

Fisheries and Management Status of Pechiparai Reservoir in Tamil Nadu

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ABSTRACT

The study attempts to give a comprehensive account of socio-economic and ecological aspects of the fisheries and management in Pechiparai reservoir of Kanyakumari district, Tamil Nadu by analysing the data obtained both using primary and secondary sources. It is unique in terms of demographics - sparsely populated reservoir periphery, very low primary productivity, relatively less diversity in fish species and a typical institutional arrangement for benefit sharing and marketing (share system). Increase in fish seed stocking and fishing effort through share fishing system has increased the total fish catch of the reservoir from an average of 3.5 kg/hectare/year (1962-1980) to an average of 13 kg/hectare/year (1981 to 2015) due to considerable contribution by stocked varieties especially Indian Major Carps. However, regression analysis revealed that there is no significant relationship between fish seed stocking and fish catch in the reservoir. Underlining the limitations of present stock enhancement program, the study emphasises the possibilities of eco-tourism and sport fishing, for creating sustainable livelihood based on further detailed scientific investigations on the socio-ecology of the reservoir region.

Keywords: Pechiparai, Fisheries, Institutions, Management.

INTRODUCTION

India is a peninsular country with vast natural resources engulfing rich diversity of fauna and flora. The country is acclaimed to be one of the global leaders in fish production and also has huge population relying on fish as the cheaper source of protein. Besides unpromising returns from declining marine capture fisheries and capital intensive aquaculture, the country identified its reservoirs as the focus of future fisheries development plans because of its enormous resource size and untapped production potential¹. Even though reservoirs in India

were mainly formed for irrigation, hydel power and to some extent for drinking water purposes, fisheries in these reservoirs were also given considerable importance over the years. This importance was exhibited through suitable scientific interventions coupled with optimum fish seed stocking and fishing effort in the reservoir.

Pechiparai dam in the Kanyakumari District of Tamil Nadu is one among four dams in Kodayar irrigation project and was constructed during the period from 1896 to 1906 by a British Engineer, Alexander Humphrey Minchin for Travancore

Government during the reign of Srimoolam Thirunaal Maharaja. Despite several scientific investigations, in particular limnological and fish species diversity studies², carried out in different reservoirs of the country, only few studies^{3; 4; 5} attempted to give a comprehensive account of socio-economic and ecological aspects of the fisheries and management in certain reservoirs. Pechiparai dam, the reservoir taken for the present study is also not an exception to the above statement, as only in recent years some interest is evident with regard to planktonic studies^{6; 7; 8; 9}, though no studies are available about its socio-economics and fisheries management. In this regard, the current study attempts to document fisheries and management status of Pechiparai reservoir comprehensively.

MATERIALS AND METHODS

The fisheries and management status of Pechiparai reservoir was documented by analysing the data obtained both using primary and from secondary sources. Fishers and State Department of Fisheries (DoF) officials working in the reservoir were the primary sources. Semi-structured personal interviews were conducted with key primary sources to obtain vital information related to various aspects of the reservoir fisheries and its management since its formation. The information thus obtained was documented in a case study format. Besides the review of existing limited literature about the reservoir, DoF records namely General Information Register (GIR), master register and monthly report termed as periodical (PDL) of the reservoir were also critically reviewed. These departmental records maintained by the Inspector of Fisheries, Pechiparai Dam, served as the major secondary data source and has the annual fish catch as well as fish seed stocking (total and species-wise) details of the reservoir. To understand the six decadal fisheries and management status of the reservoir, the collected secondary data were further subjected to statistical analysis. The relationship between fish seed stocking and fish catch in the reservoir was done using regression analysis. Data of species-wise fish seed stocking and fish landing for the past 35 years (1980-2015) was taken for the analysis. Fish seed stocking and fish landing details for some of the years were unavailable, for which the average of

preceding and succeeding year's data was taken. In addition to it, production data for next year was taken for the corresponding previous year stocking data, as the stocked seeds require at least 8-12 months to grow into marketable size. Totally five correlation and regression models were fitted separately for each fish species of the Indian Major carps, then all the three IMC fish species together and finally for all the fish species stocked and caught in the reservoir.

