	9.08	4.69	4.82	10.14	-	5.6	7.85
4. Minnows	6.99	2.25	6.28	4.17	8.72	-	-	-
5. Miscellaneous	0.7	0.51	0.87	1.25	0.09	-	-	-
Barna								
1. Major carps	87.07	77.12	72.93	64.46	62.22	-	46.71	36.51
2. Local majors	1.42	1.7	4.49	11.02	16.17	-	11.96	12.99
3. Local minors	9.06	20.51	22.58	24.46	13.99	-	19.04	20.9
4. Minnows	-	-	-	-	7.55	-	21.97	29.6
5. Miscellaneous	2.45	0.67	-	0.06	0.07	-	0.32	-
Halali								
1. Major carps	16.99	21.64	33.45	23.39	25.1	-	20.76	13.39
2. Local majors	24.74	29.57	26.8	31.91	28.91	-	27.35	40.23
3. Local minors	58.27	48.79	39.7	44.59	36.84	-	40.75	29.41
4. Minnows	-	-	-	-	8.87	-	11.14	16.97
5. Miscellaneous	-	-	0.05	0.11	0.28	-	-	-

The group-wise landings of fish over the period 1990-91 to 1997-98 in the reservoirs revealed that in all the three reservoirs where the fishery is well managed, major carps and local majors constituted almost 90% of the total landings, followed by local minors and minnows. This showed that the major share of the catch comprises quality fish, which fetch good market price.

In case of Barna and Halali fishery, group-wise composition of landings in recent years showed that about 50% of the catch comprised of local minors and minnows. These two groups mainly constituted small sized fishes (< 1 kg) and they are of low economic value. The average market price of these groups was less than half of the value of major carps and local majors. This resulted in low profit margins from these fisheries. Hence, even though the yield rates of these reservoirs are fairly high, the profit margins from the fishery are low when compared to large reservoirs.

Table 4 : Catch per unit effort (kg per fishing unit per year) obtained in the reservoir fishery

Reservoir	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Gandhisagar	-	2717	1376	2985	5775	4864	4016	6605
Bargi	-	618	1112	3117	1774	1205	983	959
Tawa	2178	2655	1529	1431	1602	-	49*	1248
Barna	-	1599	1693	2416	1369	-	2330	2237
Halali	-	1712	1097	1714	1873	-	3745	3675

*During 1996-97, the fishery in Tawa reservoir was only for 85 days.

The significant landings of low value, under sized fishes from Barna and Halali also showed that the fishing system if not properly managed can lead to the depletion of the stock of quality fish groups. Conservation methods like mesh size regulation was not strictly followed which was evident from the landings of undersized fishes.

Stocking practices

The stocking of the fish seed in Gandhisagar, Barna and Halali is under the control of MPFDC. In Bargi and Tawa the stocking of the reservoir is carried out by the Apex Federation of the Fishermen Co-operatives. The stocking rate proposed by the Madhya Pradesh State Fisheries Department is 500 nos.ha^{-1} for the reservoirs of the size category of 4001 to 12000 ha and 250 nos.ha^{-1}.yr^{-1} for reservoirs of the size category above 12000 ha. All the reservoirs under the study fall well below this stocking target (Table 5). This was mainly because of the non-availability of sufficient number of good quality fish seed at the right time.

Earnings of reservoir fishermen

It is reported that in an aquaculture system, 77% of the price paid by the consumer is received by the producer whereas in the reservoir fishery it is only 20% because of a multiplicity of market intermediaries in this sector. Assuming that the fishermen depend only on fishing for their lively hood, it could be seen that all the reservoirs except Gandhisagar, come under the category of destitutes whose annual income was below Rs. 16,000 (Table 6), as per the income ranges devised by NCAER.

Table 5 : Stocking density of fish seeds in the reservoirs

Reservoir	Average water spread area (ha)	Average stocking density (nos.ha^{-1})	Agency
Gandhisagar	43120	158	MPFDC
Bargi	16649	186	Apex Fed. of co-operatives
Tawa	12145	215	Apex Fed. of co-operatives
Barna	4791	196	MPFDC
Halali	4795	213	MPFDC

Table 6 : Earnings of the fishermen engaged in reservoir fishery (1997-98).

Reservoir	No. of fishermen	Fishing days	Daily income (Rs.)	Annual income (Rs.)	Fishing system
Gandhisagar	551	146	223.58	32643	Royalty/fish lifting
Bargi	880	293	22.49	6590	Co-operative management
Tawa	393	267	29.01	7746	Co-operative management
Barna	125	240	39.93	9584	Contract
Halali	130	251	51.24	12862	Contract

The fishermen of Gandhisagar based on the above classification can be grouped in the lower middle class with annual income ranging between Rs. 15,000 and 45,000. In fact, reservoir fishery in all the cases mentioned above was only a supplementary means of livelihood to the fishermen who also worked as agricultural laborers and construction workers during periods of low production and closed seasons. Besides, the operational costs incurred in fishing have to be borne by the fishermen with little help from the Government in the form of subsidies or loans. This also makes a serious dent in their earnings from the fishery.

