Besides being thickly populated country, India’s economy mainly depends upon agriculture. In the five year plan, a substantial amount of fund is being allocated to fisheries sector. Hence to exploit the means of aquaculture, scientists have to plan the use of our water resources such as rivers, lakes, ponds, reservoirs, streams etc. as much as possible with the intelligent application of latest knowledge and modern technology of the fisheries. For the development of inland fisheries resources, utilization of potentialities of inland water, fish farming has special significance. The characteristic feature of Eastern Uttar Pradesh is the presence of numerous lakes, ponds and reservoirs which offer immense scope for fish culture practices.

The phenomenon of lowering down of ground water level is also posing a serious problem of adversely affecting to the irrigation facilities and opportunities thereby causing low yields in agriculture farming. So our dependability on aquaplosion or aquaculture will gain momentum and paramount importance with the passage of time in future.

India is blessed with a network of river systems which are generally classified as Himalayan rivers, Deccan rivers, coastal rivers and rivers of inland drainage basin. Rainfall in most parts of the country is restricted largely to the four rainy months from June to September. The average annual precipitation that takes place in India is of the order of 400 million hectare meter. But the aggregate annual flow through rivers is estimated at 180 million hectare meter. Harnessing of water resources of rivers for purposes of irrigation and power generation has been given considerable importance in the successive Five Year Plans of the country. About 800 major and medium projects were taken up after country’s Independence of
which 445 have been completed and the rest are in various stages of completion. These, between themselves, cover an estimated surface water area of 3 million ha (which included impoundments put up prior to independence) with an estimated storage capacity at 15 million hectare meter. According to available projections the country will have about 6 million hectare meter of surface water area in the next two decades with estimated storage capacity at 23 million hectare meter. Then, such is the vastness of the reservoir resource.

The declared objectives of river valley development projects are to serve the irrigation need of agriculture, power generation, flood control and water supply for domestic and industrial use and the dam design accordingly varies from reservoir to reservoir. The utilization of this resource for fisheries development, however, took a low priority and this is, in a way, reflected by poor fish yield which, by all accounts available, may not exceed a national average of 10 kg/ha. The reasons for this low level of fish yield from reservoirs are not far to seek and may be attributed to inadequate understanding of the ecosystem, fish behaviour, and fish stocks management. This research and management gaps were sought to be bridged through an All India Coordinated Research Project on Ecology and Fisheries of Freshwater Reservoirs which was launched in 1971 with well defined objectives which *inter alia* included studies on trophic structure and function of the ecosystem, material (nutrient) recycling, physicochemical features, ecological production functions, fish behaviour, recruitment and other population parameters and development of management principles with a view to achieve optimum fish productivity and fish yield.
In a deep-water ecosystems like reservoirs, material (nutrients) recycling assume enormous relevance for sustained organic production. The observations in peninsular and north Indian reservoirs point out that wind caused turbulence and monsoon inflow facilitates the mixing up water masses and renders the nutrients locked up in tropholytic zone being made available in trophogenic zone. In addition, north Indian reservoirs which come under monomictic category, distinguished as they are by thermal stratification in summer months, have the added advantage of overturn of water masses from convection currents.

Silt turbidity is found to lower productivity in many reservoirs in India on account of ineffective soil conservation measures. Poorer light transmissibility interferes with primary production. It is observed that while compensation depth in primary production assessment is reached at about 5 meter depth for many south Indian reservoirs it is only 2 to 2.5 meter for DVC reservoirs and Rihand in north.

Reservoirs are man-made ecosystem without a parallel in nature. The deep water release confers this ecological distinctiveness from its lake counterpart. The impoundment deviates from conventional evolutionary course and commences with a trophic ‘burst’ during the first 2 or 3 years, after the dam is scaled and marked by a very rich abundance of plankton and benthos as revealed by studies in Nalkari reservoir (Bihar). This is the most critical phase for management. The reservoir is amenable for stock manipulation or correction during these initial crucial by selective stocking with greater emphasis on fishes on short food chain and close to primary producers like Gangetic major carps. This ecological consideration, most crucial and vital in the management of reservoirs, is rarely, if at all, observed. The
result is that the vast store of fish food supply is availed readily by carp minnows and weed fishes, which in turn provides a forage base for catfishes. This is the case vividly presented in Nagarjunasagar and Tungabhadra (Karnataka) reservoirs. It may be referred, that the stocking rate during the first five years after impoundment hardly ever exceeds 25 fingerlings/ha-stocked if at all. It would be a Herculean task to establish a carp fishery through stock corrections once carnivorous and predatory catfishes have taken a foothold in reservoirs as indeed is the case in many impoundments in India.