RESULTS AND DISCUSSION

A reservoir's geographic and morphometric features play a major role in determining the productivity of the reservoir¹⁰. Pechiparai dam is a multipurpose reservoir located between 8°.30'N latitude and 77°.08'E longitude, with a total water spread area of 1515 hectares at full reservoir level. It was constructed as a 555 metre long straight gravity masonry dam across the river Kodayar. The major morphometric and hydrographic details of Pechiparai reservoir are presented in Table 1.

Ecology and Productivity

Trophic status of the reservoir is highly attributed to its location in the upstream of the source river and close proximity to its catchment area. The reservoir receives rainfall from both South West and North East monsoons, but to a larger extent gets filled by North East monsoon (October to December). The reservoir is surrounded by a chain of huge and densely forested mountains (Western Ghats) and hence the path of water inflow to the reservoir is very short. As a result, plankton productivity is very low in the reservoir. The major carps of the reservoir is surviving on the low plankton density and with a growth of up to 300-400 grams annually as against 800-1000 grams in plankton rich reservoirs. The average pH of the reservoir is 6 to 6.5, which also hinders the growth in fish¹¹. This characterisation clearly places the reservoir in mesotrophic status. However, the reservoir is also reported to have a mesotrophic to early eutrophic status, with less turbid water characterised by dominance of oligotrophic phytoplankters in it⁹. Maximum diversity and primary productivity in the reservoir was recorded during the post monsoon period (January to March) as the inflow of water during this period largely influences the input of the nutrients and primary production

in the reservoir^{7; 8}. Thus, it can be inferred that this century old reservoir has very low primary productivity.

Stocking intervention and fish catch

Unlike other tropical reservoirs, Pechiparai reservoir has less fish diversity. Fish catch from the reservoir consists of stocked, unstocked and few other unidentified minor fish species (Table 2). From the year 1959, DoF holds the responsibility to stock fish seeds in the reservoir. During the course of DoF's intervention in the reservoir, preferred choice of fish species for stocking in reservoir has undergone major changes over the years. In the initial 20 years (1959-1981), *Labeo fimbriatus*, *Cirrhinus mrigala*, *Cyprinus carpio* were highly preferred. After this period, stocking of *Labeo fimbriatus* became almost meagre and currently, stocking of Indian Major Carps (IMC) is given major priority. Fig.1 and Fig.2 depicts total fish seeds in numbers stocked per annum (1959-2015) and total fish caught in kgs (1962-2015) per annum in the reservoir respectively. In 1980, establishment of fish seed rearing centre in the dam premises enabled DoF to increase the annual average IMC seed stocking from 47,000

seeds (1959-1980) to 3.5 lakh seeds (1981-2015). Increased IMC fish seed stocking has considerably increased the annual average catch in the reservoir from 3.5 kg/hectare/year (1962-1980) to 13 kg/hectare/year (1981 to 2015). Increase in fish seed stocking and fishing efforts through share fishing system has shown increase in the total fish catch due to considerable contribution by stocked varieties especially IMC.

According to local fishers, seeds of Mozambique tilapia and pearl spot were introduced into the reservoir in 1960s with the initiative of the then Fisheries Minister of the State. The seeds of tilapia were procured from West Bengal whereas Pearl Spot has entered the reservoir from the downstream Manakudy area and also occasional stocking by the DoF. The major carps that are typically stocked face a stiff food competition from naturally abundant unstocked fishes of the reservoir for their survival.

Pechiparai Government fish farm is one of the oldest fish seed rearing centre in the State. At present, the fish farm's infrastructure especially

Table 1: Morphometric and hydrographic features of pechiparai reservoir

Particulars	Pechiparai reservoir
Location	45 km from Nagercoil in Kanyakumari District, Tamil Nadu
Inflow river	Kodayar
Basin name	West flowing rivers from Tadri to Kanyakumari
Construction period	1895-1906 (completed)
Constructed by	Government of Travancore (British India)
Purpose of construction	Mainly for Irrigation; Integrated with Kodayar irrigation project has irrigation potential of 36836 hectares
Area of reservoir (in hectares)	1515 (Full Reservoir Level); 909 (Effective)
Type of reservoir (in size)	Medium
Type of Dam	Straight gravity type masonry
Catchment area (in hectares)	20719.9
Length of Dam (in feet)	1821
Maximum water level (in feet)	Actually 93 feet is the maximum depth in which 45 feet is dead storage. Hence, maximum water level is considered as 48 feet
Mean depth (in feet)	32.5
Water holding capacity in full reservoir level (in million cubic feet)	14200
Water holding capacity in lowest reservoir level (in million cubic feet)	4350

