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Case Study

ASSESSMENT OF RESERVOIR FISHERIES RESOURCES OF UTTAR PRADESH

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ABSTRACT
Uttar Pradesh is the India's most populous state also possessed vast underutilized fisheries resources like ponds, tanks, rivers and manmade reservoirs. The famous holy Ganga River also with rich fish biodiversity has large stretch in Uttar Pradesh. The rivers and canals constitute to 28,500 km and this is considered to be one of the most important fisheries resources of Uttar Pradesh. The state has a total of 4.3 lakh hectares confined water area, including 66 reservoirs distributed in 17 districts comprises 32% of total confined water area. Distribution of small medium and large reservoirs as per classification of Govt. of UP reveals that small reservoirs constitute 65% of the total water area followed by large (21%) and medium (14%). However the reported productivity of reservoir resources in UP is only 4.7 kg ha^{-1} $year^{-1}$ as against 36.5 kg ha^{-1} $year^{-1}$ in Andhra Pradesh 23.4 kg ha^{-1} $year^{-1}$ in Kerala and 20.1 kg ha^{-1} kg ha^{-1} $year^{-1}$ in the country as a whole. A large variation in fish productivity of reservoirs with respect to size and location were also observed. Analysis of time of series data of fish production and catch and effort data indicated the declining trend of production ($y = 23.18x+317.9R^2 = 0.300$) and a progressive decline in catch per effort ($y = 3E\text{-}12x^3 - 7E\text{-}07x^2 + 0.062x - 1447$. $R^2 = 0.859$).

KEYWORDS: Productivity, Reservoir fisheries, Trend catch-effort, Uttar Pradesh.

INTRODUCTION

Uttar Pradesh is located in the northern part of India with a population of over 200 million. Uttar Pradesh is the second largest economy in India contributes 8.34 per cent to national GDP (2010). With geographical area 243,290 km^2, highly fertile land and vast underutilized fisheries resources like ponds, tanks, rivers and manmade reservoirs. Reservoir fisheries dominates in UP in terms of area but not in production. Therefore it is attempted to analyze fisheries resources data with emphasis on the trend of production of Rihand Reservoir on which research work has been carrying out by CIFRI during the past four decades (Annual Report, 2010).

RESEARCH METHODOLOGY

This study was conducted at the Department of Fisheries Economics and statistics during 2011 based on secondary published data related to fisheries resources particularly area, distribution and productivity of reservoirs of Uttar Pradesh. The Catch and effort analysis was also performed using time series data (Jensen, 1985; Paul, and Das 2010). Data was recorded in MS Excel followed by tabulation, classification using standard Statistical Package of Social Science (SPSS-15).

RESLUTS & DISCUSSION

Fisheries Resources: Uttar Pradesh Inland Fisheries Resources 1) Flowing water that constitutes rivers and channels (28,500 km) and

2) Confined water comprising manmade reservoirs 1.38 lakh ha., Natural Oxbow lakes 1.33 lakh ha., Rural Ponds lakes 1.61 lakh ha (Fig 1). The freshwater aquaculture resources in the country comprise 2.25 million hectares of ponds and tanks out of which Uttar Pradesh has 1.61 lakh ha. (W. S. Lakh, 2010), Further water bodies of U.P. has been divided into 2 groups one is flowing water in which rivers and canals comes and the total area of this flowing water category is 28,500 km., confined water resources comes in second category and it has Manmade resources (1.38 lakh ha.), Natural oxbow lakes (1.33 lakh ha.), and Rural ponds lakes (1.61 lakh ha.) Table 1.

Classification of reservoirs in Uttar Pradesh according to size

The State Fisheries Department classified the water bodies in the State based on the area. Accordingly, total areas under small (<1 000 ha), medium (1 000 to 5 000 ha), and large (> 5 000 ha) reservoirs are 1, 62, 000 ha, 31, 840 ha and 2, 71,000 ha, respectively. The State has 464 840 ha of water bodies (individual units above 10 ha in size) which also includes the natural water bodies such as oxbow and upland lakes. By deducting the estimated 130 000 ha of natural lakes, the total water area under man-made impoundments was reported 334 840 ha (Saxena, 1986).

