

**IMPACT OF IDUKKI HYDRO-ELECTRIC PROJECT ON THE  
POPULATION OF *VILLORITA CYPRINOIDES* VAR. *COCHINENSIS*  
(HANLEY) INHABITING THE ESTUARIAN WATERS OF  
MUVATTUPUZHA RIVER IN KERALA**

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**INTRODUCTION**

Idukki project in Kerala is one of the major hydro-electric projects in India. Apart from naturally affecting the ecosystem of the forest lands inundated by its reservoir, covering an area of 60 sq. kms, the project has led to the diversion of the water of one river (Periyar) to another (Muvattupuzha). This has affected the biotic and abiotic factors of both the rivers. Very little is known from the world over, and practically nothing from India, of the impacts of such changes. An attempt, therefore, has been made to assess the changes brought about by this project on the salinity contents in the lower reaches of one of the rivers and the impacts of changes in the salinity on the population of *Villorita cyprinoides* var. *cochinensis* (Hanley), a mussel inhabiting the estuarian waters of that river.

**AREA OF STUDY**

Idukki reservoir is one of the biggest artificially created freshwater bodies. It is formed by the construction of three dams across Periyar and its tributary Cheruthoni rivers. The coming up of the reservoir has led to the stoppage of the flow of water below the dams along a long stretch of Periyar river. The tailrace waters that leave the Idukki Project power generators at Moolamattom enter the Muvattupuzha river. This river divides into Murinjapuzha and Ithipuzha branches before joining the Vembanad Lake which is a brackish water body that joins the Arabian sea. The points of entry of these branches into the lake are separated by a distance of over 12 kms. The area of the lake between these points of entry, called Chempu part of the lake, is practically an enclosed area as there is a continuous stretch of landmass in the lake over four kms from the mainland. This landmass separates this waterbody, but for two outlets, from the main body of the lake (Fig. 1).

**MATERIAL AND METHODS**

Data on salinity content of the waters of Chempu area of Vembanad lake and from one point each 2 kms upstream from the estuaries of Murinjapuzha and Ithipuzha were collected once in each month during the summer season (January - June) between 1980 and 1983. Mohr's method was followed for determining salinity. Silvernitrate was

titrated against the sample by using potassiumchromate as indicator solution. Besides, data were collected from Kerala State Electricity Board (KSEB) on the quantum of tailrace waters discharged into the Muvattupuzha river daily for the period from 1980 to 1983 and the average discharge was calculated on the basis of such data. Information on the nature of the flow in Muvattupuzha river before the commissioning of the project in 1976 was gathered by questioning twenty long time inhabitants residing on the banks of the river along a stretch of 80 kms, as no other data for the flow of this period, are available.

Data on the availability of *Villorita cyprinoides* var. *cochinensis* (Hanley) found in the waters of Chempu part of the lake and in the lower reaches of the river for the pre-project period were collected by questioning forty long time inhabitants and fishermen of Chempu and surrounding areas as no such data were regularly collected and maintained by any scientific agency. Information on the population of the clams in the study area from 1980 to 1983 was gathered by examining and quantifying, once in two months, the catches made by the fishermen.

## RESULTS AND DISCUSSION

### a. *Replenishment in the flow of Muvattupuzha river*

As mentioned earlier, on the basis of data maintained by KSEB, on an average 200 M. cft. of water enter the river as tailrace. It was as high as 249 M. cft. on a day in June, 1982 and on certain days in previous years it was even higher. This replenishment in the flow allows the river to maintain a good flow all the year round whereas before the commissioning of the project the flow during summer months was restricted, especially along a stretch of many kms below Moolamattom, to a small channel running almost through the middle of the river.