Going by the results of investigations in this country it is concluded that reservoir ecosystem by and large favours facile breeding, recruitment and stock accretions in respect of weed fishes, carp minnows aswell as economic catfishes like *M. aur, M. seenghala, W. attu, S. childreni, P. pangasius*, etc. But Indian major carps need a more critical upstream bed with inundation facilities and scopes for free movement upstream during breeding migration. The physical obstructions by way of boulders and rock outcrops and too shallow a depth in Konar, steep banks with a fewer inundation facilities in Rihand have all placed severe limitations on successful breeding and recruitment of major carps. Limited upstream spawning habitat has led to dominance of one of the carps like *C. catla* in Rihand (Uttar Pradesh) and Sathanur (Tamil Nadu) and *L. calbasu* in Bhavanisagar. The severity of competition between species of major carps for the limited spawning habitat is reflected by the frequent occurrence of Catla X Rohu hybrids in Rihand. The above factors point out that management must take into consideration the ecosystem constraints and plan the species quality and stocking rate accordingly.
The species selection in stocking policy must give due emphasis on trophic strata of the ecosystem in terms of shared, unshared and vacant ecological niches. By and large, the ecosystem has a wide ranging representation of biotic communities. The phytoplankton shows a greater dominance over zooplankton among planktons, the former being made of Myxophyceae, Chlorophyceae and diatoms and the latter by copepods, cladocera, rotifers and protozoans. The benthos is represented by insect larvae and nymphs, oligochaetes, nematodes, bivalves and gastropods. In addition submerged trees, boulders, shrubs etc. serve as substrates for periphyton complex which is largely made of green algae, blue-green algae and diatoms. Its merit mention that reservoir ecotope, subject as it is to large magnitude of water level fluctuations and cyclic exposure of marginal areas does not favour establishment of larger aquatic plants. It is significant that many of the above ecological components barring insect component, myxophyceae and molluscs share niches between Gangetic major carps and carp minnows and weed fishes for improved productivity of Gangetic major carps. Such a management approach is a prerequisite for reservoirs where major fishery is the prime consideration. Myxophyceae at present largely occurs in the guts of weed fishes. The exotic silver carp has been observed to utilize this ‘niche’ to a large degree as revealed in studies in Getalsud (Bihar) reservoir and Govindsagar (Himachal Pradesh). One of the ecological populations of *Catla catla* easily distinguished by medium size pectoral fins has been observed to utilize this ‘niche’ significantly in Rihand. Catla X Rohu hybrid is found to utilize *Ceratium* in Rihand which otherwise remains largely unutilized in the ecosystem. Molluscs
are dominantly utilized by *Pangasius pangasius* and *Tor khudree* as observed in Nagarjunasagar. The studies reveal that exotic silver carp and *C. catla* (with medium pectoral) are suitable candidates to utilise phytoplankton; *C. catla* (with long pectoral) for zooplankton: Catla X Rohu hybrid for detritus and dinophyceae: *Cirrhus mrigala, Labeo robita* and *L. calbasu*, algae, detritus and periphyton; *Pangasius pangasius*, molluscs; *Puntius kolus*, insects; *T. putitora*, weed fishes. In addition, exotic common carp, being omnivorous, is useful to utilize insects, worms, algae and detritus.

The reservoir management in India largely centers on the development of carp fishery, especially of those belonging to Gangetic major carps. Enlargement of species spectrum as indicated above would further improve optimum utilization of diverse ecological niches of the ecosystem and augment fish yield.