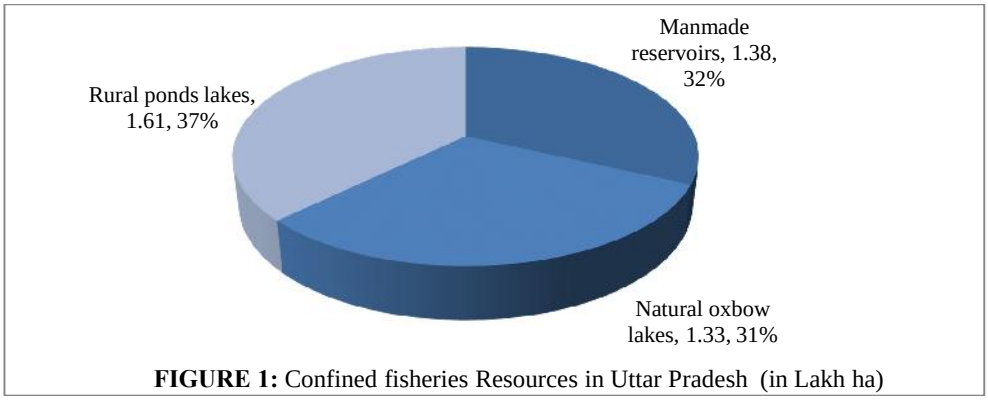

FIGURE 1: Confined fisheries Resources in Uttar Pradesh (in Lakh ha)

TABLE 1: Fisheries Resources of Uttar Pradesh

Sr.No.	RESOURCES	Area
A.	**Flowing water**	
	Rivers and Canals	28,500.00 Km.
B.	**Confined water**	
1.	Manmade reservoirs	1.38 lakh ha
2.	Natural oxbow lakes	1.33 lakh ha
3.	Rural ponds lakes	1.61 lakh ha
	Total Confined water	4.32 lakh ha

Distribution of small, medium and large reservoirs as per classification of Govt. of UP reveals that small reservoirs constitute 65% of the total water area followed by large (21%) and medium (14%) (Fig 2). Sixty-six reservoirs of the state with an area of 137 034 ha are distributed among 17 districts (Fig 3). The four large reservoirs, *viz.*, Rihand, Malhatila, Kalagarh and Saradasagar, occupy 71, 196 ha**.** lies in Sonbhadra district. The Rihand reservoir alone occupies 52 000 ha has the largest area under reservoirs. The medium impoundments, having a total water spread of 44, 993 ha. Forty small reservoirs have been documented with a total area of 20, 845 ha. From figure 3 it is apparent that Sonbhadra district is having highest reservoir area 52002 ha followed by Mirzapur with 14,544 ha Jhansi 11051 ha. Districts like Eta, Sidhaerth Nagar, Agra, Bahraich and Basti districts having reservoir area ranges from 200 to 518 ha.

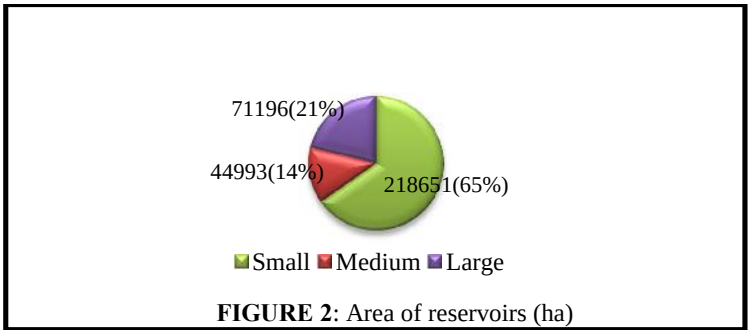

FIGURE 2: Area of reservoirs (ha)