### b. *Impact of the entry of tailrace waters on the salinity content of the estuarian waters of Muvattupuzha river*

During the summer months (January - June) before the commissioning of the project in 1976 salinity in Muvattupuzha river used to be felt upto Kakkad, near Piravom i.e. along a stretch of over 12 kms from the estuary upstream, if the experiences and reports of inhabitants along this stretch are to be believed for no scientific data for the period are available. According to local fishermen many freshwater species of fishes that were seen in the lower reaches of the river before 1976 only during summer months are found in these water all the year round. These include *Channa striatus*, *Channa orientalis*, *Nandus marmoratus*, *Mastacembulus guentheri*, *Glossogobius giuris* and *Puntius filamentosus* which I could collect from these waters during the summer season also. According to the fishermen the quantity of freshwater fishes being caught from these waters has doubled and in the case of certain species trebled since 1976. This change in the piscian fauna is indicative of the decline in salinity.

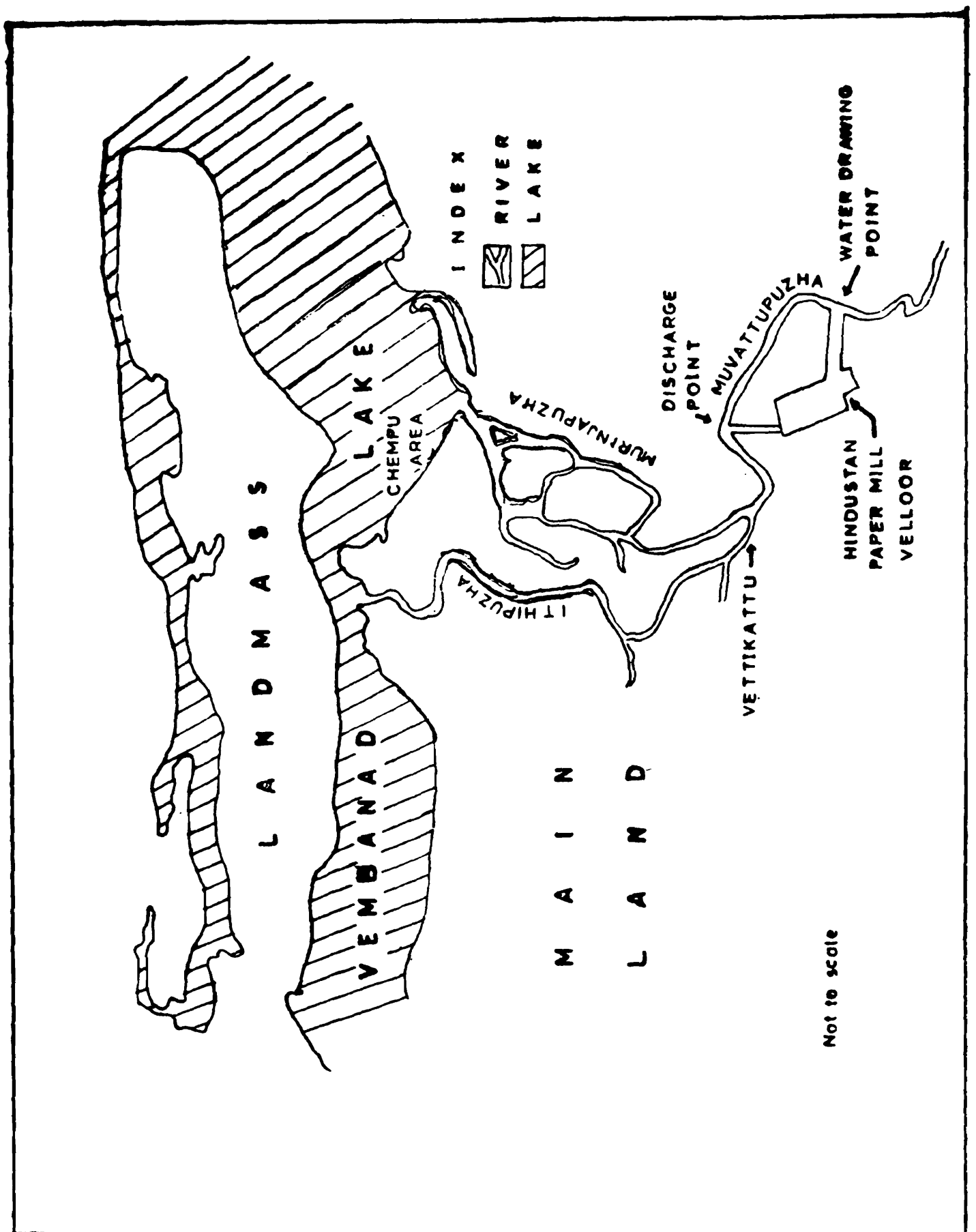


Fig. 1. Study area showing the Muvattupuzha River and its branches, Vembanad Lake, site of Hindustan Paper Mill etc.

