CHAPTER-VII

CONCLUSION
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The ever increasing demand and short supply of fish in the North eastern region made to conceive the idea of biostatistical importance to investigate into the productive potential of the Brahmaputra water resources and its related factors effecting the fisheries. The importance of the present study was further pressed upon the non availability of literature for planning fisheries and fishery development in the North eastern region of India.

The salient features of the present investigation are

1. The Brahmaputra river system has a combined length of 4200 km having a catchment area of approximately 93500 sq km and showed a high flood discharge of 96654 m³/sec. The upper reach of the river flows over a steep gradient maintaining a strong current. In the lower reach it has been
sluggish and in this portion many islands have been formed owing to the deposition of enormous load of sediments. The abandoned beels of the course changing rivers known as riverine beels cover an extensive area of one lush habitat and serve as an important habitat of the freshwater fish.

2. The commercial fisheries of the Indian major carps were found restricted to the lower reach of the river and riverine beels.

3. The contribution of the Indian major carps towards the total catch of the Brahmaputra water resources have been estimated to be of 12.32% (42.2 t) at Uzanbazar; 16.2% (103.1 t) at Fancybazar (based on data during 1973-1975); 16.45% (36.01 t) at Shubri and 21.03% (42.2 t) at Tezpur (based on data during 1974-1977). Among the four Indian major carps species, *L. rohita* was found to be most dominant being 5.37% at Uzanbazar, 12.91% at Fancybazar, 7.75% at Shubri and 11.65% at Tezpur. *L. calbasu* catch was recorded to be the least, being 0.24% at Uzanbazar, 0.31% at Fancybazar, 0.01% at Shubri and 0.90% at Tezpur.

4. The total catch as well as the Indian major carps catch have shown gradual decline in all the catch of collection of the lower reach of the Brahmaputra river and the riverine beels during the period of our study. The reasons of such decline have been discussed in details in Chapter 8.
The percentage of decline being 46.53% in 1974, 44.92% in 1975, 79.02% in 1976, 80.52% in 1977, 70.45% in 1973 and 77.47% in 1979 at Uzanbazar; 41.00% in 1974, 59.52% in 1975, 65.47% in 1976, 62.34% in 1977, 65.88% in 1978 and 84.19% in 1979 at Fancybazar; 24.47% in 1975, 25.1% in 1976 and 36.81% in 1977 at Dhubri and 58.92% in 1975, 79.78% in 1976 and 78.95% in 1977 at Tezpur.

5. The catch at Dighali beel was very poor. A meagre 1.2 t of Indian major carps was recorded during 1979-1981 and the percental contribution of L. rohita, C. catla and C. mrigala respectively were 5.12%, 2.77% and 0.17%. Quite a negligible catch of L. calbasu was recorded. The reasons for such state of decline could be mostly attributed to the failure of proper breeding in the fishery. Migration of fishes during breeding season could not take place due to closure of connecting channels. There was also neither artificial nor autostocking in the beel.

6. The total catch of Indian major carps at Dhir beel during 1982 and 1983 was 41.4 t. The contribution of Indian major carps made towards the total catch at Dhir beel during 1982 and 1983 was found to be 22.45% and 18.31% respectively. L. rohita was found contributed 16.65% and 12.87%; C. catla 3.57% and 4.40%; C. mrigala 1.74% and 0.87% and L. calbasu 0.49% and 0.16% respectively during the same period. The individual catch of the above species was 30.2 t, 7.8 t, 2.3 t and 0.7 t respectively.

7. The traditional katal and bana fishings were observed to
be the predominant fishing practice in the beels.

3. The main fishery season happen to be the retreating monsoon and winter as the water level recedes and refills in manageable state in riverine beels and rivers. The monsoon season was not found suitable for catch because of the fact that during high water in monsoon season, fishes are found dispersed over flood plains and the high water currents carrying with them logs and floating vegetation make it impossible to capture fishes by existing year and crafts. Moreover, the bulk of population are juvenile, often too small to capture. As the water level recedes during retreating monsoon and winter, the operation of gears are convenient and more catch are possible.

9. The catch structure of the Indian major carp showed striking qualitative changes in their mean length. The analysis of the length frequency data over the period 1974 - 1979 clearly indicated that the fishes were found virtually dominated by higher size group which showed poor recruitment pattern. The estimation of coefficient of variation in mean lengths revealed minor variation in the body length within a year. Therefore, it was probable that recruitment was not proper or natural. The decline in the availability of major carps spawn also hinted to the same conclusion.

10. The fishery in the Brahmaputra river was found deteriorated considerably due to excessive siltation, closure of connecting channels of the river to the beels during the retreating
monsoon and wanton killing of gravids and fingerlings during the premonsoon taking the advantage of shallow water dispersion.