The wage structure of fishermen differs from reservoir to reservoir. In the reservoirs under the management of the MPFDC or apex federation of co-operatives, the fishermen are receiving uniform wages fixed by MPFDC, which are periodically revised. Besides, they also get other incentives such as bonus and deferred wages during the closed season. In some cases, as in the case of Tawa fishery, the fishermen are also provided with fishing crafts under Government schemes like IRDP and webbing under no profit - no loss basis. But such welfare schemes are unheard of in many reservoirs, especially, these under the auction system. Also, the wages paid are much lower than that fixed by the MPFDC.

Conservation methods adopted in reservoir fishery

Various conservation methods are adopted in reservoirs of the state to ensure sustainable production, which include:

i. Mesh size regulation: Minimum bar size of 50 mm.

ii. Regulation in the size of the fish caught (Catla: minimum 2 kg; other major carps: minimum 1 kg).

iii. Enforcement of closed fishing season from 15 June to 15 August, every year.

iv. Anti-poaching measures: Patrolling the reservoir area, confiscation of illegal catch, etc.

v. Seed stocking for the replenishment of the stock.

The conservation methods cited above are practised in all the reservoirs in the state, especially, the closed fishing season. In reservoirs like Gandhisagar, Bargi and Tawa, the mesh size regulation as well as the regulation in the size of the catch is enforced, strictly. This is reflected in the catch composition also. Minnows and other under sized species are almost absent in the fish landings from these reservoirs. The above mentioned groups form a significant percentage of the landings of Barna and Halali, where the fishery is under the control of an individual. This calls for a strict monitoring of fishery in these reservoirs by the authority.

The stocking of fingerlings in all the reservoirs falls short of the prescribed stocking rate. A number of reasons can be attributed to this like the non-availability of quality seed at the right time, financial constraints in procuring sufficient quantity of seed, etc. Poaching is a major problem in Gandhisagar, Bargi and Tawa. Lack of manpower, heavy costs, vastness of the area, hostile terrain and absence of vehicles makes the task difficult for the concerned fishery managers to take effective steps against this menace.

Post-harvest handling of the catch

Almost all the landings are from gill net fishery, except during a short period in summer when shore seines are operated. Since the operation time of a gill net extends over an average period of 8 h, there is a long delay in the recovery of the catch. Hence, the catch shows symptoms of spoilage even at the time of extricating from the net. Besides, most of the fish are caught by entangling which may cause cuts on the body. This will further enhance the chances for spoilage. After the recovery of the catch also, it takes lot of time to transport it, in the traditional non-mechanized crafts to the landing centers for weighing and packing. In Gandhisagar, motorboats carrying ice are deployed for the quick transportation of the catch. At the landing centres packing of the fish will start only when the full day's landings have been recorded and weighed. Thus, in effect, the fish caught in a gill net from the reservoir will remain exposed to the elements of nature at least for a period of 24 h, before it is properly packed. This time lag can be reduced considerably if there are means for quick transportation of the catch, as seen in the case of Gandhisagar. Also the fish can be stored in large tanks with sufficient quantity of crushed ice till it is packed for outstation markets.

Packing is done in bamboo baskets and open plastic crates. The problem of spoilage is minimum during winter season (November-February) when the average daytime temperature is around 20°C. But spoilage poses a problem during summer months and also during seasons of glut causing downgrading of the catch and thereby loss, due to low profit margins.

Downgrading is a major problem encountered in reservoir fishery during the disposal of the catch. Fish, which do

not meet the standards of the intended markets, sold at a lower price. In reservoir fishery, downgrading is usually done by the commission agents / wholesalers / contractors, who lift the catch. The catch data of Gandhisagar fishery shows that about 6% of the total landings in 1997-98 are classified as downgraded fish, which formed 3.75% of the sales turnover. This downgraded catch will fetch only half the value of the rest of the catch, some times even less. Though data is not available, officials of Tawa and Bargi acknowledged the problem of downgrading. This calls for the standardization and adoption of a system for evaluating the quality of the catch in the inland fisheries sector, which is acceptable to the producers, intermediaries and consumers.

Marketing

About 75% of the total production from the reservoir fishery of Madhya Pradesh is marketed outside the state. Within the state the sale of fish is confined to the nearby areas and cities like Bhopal and Jabalpur. The profit margin from local sales is more than that of outstation sales. This is because the marketing of the catch in distant cities like Delhi and Calcutta involves additional packing and transportation charges. Besides, the prices in outstation markets are fully controlled by intermediaries like the wholesalers/commission agents over whom the producer (Federations/ MPFDC) has no control. Hence, there is a need to develop a strong chain of retail outlets for fish sales inside the state. This will enhance the returns of fishermen and will provide the population a cheap source of protein at affordable prices. For this an initial survey has to be undertaken in the state of Madhya Pradesh to assess the consumer preference and local demand.

The diverse fishery management systems of reservoirs in the state of Madhya Pradesh need to be reorganized for the optimum utilization of this resource. In the present scenario, ownership of these water bodies by the apex federations of primary fishermen co-operatives seems to be the best option for their management and sustainable exploitation. The Government agencies and departments should act as facilitators for the management of the reservoir fishery rather than controllers. Reservoir fishery management can be successful only when the targets of yield optimization and conservation are achieved.

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