TABLE - I

Showing salinity (‰) at 3 stations namely Chempu area of Vembanad Lake and at a point 2 kms. upstream from the estuaries of Murinjapuzha and Ithipuzha in summer (January - June) during the years 1980 to 1983.

<i>Year</i>	<i>Month</i>	<i>Chempu</i>	<i>Murinjapuzha</i>	<i>Ithipuzha</i>
1980	January	17.2	9.0	8.0
	February	30.0	12.0	8.0
	March	26.0	8.5	8.1
	April	26.0	8.0	7.5
	May	20.0	7.5	7.0
	June	18.0	6.5	6.0
1981	January	17.0	2.0	1.2
	February	24.0	6.7	6.3
	March	24.0	8.4	8.0
	April	23.0	7.6	7.1
	May	22.0	7.2	6.9
	June	18.6	6.5	6.2
1982	January	18.5	6.0	5.5
	February	26.0	7.5	7.0
	March	25.3	6.9	6.3
	April	24.4	7.2	7.0
	May	22.0	6.4	6.1
	June	18.0	6.0	5.2
1983	January	20.6	7.0	6.0
	February	25.6	12.0	8.0
	March	30.0	7.2	6.5
	April	24.0	8.5	8.2
	May	20.0	5.3	5.0
	June	17.4	4.4	4.0
Average salinity in summer months (January - June) during the years from 1980 to 1983		22.4‰	6.8‰	6.5‰

TABLE - II

Showing the landings of Clams from 4 boats, selected at random, at Chempu once in two months during July 1980 to May 1983

Year	Month	Boat 1		Boat 2		Boat 3		Boat 4	
		Quantity (Kg.)	size range (mm)	Quantity (Kg.)	size range (mm)	Quantity (Kg.)	size range (mm)	Quantity (Kg.)	size range (mm)
1980	July	30	17-40	31	15-36	30	20-41	32	17-41
	September	27	13-39	34	20-43	31	17-39	34	18-43
	November	35	18-46	27	19-52	37	15-47	26	16-42
1981	January	32	12-35	30	11-37	31	9-37	24	14-36
	March	18	13-27	20	14-32	22	15-31	20	16-33
	May	17	12-30	16	15-34	18	16-38	19	15-35
	July	26	16-41	28	20-37	27	18-40	26	19-39
	September	35	22-44	34	21-47	35	23-51	36	20-41
	November	41	24-45	40	20-48	41	12-39	44	21-48
1982	January	34	9-36	32	12-37	29	10-35	30	12-38
	March	22	8-28	21	9-30	20	13-32	21	9-30
	May	19	13-32	18	10-32	17	12-36	19	11-34
	July	29	17-37	27	16-34	28	15-35	27	14-37
	September	36	23-44	38	21-40	36	20-43	38	19-40
	November	46	14-48	43	10-50	47	9-47	48	11-47
1983	January	36	13-37	34	15-45	33	16-42	33	15-43
	March	23	10-34	25	14-29	24	14-28	25	14-29
	May	22	13-35	23	15-31	23	15-34	27	10-28

On the basis of data collected once in each month during the summer seasons from 1980 and 1983 salinity and chloride content beyond Vettikattu, i.e. beyond a stretch of 8 kms from the estuary upstream, is nil. During this period salinity content in the Chempu part of the lake was much less than that of the main body of the lake. It never went beyond 30.0‰ (February 1980 and March 1983) and was as low as 17.0‰ in January 1981 with an average of 22.40‰ for the entire summer periods since 1980.