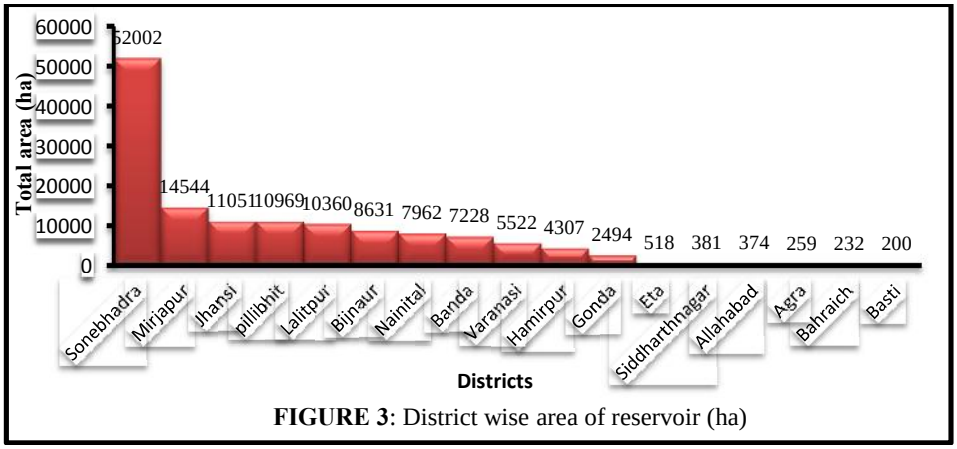

FIGURE 3: District wise area of reservoir (ha)

Fish Productivity of Reservoirs of Uttar Pradesh

Reservoirs of Uttar Pradesh have a relatively low fish yield. Examination of 31 small reservoirs covering 11, 475 ha, under 10 districts showed yields ranging from 1.1 to 227 kg ha^{-1}. The widest range of 3.2 to 227.3 kg ha^{-1} is observed in Hamirpur, which has a highest district average of 19.8 kg ha^{-1}. Bahraich district with average 28 kg ha^{-1} (17.6–44.4 kg/ha.), Allahabad with 17.4 kg ha^{-1} (13.6 to 30.9 kg ha^{-1}) and Jhansi with 21.2 kg ha^{-1} (5.8 to 34.8 kg ha^{-1}) also have high yields (Table 2). The 44 ha Kabarai reservoir in Hamirpur district yielded 10 t (227.3 kg ha^{-1}) of fish during 1992–93 being the most productive reservoir in Uttar Pradesh. However, this is more of an exception than rule, as the next highest yield obtained at Kohargaddi, Gonda district is only 59.67 kg ha^{-1}. On an average, the small reservoirs produce 14.6 kg ha^{-1}. Thirteen Medium size reservoirs covering 21 733 ha, located in seven districts have a fish productivity ranges from 1.2 to 15.04 kg ha^{-1}. The Rihand is the only large reservoir (46539 ha) produced 50 t of fish during 1992–93, with the fish productivity 1.07 kg ha^{-1} (Table 3).

TABLE 2: Fish yields of small reservoirs in Uttar Pradesh (1992–93)

Sr.No.	District	Number of reservoirs examined	Yield range (kg ha^{-1})	Average yield (kg ha^{-1})
1.	Varanasi	2	8.9–9.5	9.1
2.	Mirzapur	6	1.4–34.6	7.6
3.	Jhansi	3	5.8–34.8	21.2
4.	Hamirpur	6	3.2–227.3	19.8
5.	Banda	2	3.9–6.4	5.1
6.	Allahabad	2	13.6–30.9	17.4
7.	Eta	1	11.6	11.6
8.	Bahraich	2	17.6–44.4	28.0
9.	Gonda	5	1.1–59.7	16.6
10.	Siddhardh Nagar	2	15.9–29.1	18.9
Total		31	-	-
Average		-	-	14.60

TABLE 3: Fish yield rates in medium and large reservoirs of Uttar Pradesh (1992–93)

Sl No.	District and Reservoir	Average yield (kg ha^{-1})
(a.)	Medium	
1.	Varanasi(Bhusakhand)	2.49
2.	Varanasi(Chandraprabha)	2.70
3.	Varanasi(Nowgarh)	1.20
4.	Sonebhadra(Ghagherol)	8.72
5.	Sonebhadra(Nagwa)	1.84
6.	Mirzapur(Ahrora)	2.96
7.	Mirzapur(Mera)	4.70
8.	Jhansi(Pahari)	15.04
9.	Jhansi(Parwar)	13.80
10.	Hamirpur(Arjun)	12.35
11.	Banda(Ragwa)	10.42
12.	Banda(Varua)	8.67
13.	Bijnaur(Pilli)	11.53
(b.)	*Medium reservoirs average*	7.17
(c.)	Large	
1.	Sonebhadra(Rihand)	1.07