condition of tanks, need to be strengthened, which is considered a major constraint in raising adequate number of stockable fish fingerlings of 80-100 mm size (this size is needed to achieve the fish production target from the reservoir fixed by DoF). Fishers of the reservoir allege that the lessee is more interested in exploiting the stock rather than stocking as per the terms. It is said that every year, i.e. from June to December, DoF used to stock the reservoir with 10 lakh fish seeds though records suggest an average of 4-5 lakh fish seeds (IMC and Common carp). The current approach of the lessee is a cause

of concern for the fishers as they fear it may affect their livelihood in the coming years.

Fish seed stocking and fish landing details for some of the years were unavailable, for which the average of preceding and succeeding year's data was used for imputing such values to obtain a complete data set. In addition to it, production data for next year was taken for the corresponding previous year stocking data, as the stocked seeds require at least 8-12 months to grow into marketable size. Totally five correlation and regression models

Table 2: Commonly caught fish species in pechiparai reservoir

Origin of fish	Common Name	Scientific name	Vernacular name (Tamil)
Stocked	Catla	<i>Catla catla</i>	Catla/Thepa Meen
	Rohu	<i>Labeo rohita</i>	Rohu
	Mrigal	<i>Cirrhinus mrigala</i>	Mirgal/Bengal Kendai
	Common carp	<i>Cyprinus carpio</i>	Saadha Kendai/ Bangkok Kendai
Unstocked	Fringed lipped peninsula carp	<i>Labeo fimbriatus</i>	Sael Kendai
	Calbasu/Black Rohu	<i>Labeo calbasu</i>	Kakkai Meen
	Pearl Spot/Green Chromide	<i>Etroplus Suratensis</i>	Setha Kendai/ Seepu Meen
	Mozambique Tilapia	<i>Oreochromis mossambicus</i>	Thilepi Kendai/ Jelebi Meen
	Great Snakehead	<i>Channa marulius</i>	Aviri
	Spotted snakehead	<i>Channa punctata</i>	Koravai
	Oliver Barb	<i>Systemus sarana</i>	Panjalai
	Red Fin Mahseer	<i>Tor tor</i>	Pon meen
Long-whiskered catfish	<i>Sperata aor</i>	Kezhuthi	

Table 3: Relationship between fish seed stocking and fish catch in the reservoir

Fish species	Correlation coefficient (r)	Regression Model $Y_t = \beta_0 + \beta_1 X_{t-1}$	R ² Value (%)	Significance F (p-value in ANOVA)
<i>Catla catla</i> (Catla)	0.109	$y_t = 1363.36 + (0.01) x_{t-1}$	1.20	0.53
<i>Labeo rohita</i> (Rohu)	0.175	$y_t = 388.71 + (0.0008) x_{t-1}$	3.06	0.31
<i>Cirrhinus Mrigala</i> (Mrigal)	0.072	$y_t = 2096.83 + (0.001) x_{t-1}$	0.50	0.68
Indian Major Carps (Catla+Rohu+Mrigal)	0.268	$y_t = 2707.28 + (0.005) x_{t-1}$	7.10	0.12
All fish species	-0.039	$y_t = 12572.81 + (-0.0009) x_{t-1}$	0.10	0.82

were fitted separately for each of the three fish species of the Indian Major Carps (IMC), then all the three IMC fish species together and finally for all the fish species stocked and caught in the reservoir. The correlation coefficient and R^2 values (Table 3) of all these models showed that there is no significant relationship between fish seed stocking and fish catch in the reservoir. In addition, it can be seen that the regression ANOVA also suggests that the relationship between fish catch at time t and fish stock at time $(t-1)$ i.e. lagged by one year is also statistically not significant suggesting that there is

no causal effect of fish stock on the output i.e. fish catch.

