

**ECOLOGICAL STUDIES ON LABEO ROHITA
WITH SPECIAL REFERENCE TO
GROWTH AND PRODUCTION IN NAGALAND FISH PONDS.**

ABSTRACT

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ABSTRACT

Aquaculture or culture fisheries has hit the scene in developing countries in the last decade. It was received with great enthusiasm by one and all as it promised to supplement the need to produce additional fish protein for the rapidly increasing population. Although the increase in production of the protein from aquaculture, in the past few years has been significant the overall figures have been much less than anticipated. This is, by and large, to the unwritten and highly site-specific production technology in this field. Moreover the wealth of information needed to such problems do not exist for species of interest to developing countries, and wherever it does, sustained figures have never been obtained. All the more, unlike agriculture there is no strong base of research knowledge for aquaculture.

The present investigation therefore, is a compilation of the results of detailed analysis of most of the important characteristics affecting fish production in a region like Nagaland. The experiments were so designed as to enable the transfer of the technological understanding not only to the State Government in the region but also to the fish farmers. Two sets of aquatic systems were identified for this purpose (i) the natural fish ponds and (ii) the circular plastic pools. In both these systems differential fertilization were administered in addition to supplementary feed in some, to enable the possibility of achieving the highest yield of fish in a particular set of such fertilizer combinations. The fish used in these systems was confined only to one species Labeo rohita, commonly called Rohu, possibly the tastiest of all Indian major carps.

The study was broadly classed into the abiotic and biotic components, like physico-chemical parameters and the phytoplankton and

zooplankton components respectively for the structural understanding and primary production for the functional aspects. These were then correlated to the fish growth and production levels.

The first chapter in the thesis deals therefore primarily with the physico-chemical observation and their interpretation in the various aquatic systems undertaken. It was observed that all the ponds and pools undertaken maintained a steady state equilibrium in relation to the physico-chemical factors in addition to the maintenance of well marked buffering capability. However, in Experimental Fish Pond-2 and Circular Plastic Pool-4, most of the values were on the higher side. The other systems had a magnitude of fluctuation very narrow, though in all of them the values obtained have been shown to be very conducive for fish production. Moreover, the individual physico-chemical parameters analysed revealed a maintenance of a mesoeutrophic condition and not a highly eutrophic one as would normally be expected in such tropical situations.

The second chapter dealing with the biota as the next structural component namely phyto- and zooplankton revealed that algal succession is altered due to fertilization. The phytoplankton analysed both at generic and higher levels indicated that the system controlled the development of blue-green algae while at the same time helping in the development of some of the eutrophic genera among green algae. This seemed to be an excellent inherent quality as the latter group is known to be efficient primary producers. The study of these autotrophs confirmed the physico-chemical parameters in that the systems were never allowed to reach higher levels of eutrophication but having all the qualities of a eutrophic status under control. The abundance in number was however more in the pools than in the ponds. As far as zooplankton was concerned they seemed to be in

synchrony with the abundances of phytoplankton. The group rotifera dominated in both the ponds and pools while protozoa though far less possessed larger numbers atleast in the organically manured ponds and pools. There was a clear cut seasonality in their behaviour and the number obtained were at levels essential for fish production.

The third chapter in the thesis was confined to the understanding of the functional aspects of the autotrophs-primary production. The determination of primary production in fish ponds besides giving information on the magnitude of organic production has its practical considerations. Primary production is the basis of the whole biogenic metabolic cycle, and therefore the relative proportion of their values would help in understanding higher trophic levels. In the present investigation it was seen that the highest values obtained were in Experimental Fish Pond-2 among the ponds and Circular Plastic Pool-2 among the pools. The ranges in their values either in the ponds or pools were indicative of high production and is in line with such fertilized systems both in the tropic and the world. The levels though indicative of the eutrophic nature were not equal to higher records of values as in usual eutrophic systems in the tropics. In addition, whenever respiration exceeds production which was observed more than once over the different seasons in the different ponds and pools was another indication of eutrophication. The inorganic fertilizers alone, when administered were seen not to have any significant results but certainly organic fertilizer along with supplementary feedings were seen to enhance the production levels in both the ponds and pools wherever administered. Once again it was seen that primary production levels behaved as well, as that of established equilibrium systems.

The last chapter of the thesis was related to fish growth and

production. It was seen that the fertilized fish ponds revealed much higher growth rates than the control. Moreover, in these fertilized ponds, the sixth month and the twelfth month was observed to be phases of sudden exponential increases in weight. Experimental Fish Pond-2 again revealed the maximum growth rate as far as mean weight was concerned. Such was not observed in the mean length of fish among the different ponds, though Experimental Fish Pond-2 had the maximum length. The Circular Plastic Pools though showed after the twelfth month a similar phenomena of increase was not significantly different from each other. The rate of survival among the fishes in the different systems was again seen to be maximum in Experimental Fish Pond-2 and the lowest in Experimental Fish Pond-3, the former being nearly 70% and the latter with only 50%. Here again as in the primary production values, the inorganic fertilizer seemed to inhibit the growth rate of the fishes. However, the organic fertilized system revealed higher mortality. A similar observation was also seen among the Circular Plastic Pools. The production or the fish yield was also calculated during the study period and again the highest value obtained was seen in Experimental Fish Pond-2. Among the Plastic Pools it was Circular Plastic Pool-4, and since the stocking densities were very high the figures though incorporated have not been used for comparison. The ponds revealed nearly six times the production figures of India though not near to the maximum record available. Both increased growth rates and higher yields from the present study reveal that maximum out-put can be obtained by a judicious combination of organic and inorganic fertilizers along with supplementary feed. However this study has helped in the understanding that quite high fish yield can be obtained by simple scientific management even with monoculture of an economically important fish like Labeo rohita in places like Dimapur, Nagaland.

With the knowledge of these four sections it was seen finally to correlate and integrate all of these for a total comprehension of the ecosystems, helping in understanding higher fish yields. Though these individual components revealed an existence of a cyclic development of the pulses of the various factors undertaken, the initiation or termination got displaced over annual periods. Therefore, statistical correlation between these pulses were found out to enable the integration and also anyone factor responsible for a number of variables. As would be expected phytoplankton and primary productivity had significant correlations and very little effect of other abiotic factors was seen on the functioning of the systems or in relation to fish growth and yield. Moreover, nutrients did not play a significant role and it was observed that there was hardly any major differences amongst such correlations between the different systems. The various correlations that have obtained, however, has been discussed and implications drawn upon.

Finally, it was calculated to see, how much of the primary production or the autotrophic biomass as it were, got converted into fish flesh expressed as yield. In the present investigation it was observed that such conversions even in the control pond was quite high and significantly so in the fertilized ponds. Though higher production/ha was seen in Experimental Fish Pond-2 the conversion helped us to show that Experimental Fish Ponds-2 and 3 both had the same conversion figures. This indicated that fish production alone is not a correct measure but in addition such conversion values helped in understanding the basic ecological theories that operate in such ecosystems. Moreover annual production is theoretically and empirically a better predictor of fish yield from aquatic bodies than other suggested relationships between fish yield and environmental variables.

Knowing that both fish yield and conversion are encouraging from the present study an economics was worked out for the application of such a study in atleast the region under consideration. Experimental Fish Pond-2 and Circular Plastic Pool-4 were found to be the most profitable ventures undertaken and even though these had the maximum inputs of expenditures they out-ranked the others in terms of their out-put of fish. All these helped us in arriving at a certain generalised recommendation for implementation in fish ponds in Nagaland.

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