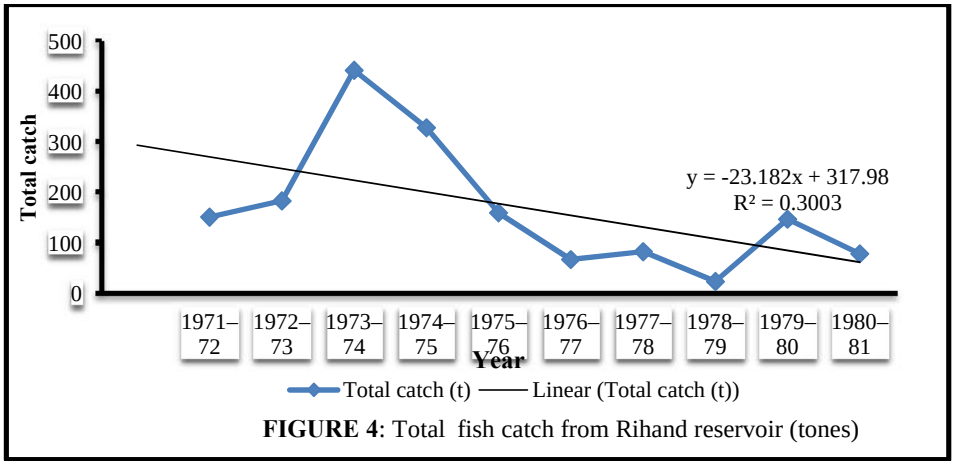

FIGURE 4: Total fish catch from Rihand reservoir (tones)

However the average fish productivity for the country as whole for small, medium and large reservoirs and overall were reported to be 49.5 kg ha^{-1}, 12.3 kg ha^{-1}, 11.4 kg ha^{-1} and 20.1 kg ha^{-1} per annum respectively. The highest productivity for small reservoir recorded from Andhra Pradesh (188 kg ha^{-1}) for medium reservoirs from Rajasthan (24.5 kg ha^{-1}) and for large reservoirs in Himachal Pradesh (35.7 kg ha^{-1}) (Vass and Sugunan 2009). Above facts revealed that vast potential of reservoir in Uttar Pradesh each still untapped.