Fishing effort

In various reservoirs of Tamil Nadu, fishing is carried out by what is described as 'fishing units'. In majority of reservoirs in the state, a 'fishing unit' generally refers to a coracle being operated by two fishers but in case of Pechiparai it refers to only one fisher in a coracle. Fishers in the reservoir carry a minimum of 3-4 "sets" (monofilament gill nets bundled in clothes) for fishing operation. Each set

Table 4: Community and Religion Profile of Pechiparai Reservoir Area

Community	Pechiparai (in %)	Fishers (in numbers)	Religion (in %)	Pechiparai (in numbers)	Fishers
Nadars	30	10	Hinduism	55	4
Kanis	24	1	Christianity	30	9
Nairs	20		Islam	15	
Lebbai Muslims	15				
Mukkuvars	11	2			

Table 5: Key features of fishing system in Pechiparai reservoir

Roles/ Respons- ibilities	DoF	Fishers	Lessee
Fish seed stocking	Stocked seeds from 1959 to 2014	No stocking responsibility	Stocking seeds from January 2015 to till date
Fishing rights	Retained rights from 1962 to 2014	Fishers employed with or registered with DoF only can fish in the reservoir	From January 2015, DoF handed over fishing rights to a private contractor following open tender
Benefit sharing	66% and 50% of stocked and unstocked fish catch respectively (till 2014) From January 2015, leased out the fishing rights. Receives Rs.8.5 lakhs as lease value plus 10% royalty for the leased out amount every year for five years	33% and 50% of stocked and unstocked fish catch respectively (till 2014) From January 2015, fishers receive pays Rs.40/Kg irrespective of fish species and size	After getting fishing rights (from January 2015), follows simplified share fishing system, wherein lessee retains the difference between market price (usually Rs.100-120/kg) and fishers share (Rs.40/kg)

normally weighs around 40 kilograms (kg) (1 set has 10 kgs of net), though small nets of 0.5 kg size are also carried. Cost of 1 kg of net is Rs.600. Length of the net is usually of 10 metres while depth of the net varies from a minimum of 25 feet to a maximum of 30 feet depending on different mesh sizes like 3, 5, 6, 8, 10 inches. Fishers allege that nets could not be operated below 30 feet due to presence of huge trees and bushes, which could damage the nets.

Of the existing 13 fishing crafts (10 coracles and 3 boats) being operated in the reservoir, nine crafts are owned by DoF, while the remaining four are privately owned by individual fishers. All these coracles are made of fibre-reinforced plastic (FRP). Out of the nine DoF owned coracles, three are directly operated by employee fishers of DoF while the remaining six are lent to other fishers. Diameter and weight of a single coracle is 6 feet and 40 kg respectively. Among the three boats, two (one FRP & Ferro-cement each) are DoF owned and the remaining one is a privately owned FRP boat. Length of the FRP and cement boats are 18 and 15 feet respectively. On an average, 6-7 fishing units operate daily in the reservoir. Fishers place the gill nets in the reservoir one day before the actual fishing (usually the evening before) and fish in the early morning between 4 and 5 am. Once they reach the spot, they slowly haul the net (which is the difficult part in reservoir fishing) and collect the fishes gilled in the nets. Once the catch has been completely taken from the net, they release the new nets which they carry with them and will be collecting it next day. Thus, it is a cyclic process.

It has to be noted that, many a times, fishers do not use the same spot for fishing, and instead they release nets in different areas in the reservoir to ensure catch. The unique dead storage (45 feet) of the reservoir is not allowing fishers to exploit the bottom dwelling fishes like mrigal and common carp, as the dead storage has a lot of trees and bushes in it, which is hindering the gear beyond a certain depth. In addition to it, year round strong winds from Western Ghats is also one of the major difficulties in carrying out fishing operation in the reservoir. Though the fishers use coracles which makes it tedious for them to reach their desired fishing spot in the reservoir, they continue to prefer coracles as they believe motorised boats may scare away the fishes from the nets. However, operation of motorised boats may not be economically viable in the reservoir considering the meagre fish catch. Fishers return to the shore between 8 to 8.30 AM daily with their catch and take it to the fish sale centre of DoF situated within Pechiparai Government fish farm.