11. The analysis of variance of the monthly catches revealed that the monthly variation in catch is very pronounced, the coefficient of variation being 61% in January, 52% in February, 70% in March, 42% in April, 35% in May, 30% in June, 59% in July, 70% in August, 35% in September, 33% in October, 45% in November and 42% in December.

12. Among the three sampling designs, systematic sampling was found superior to the stratified random sampling and simple random sampling without replacement. Hence, estimation of catch in a centre with systematic sampling is most suitable.

13. The determination of age of the Indian major carp species was made by Petersen's length frequency method, probability plot technique and Schnute and Fournier's method. In these methods were found adequate although the latter method had an edge over the other two. Schnute and Fournier's method take into account of biological structure in the mean lengths and standard deviations of the lengths of the various age groups. Closeness of fit was tested by the separation statistic $r$ (Schnute and Fournier, 1970) and $X^2$.

14. Length-weight relationships were found to follow the allometric growth pattern in most cases.
15. Analysis of relative condition factor for different months and sizes revealed that the values were higher during the period of maturation of gonads and just after spawning and winters due to low feeding activities.

16. Indian major carps initially showed rapid growth in length and subsequently in weight and instantaneous rate of growth was maximum during the first and the second year of life.

17. Von Bertalanffy and Sompera growth curve fitted well to the age-length data of Indian major carps. Von Bertalanffy growth curve had given reasonably better fit to the data. The parameters of the Von Bertalanffy growth curve estimated by Schnute and Fournier's method had used advantage over the others in the sense that \( l, l, \) and \( k \) are much more appropriate than \( w_0, K, t_0 \) because it was easy to obtain the first estimate of \( l, l, k \) which are biologically more meaningful. Biologist actually can have the idea of the longest and the shortest observed lengths since \( l \) and \( L \) are based on observation near the shortest and the longest lengths in the sample. Information on \( k \) comes from an estimation of one or more means other than the first and the last. Consequently, \( k \) represents the fixed fraction by which the annual growth increment is multiplied each year. Moreover, the parameters \( l, l, \) and \( k \) merely summarise the observed facts about growth, by contrast \( w_0, K, t_0 \) have been used as indicators of fundamental biological characteristics of fishes.
13. The coefficient of determination $r^2$ have been found to be very close in case of all growth curves.

19. Dissolved oxygen, nitrate nitrogen and phosphate have been found significantly correlated to the catch.

20. Significant correlations among ecological parameters have been observed.

21. The influence of ecological parameters have been established. When the influence of nine ecological parameters on Indian major carp catch were considered, the coefficient of determination was found to be 43, which was highly significant.

22. The average size of the fishing household in Barjaon-Sanjilajhar, Nowatary, Santipur and Satyapur villages were 4.4, 6, 5 and 5.5 respectively.

23. 62.44% of the male population are active fishermen.

24. There was 29 country boats operating in the signal beel belonging to the Barjaon-Sanjilajhar village. 161 country boats operated in Shir beel belonging to the fishermen of Nowatary, Satyapur and Santipur villages.

25. Most of the fishermen are below poverty line. Per capita monthly income of the fishermen household within the range 5-60 were 61% in Barjaon-Sanjilajhar, 55% in Satyapur and 56% in Nowatary and Santipur.
26. 80% of the fishermen families possessed land in the range 0-0.05 ha.

27. The percentage of literacy was 20% only. Female education is found to be only 7%.

28. Income and family size of fishing household was directly correlated. Family size, expenditure on food, cloth and fuel had direct bearing on the total expenditure of the fishing households.

29. The consumption pattern in the household budget of fishermen population had been studied by three different forms of Engel curves to three items of consumption and the linear form of Engel curve emerged as better one. $\chi^2$ and t values corresponding to the linear model were found to be significant.

30. Elasticity for food based on all forms were almost similar and can be said to be non-elastic ($\eta < 1$). Elasticity for cloth was found to be larger ($\eta > 1$) in all cases. Fuel had been found to be elastic ($\eta > 1$) in semi-log form whereas it was found non-elastic in other two forms.

The work carried out so far has its own limitations. Because, statistical analysis of events is largely dependent on the quality and quantity of meristic data, the lack of which may result in erroneous or bias inferences.
with the development of new theories and models, the need for precise data has tremendously increased.

While undertaking studies on some biostatistical aspects, the non availability of precise data have greatly been felt. The main difficulty in using the secondary data has arisen out of the following facts.

1. non collection of fishery data by competent agency
2. lack of uniformity in the available data
3. inconsistency in available data
4. non coverage of all important aspects.

Secondary data could be used only for certain aspects of physico-chemical conditions of the river Brahmaputra. Therefore, primary data had to be collected for various aspects of fishery. Complexities of collecting riverine data (discussed in chapter-11) have been experienced throughout the period of investigation. It may be recommended that a full fledged statistical wing of the department of fisheries should collect data on fishery and compile systematically.