In July 1983, after the onset of monsoon, it was as low as 1.40‰ in the area where the river enters the lake with the salinity going upto 18.1‰ as one reaches the centre of the Chempu part of the lake which covers approximately an area of 50 sq. kms.

At a point 2 kms upstream from the estuaries in Murinjapuzha salinity during this

period was in the range of 12.0‰ (February 1980 and April 1983) and 2.0‰ (January 1981) and in Ithipuzha in the range of 8.20‰ (April 1983) and 1.2‰ (January 1981).

c. *Impact of reduction in the salinity content on the population of Villorita cyprinoides var. cochinensis* (Hanley)

*Villorita cyprinoides var. cochinensis* (Hanley), popularly known as the black clam, occurs abundantly in the major estuaries, backwaters and lagoons of Kerala. The shell of the clam is used for the manufacture of cement and lime and the flesh provides a cheap source of protein food for a large section of people inhabiting the coastal areas of the state. This species grows to a size of 50 mm or even beyond.

Studies by Blum (1922) on *Teredo navalis* Hill and Kofoid (1927) on *Limnoria* sp. and Nagabhushanam (1955) on *Martesia demissus* revealed that around 6.0‰ is the lower lethal salinity limit of most of these bivalves. But *cochinensis* is capable of tolerating wide fluctuations in salinity. Studies on the salinity tolerance of *cochinensis* by Nair and Shynamma (1975) showed that larger clams (size : 40 - 50 mm) can tolerate salinity in the range of 4.73‰ and 27.11‰. In the smaller clams (size : 15-20 mm) the tolerance range is between 0.87‰ and 29.85‰. Some of the smaller ones survived even upto 5 days in sea water (salinity : 33.01‰) and upto 5 days in freshwater (salinity : 0‰).

The reduction in the salinity content of Chempu and surrounding areas of vembanad lake, which keeps the range within the tolerance limits of *cochinensis*, enables the specimens to thrive in the estuarine waters even in summer months and flourish later when the conditions become favourable after the onset of monsoon. In the past probably they could not survive in the Chempu part of the lake during summer months as salinity in this stretch also went up beyond their tolerance limits. Questioning many fishermen and long time inhabitants of the area revealed that no commercial collection of these mussels was prevalent in this area before 1976 as according to them the specimens used to die out in summer, their population was never high and hence their collection not economically viable. Since 1976 their population has been steadily going up. Present studies showed that now a days, on an average, about 200 country boats, each employing 2 to 3 persons, are engaged daily in collecting the specimens from this area of the lake. On an average each boat collects specimens worth (commercial value of the empty shells and edible flesh of the mussels) Rs. 150 (Table II). On a rough estimate, in recent times specimens of mussels worth nearly 10 million rupees are collected from the waters of this area annually.

#### ADDITIONAL OBSERVATIONS

*Influence of the anticipated changes on the future population of Villorita cyprinoides var. cochinensis.*

The completion of the third stage of the Idukki project, leading to the supplementation of the tailrace waters, is expected to further enhance conditions favourable for the growth of these mussels in the estuarian waters of Muvattupuzha river. But the Malankara hydel project, expected to be commissioned in 1988, is scheduled to divert much water from the Muvattupuzha river to the extent that the flow in the river is expected to be reduced by 60%.

The Hindustan Paper Mills at Vellore, which was partially commissioned in 1983, has started discharging effluents into the Muvattupuzha river at a point about 20 kms from the estuary. The diversion of water through the commissioning of the Malankara project and the initiation of full production, with the resultant discharge of more effluents, in the paper mill may lead to a situation when it will not be possible to dilute the toxic effluents in the river to the desirable limits. The cumulative impacts of all these changes anticipated on the population of mussels in the estuarian waters is yet to be seen. Apart from negating the present favourable impacts the changes expected in the near future may even adversely affect their population.

#### SUMMARY

Studies on the ecological impacts of Idukki hydro-electric project on the population of *Villorita cyprinoides* var. *cochinensis* (Hanley) inhabiting the estuarian waters of Muvattupuzha river is discussed. The reduction in the salinity content of the river is found to favourably affect its population.

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