Socio-economic profile

Pechiparai reservoir region has certain unique demographic and socio-economic characteristics that directly and indirectly impact the reservoir fisheries and its management. The reservoir's is located in the Pechiparai village panchayat of Thiruvattar Taluk in Kanyakumari district. The hilly region is predominantly populated by Kani tribes. For instance, Kanis form 24% (2054) of the total population (8686) of Pechiparai panchayat¹² which includes both hilly region and the adjoining plains. The tribes have a long history as agriculturists in the hills practicing shifting cultivation

Table 6: Prices of commonly sold fishes in Pechiparai reservoir

Types of fishes	DoF fixed rate (Rs/kg)	Lessee rate (Rs/kg)
Stocked fishes (IMC, Common carp)	90	100
Unstocked (especially Tilapia)	>150 grams – 30; <150 grams – 20	>150 grams – 40; <150 grams - 30
Special varieties (Rarely caught fishes)	Olive Barb – 20; Pearl spot – 40; Murrels – 125	Based on the demand, auctioned to higher price which is usually 2-3 times more than Government fixed rate

and collecting natural forest produce like honey, wax, etc. for their livelihood¹³. Importantly and interestingly, they have not involved themselves in any major reservoir fisheries activities except in a few instances of artisanal fishing. This can be attributed partly to the location of their habitations on the hill side

of the reservoir that is dominated by plantations. However, recently a ‘fishing agitation’ was carried out by Kanis in three major dams of Kanyakumari district including Pechiparai dam against DoF to ensure their rights enshrined in the Scheduled Tribes and other Traditional Forest Dwellers (Recognition

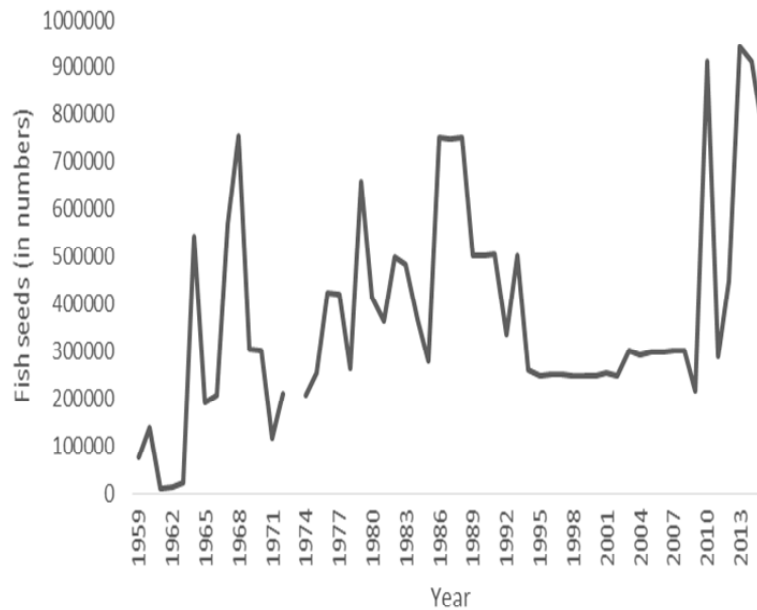


Fig. 1: Total fish seeds stocked in Pechiparai reservoir over the years (1959-2015)

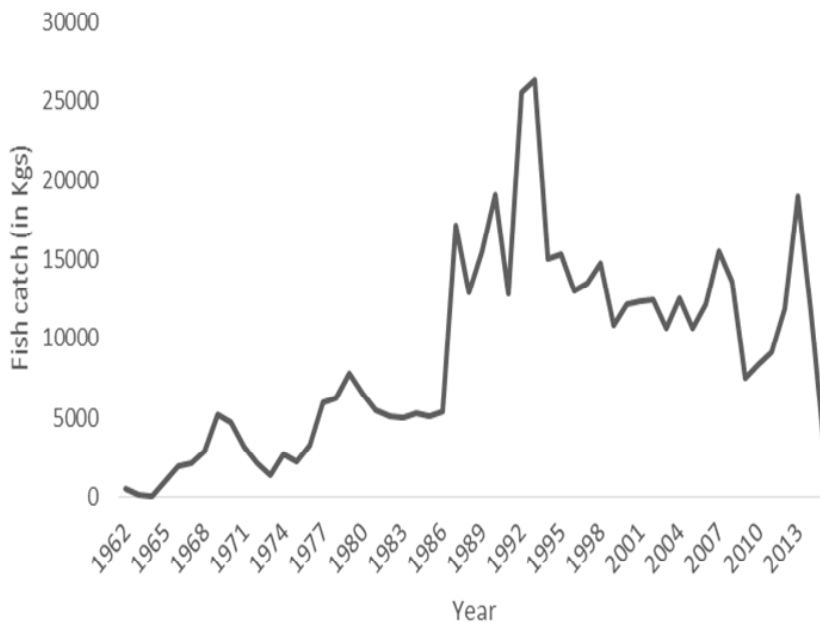


Fig. 2: Total fish catch in Pechiparai reservoir over the years (1962-2015)

of Forest Rights) Act, 2006¹⁴, indicating their intent to become involved in fishing activities.