Studies carried out under All India Coordinated Research Project on Reservoir Fisheries have revealed the presence of three ecological populations of *C. catla* which could be distinguished morphologically by size differences in pectoral lengths. The populations with long pectoral take dominantly to zooplankton while that with medium pectoral to phytoplankton. This finding opens up possibilities of utilizing these populations for optimum utilization of plankton of reservoirs.

*Labeo robita* among major carps does not show, with a few exceptions, the same degree of adaptability in many reservoirs in India. Catla X Rohu hybrid appears to be an ideal replacement for *L. robita* for reservoirs in general. The hybrid in detritophytoplanktophagic, grows faster than *L. robita* and has a growth rate
closer to *C. catla*. The proneness of the hybrid to take to dinophyceae, besides detritus, has great application in reservoirs like Govindsagar (Himachal Pradesh) where ceratium forms the dominant fraction in plankton. The hybrid thus holds out enormous promise for reservoir fishery development, in general, in India. It was observed that reservoirs rich in Ca++ harbour a dense benthic population of molluscs. Such reservoirs especially need to be stocked with *Pangasius pangasius* a fast growing catfish.

The performance of silver carp in Kulgare reservoir (Madhya Pradesh) and Getalsud reservoirs (Bihar) is remarkable where the fish registered a growth of 4 to 5 kg in 1½ to 2 years. The fish, which accidentally found entry into Govindsagar following a breach in an adjoining fish farm is fast reaching the dimension of a fishery. The performance of *Tilapia mossambica* in small reservoirs in peninsular India is equally remarkable. It improved the yield to the order of 187.7 kg ha in Amarathy reservoir, a small impoundment in Tamil Nadu. Opinion in India is divided about introduction of exotic silver carp and Tilapia in reservoirs as the former is known to compete with Catla while the latter with Indian major carps in general. These fishes placed as they are, at the lower end of the trophic spectrum, it is feared, on entry into river systems from reservoirs cause large scale ecological distortions and endanger the abundance and productivity of indigenous prime carps.

One of the important of management in reservoir fisheries development is proper assessment of recruitment of economic fishes. Breeding by itself is no index of successful recruitment in major carps as reflected in studies in Tilaiya (Bihar) and Konar where eggs are
washed into depths of reservoir where they perish. This largely due to limited upstream stretches necessitating breeding close to reservoir.

Studies in Konar and Tilaiya marked by and large by poor recruitment of major carps indicates that stocking for major carps @ 250 fingerlings/ha is desirable for reservoirs without predatory catfishes and 600 fingerlings/ha for reservoirs with abundance of catfishes to realise a yield of 50 kg/ha/yr.

The insecticides carrying run-off from agricultural lands, effluents from chemical factories, rayon factories, paper mills, sugar mills, etc. have led to fish mortality in a number of reservoirs like Mettur reservoir (Tamil Nadu), Bhavanisagar, Hirakud (Orissa), Panchet reservoir (Bihar), etc. Scientific appraisal of these lethal waters and enforcement measures for their safe disposal are indicated. Upstream spawning habitat are biologically ‘sensitive zone’ for Indian major carps where discharge of pollutants need to be strictly prohibited.

The ownership of public waters including reservoirs vests with State Governments. The policy governing the exploitation of reservoir fishery resources ranges from free fishing with or without licensing system to levy of royalty or outright auctioning, free fishing as practiced hardly provides any motivation for the States to develop fishery resources in reservoirs, excessive levy of royalty, beyond augmenting the revenues for the States, is hardly relevant for development of viable fishermen cooperatives not does it benefit the individual or group of fishermen economically. Royalty system is necessary for the reservoir fisheries management implies such as financial resources for developmental inputs by way of stocking, habitat improvement like improvement of spawning habitat, timber
clearance, development of fishing zones and enforcement of management measures like closed season, size limit, catch limit etc.. But the scale of royalty should be limited to one-third of the value of the produce at wholesale price level. Outright auctioning, without safeguards, has hardly any known merit except it encourages the greedy contractors towards indiscriminate exploitation of fish stocks, livestock and barrel and should in no case be allowed for small impoundments.