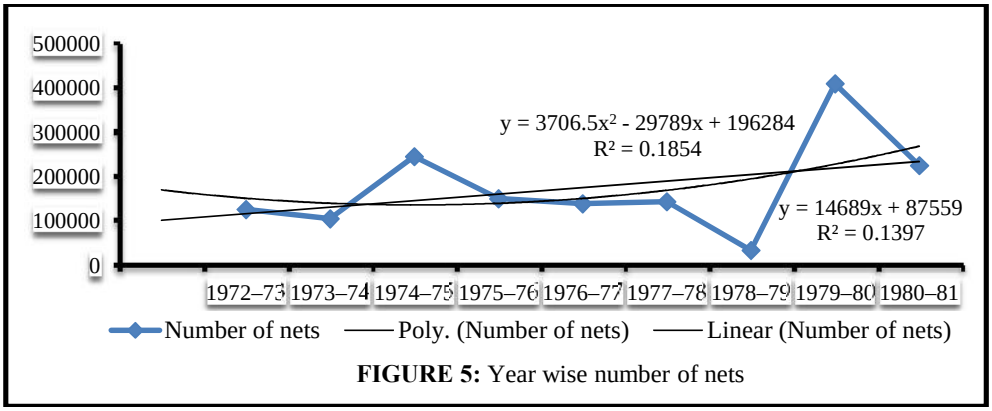

FIGURE 5: Year wise number of nets

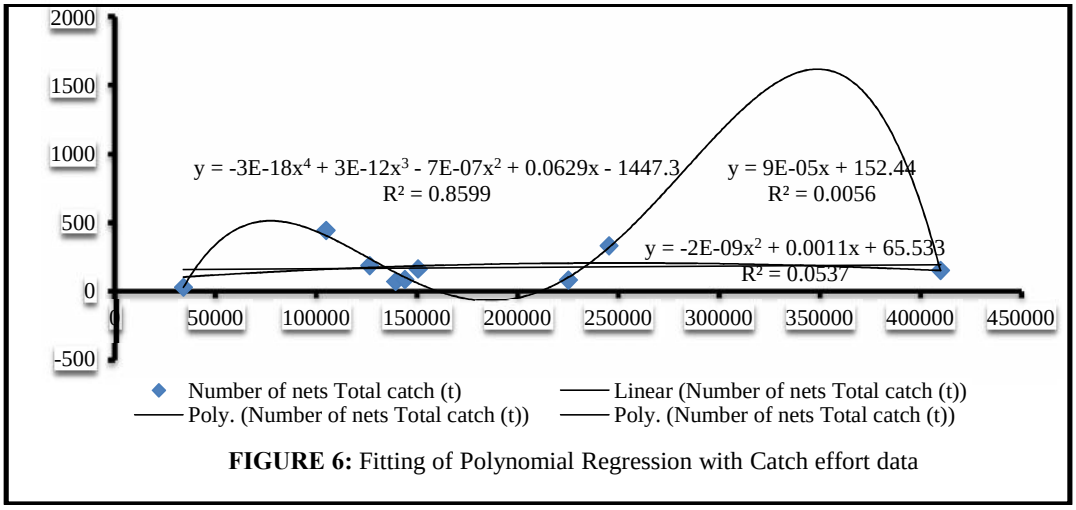

FIGURE 6: Fitting of Polynomial Regression with Catch effort data

Fish Production Trends in Reservoirs of Uttar Pradesh

Further the available time series catch statistics of Rihand reservoir were analysed to get an idea about quantum and trend of fish production and trade and associated employment through various activities.

From Fig. 4 of fish catch shows decreasing trend of -28.18 tons per years. The estimated linear regression equation of fish catch and year (y = -23.18x + 317.9R^2 = 0.300). However polynomial equation of the 3rd order were found better fish catch as indicated by R^2 = 0.657. However study on fish production of Govindgarh reservoir of MP from 1961-62 to 1979-80 was analysed and reported by (Upadhyay *et al.*, 2012). There study indicated the increasing trend in fish catch and they also reported greater variability in fish catch in the reservoir.

Catch and effort analysis

The catch (tones) and Effort data (number of 50 m gill nets) for 10 years (1971-72 to 1980-81) were complied, analyzed and presented (Fig. 6). The polynomial regression of fourth order has been found best fit capable of explaining 85.9% variability (y = 3E-12x3 - 7E-07x2 + 0.062x - 1447. R^2 = 0.859) could explain only 18.5% of total variability although it is better than linear regression (13.9%) (Fig.5). Polynomial fitting is poor one suggesting more number of variables is to be taken up to identified real cause for erratic behavior of effort data over the years at Rihand dam.

Desai, 1980; describes an inverse relationship between the water level and fish yield in the reservoir. The high production of 242.62 t (1973–74) and 328.82 t (1974–75) were achieved at low water levels of 248.55 m and 248.22 m respectively. There was a similar correlation between the water level and catch for 1971–72, 1972– 73 and 1975–76. Lower water level permits effective operation of gill nets, especially in areas of the reservoir, where column setting of gill nets becomes possible. There is a progressive decline in catch per effort. During 1979–80, despite a catch level near to that of the first year (1971–72), the catch per effort was only 0.60 kg, compared to 2.44 kg for 1971–72. This is due to a three and half times increase in fishing effort.

Sociological Impact of Reservoirs in UP

Dams and reservoirs can be used to supply drinking water, generate hydroelectric power, increase the water supply for irrigation, provide recreational opportunities, and improve certain aspects of the environment. However,

adverse environmental and sociological impacts have been identified during and after many reservoir constructions. Whether reservoir projects are ultimately beneficial or detrimental to either the environment or surrounding human populations has been debated since the 1960s.

CONCLUSION

Uttar Pradesh possessed vast underutilized fisheries resources like ponds, tanks, rivers and manmade reservoirs. The state has a total of 4.3 lakh hectares confined water area, including sixty-six reservoirs distributed in 17 districts comprise 32 per cent of total confined water area. Distribution of small medium and large reservoirs as per classification of Govt. of UP reveals that small reservoirs constitute 65 per cent of the total water area followed by large (21%) and medium (14%). However the productivity of reservoir resources in UP is only 4.7 kg /ha/year as against 36.5 kg ha^{-1} $year^{-1}$ in Andhra Pradesh 23.4 kg ha^{-1} $year^{-1}$ in Kerala and 20.1kg ha^{-1} $year^{-1}$ in the country as a whole. A large variation in fish productivity of reservoirs with respect to size and location were also identified. Analysis of the time series data of fish production and catch and effort data indicated the declining trend of production and a progressive decline in catch per effort.

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