Untill now, Kanis main dependence on reservoir is for transportation as they use the panchayat boats to quickly cross the reservoir and connect themselves to the rest of the world whenever it is necessary, mainly for marketing their produce and education. Apart from the hilly Kanis, the reservoir area is inhabited by following communities namely: Nadars (30%), Nairs (20%), Lebbai Muslims (15%) and Mukkuvars (11%) all of whom reside close to the dam. In terms of religious affiliation, majority of the people including Kanis around the reservoir are Hindus (55%) while about 30% are Christians and the rest are Muslims. Community and religious profile of the reservoir area is given in Table 4. There are only a total of thirteen fishers fishing in the reservoir. Among them, ten are Nadars, two are Mukkuvars and the last one belong to Kani. Among the Nadars, seven are Christians and three are Hindus whereas both the Mukkuvars are Christians. The only Kani is a Hindu. Thus, the demographics, though small, speak of a diverse and heterogeneous religious and community profile.

Institutional framework

The formal fishing rights of Pechiparai reservoir was transferred from the parent Irrigation department in 1961 to DoF vide G.O. Ms.No.4103, Food and Agriculture dated 18.12.1961. Though the reservoir was completed way back in 1906, fisheries development in the reservoir was given impetus only after the establishment of State DoF's Office of Inspector of Fisheries in the dam premises in 1963. Pechiparai, like many other reservoirs with DoF, follows what can be termed as a 'share system of fishing arrangement'. The key features of this system are described in Table 5. The role and responsibilities of DoF, fishers and lessee are clearly defined and unique, and have only been modified slightly in recent years. Under the power delegated in the Government memo (No.75901/F3/84 dated 16.10.1984), Deputy Director of Fisheries (Tuticorin) engaged fishers for fishing in departmentally managed waters within the jurisdiction on predetermined sharing of fish caught. In this system, of the total fish caught, fishers retained 33% of stocked fishes and 50% of unstocked fishes, while the rest were taken by DoF. In 2015, DoF changed its reservoir fishing

policy for Pechiparai, wherein the fishing rights are handed over to private contract following open auction. However, share of fishers and their terms of engagement remain unchanged while the DoF's share is now taken by private contractor. According to the leasing agreement (valid for five years), the lessee has to pay 8.5 lakhs/year and also have to pay 10% royalty every year to DoF. In practice, the lessee follows simplified share fishing system, wherein they offer Rs.40/kg to fisher for whatever fish they bring to shore.

As there is no fishermen cooperative society in the reservoir area, only fishers who are registered in the Tamil Nadu Government Fishermen Welfare Board are being allowed to fish in the reservoir. In practice, Inspector of Fisheries, Pechiparai Dam ensures that only eligible fishers fish in the reservoir. Eligible fishers are given "share fisher" identity card issued by the Office of Assistant Director of Fisheries (Aquaculture), Nagercoil. Fishers on an average bring 50 kg/day to the sale centre where DoF staff oversee the selling process. Fish sale starts by 9 AM in the centre and usually the locals come to purchase the fishes. As per the marketing arrangement, fishes are sold on a pre-determined price (Table 6). Since the local demand is usually higher than the supply, the practice of issuing coupons on 'first come first serve basis' was followed years ago where quantity per buyer was also restricted. Now, the private lessee auctions the fish to the buyers who bid high, which is normally 2-3 times of DoF fixed rate.

CONCLUSIONS

Pechiparai reservoir has several comparative advantages which can be usefully exploited. While efforts for enhancement of food fish catch shall be continued, its major strength lie in eco-tourism and sport fishing. Picturesque greenery and proximity to other major tourist attractions of the district (like Padmanabhapuram Palace, Tirparappu Waterfalls) has already made the reservoir familiar as an important stopover during picnic and excursions. The State Ministry of Tourism also has acknowledged the dam's attraction by introducing boat service inside the reservoir and also by maintaining a beautiful park in the dam premises which has the pillar and tombstone of the British engineer who constructed the dam.