The reservoir fishery development in India has always been identified with development of carp fishery alone and reservoirs must be stocked and each reservoir must have a seed farm. This presupposes that reservoir ecotope is unsuited for natural breeding and recruitment of economic fishes including major carps. Nothing could be farther from this contentious position. Studies carried out under the All India Coordinated Research Project on Ecology and Fisheries of Freshwater Reservoirs provide unmistakable baseline data to the effect that many reservoirs could be developed entirely as capture fisheries economic carps taking advantage of natural breeding and recruitment as in Govindsagar; some as capture fisheries largely made of economic large catfishes as in the case of Nagarjunasagar and Tungabhadra; and some as capture fisheries made of economic carps and large catfishes as in Bhavanisagar. Reservoir under above categories could develop fast within five years applying some of the capture fishery principles like optimum deployment of fishing effort and optimum mesh sizes relevant to reservoir conditions and fish behaviour. This leaves those reservoirs that require total stocking as in the case of Getalsud, Konar and Kangsabati (West Bengal) marked
by recruitment failure of carps and partial stocking as in Rihand marked by single species dominance. This would bring down the massive scale of investment on seed farms inputs for raising stocking material and reduce the carp seed requirement to less than a third of the projected 3,000 million fry. The above strategy is relevant for reservoirs, already constructed. For new ones, stock manipulation should be carried out at the initial stages of impoundment in favour of prime carps and necessary seed farm infrastructure provided.

Under scientific management the yield rate of reservoir fisheries in India can be easily augmented to 50 kg/ha/yr. This will increase the national income of Rs. 750 million rupees and open up a gainful employment for 50,000 fishermen with a net per capita annual income of Rs. 5000/- Fish handling, ice plants, packaging, transport and marketing would open up further employment opportunities for skilled, semi-skilled and unskilled workers and unemployed youths and generate additional income. Implied in the accomplishment of above production targets is the development of infrastructure which includes provision of approach roads to reservoirs, setting up of appropriate capacities of ice plants, improvement of fishing gears and craft suitable for deep-water, upgrading the skills of fishermen for deep-water fishing and marketing cooperatives.

Reservoirs contribute considerably to the inland fish production of India which has been estimated at 93,000 tonnes (Anon, 2006) inspite of this fact, reservoir fish production has been treated as a by-product, giving it less importance as a fish production system. For this reason, reservoir fisheries have not made significant progress in the country and do not contribute to inland fish production of the
country to the extent they could. However, subsequently, the managers of a majority of the water and power projects in the country have realised that fisheries need to be given its due importance in overall reservoir management. Unlike rivers, which are under increasing threat of environmental degradation, reservoirs in India offer ample scope for fish yield optimization through effective management (Vass, 2007). The sheer magnitude of the resource makes it possible to enable substantial increase in production by even a modest improvement in yield. Further, the importance of reservoirs derives mainly from advantages from environmental and social perspectives. The benefit of increase in the yield and income generated of fishing communities of reservoirs is more equitably distributed. There is also a need to dovetail the twin objectives of yield optimization and environmental conservation.

The presence of many ponds, lakes and reservoirs in the Tarai region of Eastern Uttar Pradesh offer immense scope for fish culture practices. In the District Balrampur itself, there are three large reservoirs/dams, which cover an area of about 15 hectares of perennial water. Such a vast area of water is presently in a state of dereliction and neglect and warrants immediate attention of the fisheries’ workers for exploitation on scientific basis.

For any fish culture operation in soil and water body, it is of utmost importance to have the knowledge of water quality, as it determines not only the existence of fish fauna but also governs the production of plankton organisms or primary production. Paucity of such knowledge is a serious constraint in exploitation of these reservoirs.
Therefore, the present research work is aimed to undertake the study of -


ii. Seasonal variations in physicochemical parameters of water of Bhagwanpur reservoir in relation to fisheries.

iii. Qualitative and quantitative estimation of phytoplankton and zooplankton. (Periodicity of Phytoplankton and Zooplankton).

iv. Correlation coefficient between different plankton and various parameters of water.

v. Study of aquatic flora and fauna and their impact on fishery.

*****