In addition to the existing tourist attraction, this reservoir could be developed as a hot destination for domestic and international tourists by introducing fishing sports in the reservoir. This can be achieved by stocking Mahseers in the reservoir. As a part of ecotourism activities, DoF can also initiate ornamental fish culture in cages and establish an aquarium selling ornamental fishes to the tourists and nearby urban residents. This can be done through a participatory approach by involving the local Kani tribes by training them in such activities through NGOs who are already actively working for their welfare. More comprehensive scientific investigations on the ecology, fisheries, socio-

economics and potential for eco-tourism is the need of the hour to prepare a pragmatic roadmap for enhancing sustainable livelihood options for people around Pechiparai reservoir.

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REFERENCES

1. Ayyappan, S., Jena, J. K., Gopalakrishnan, A., and Pandey, A. K. Handbook of fisheries and aquaculture. Indian Council of Agricultural Research, 238-248 (2006).
2. Sugunan, V.V. Ecology and fishery management of reservoirs in India. *Hydrobiologia*, **430**(1-3): 121-147 (2000).
3. Nikumbe Prabhakar, A., Study of fishers' livelihood and fisheries management in Girna, Yedgaon and Manikdoh reservoir region in Maharashtra, unpublished M.F.Sc. thesis submitted to CIFE, Mumbai, (2011).
4. Katiha, P. K., Sharma, A. P., & Chandra, G. Institutional arrangements in fisheries of Ganges River system. *Aquatic Ecosystem Health & Management*, **16**(4): 465-472 (2013).
5. Jitesh Vilas Keshave., Ananthan, P.S. and Asha Landge. Fish and fisheries management status of Itiadoh reservoir, Maharashtra State. Ecology, *Environment and Conservation*, **20**(4): 1653-1659 (2014).
6. Manoharan, S., Murugesan, V. K., and Rani Palaniswamy. Numerical abundance of benthic macroinvertebrates in selected reservoirs of Tamil Nadu. *Journal of Inland Fishery Society of India*, **38**(1):54-59 (2006).
7. Mohan, P. J., Wesley, S. G., Ramya, S., Alaguchamy, N., Kalyanasundaram, M., and Jayakumararaj, R. Influence of Spatial and Temporal Variations on Phytoplankton Community Structure in Pechiparai Reservoir, Kanyakumari District, TN, India. *Ethnobotanical Leaflets*, 2009 (1):31.
8. Mohan, P. J., Wesley, S. G., Ramya, S., Alaguchamy, N., Kalayanasundaram, M., and Jayakumararaj, R. Correlation between the Diversity Manifestation and Phytoplankton Productivity in Pechiparai Reservoir, Kanyakumari District, Tamil Nadu, India. *Ethnobotanical Leaflets*, 2009 (2):4.
9. Rani Palaniswamy., Manoharan, S., and Mohan, A. Characterisation of tropical reservoirs in Tamil Nadu, India in terms of plankton assemblage using multivariate analysis. *Indian Journal of Fisheries*, **62**(3):1-13 (2015).
10. Jhingran, A. G. Reservoir fisheries in India. *Journal of the Indian Fisheries Association*, **18**: 261-273 (1988).
11. Department of Fisheries (DoF), Tamil Nadu. Internal correspondence from Office of Assistant Director of Fisheries (Aquaculture), Nagercoil to Joint Director of Fisheries (Regional), Tuticorin dated 31.07.2012 (unpublished).
12. Census of India. Total population and population of scheduled castes and scheduled tribes for village panchayats and panchayat unions of Kanyakumari district. Retrieved from http://www.tnrd.gov.in/databases/census_of_india_2011TN/pdf/31-Kanniyakumari.pdf 2011.
13. Thurston, E. Casts and Tribes of Southern

- India Vol. III-K. Cosmo Publications, Delhi, 162-177 (1909).
14. Anon. Kani tribals fish in dams to establish their right. The Hindu. Retrieved from <http://www.thehindu.com/news/national/tamil-nadu/kani-tribals-fish-in-dams-to-establish-their-right/article6863698.ece> 2nd February (2015).