CHAPTER 1
LENGTH-WEIGHT PROGRESSION AND SOMATIC CONDITION IN MAJOR CARPS, CATLA CATLA, LABEO ROHITA AND CIRRHINA MRIGALA

INTRODUCTION

Apart from its academic importance the study of mathematical relationship between length and weight of fishes is known to yield information on general well being, onset of first maturity, spawning season, feeding intensity and suitability to environment of the animals. Data on these aspects is useful in rationally managing the populations of fishes. The formulation of the length-weight relation through exponential equation and according to LeCren's (1951) classical cube-law helps in determining growth in body weight per unit length. Undoubtedly, this provides an index of relative robustness of the fish. The present study was designed to obtain information on the growth and general well being of three species of major carps, Catla catla, Labeo rohita and Cirrhina mrigala stocked in combination in a pond. It was believed that data would throw light on compatibility of the species, an essential condition for polyculture.
MATERIALS AND METHODS

Fishes forming the basis of present study were collected from a freshwater pond (area = 8000 sq.m, total depth 8 ft) at Aligarh (Lat. 27° 34' 30" N, long. 78° 4' 26" E) by the help of cast nets during the period October 1981 to July 1982. Samplings were carried out on monthly basis and 100 specimens of *Catla catla* and 50 each of *Labeo rohita* and *Cirrhina mrigala* were caught in the middle of each month in the forenoon. Fishes were transported to laboratory and measured for total length and body weight. The length-weight relationship was calculated by the equation:

\[ \log W = \log a + n \log L \]

where, \( W \) = body weight (g)
\( L \) = total length (cm)
\( \log a \) = constant (intercept)
\( n \) = exponent (slope)

Values of \( \log a \) and \( b \) were derived by the method of least squares given by Snedecor and Cochran (1968).

The condition factor (ponderal index, \( K \)) was worked out by the formula:

\[ K = \frac{W}{L^3} \times 100 \]
where, \( W \) = body weight (g)
\( L \) = total length (cm)

Relative condition factor \( (K_n) \) was computed as:

\[
K_n = \frac{W_o}{W_c}
\]

where, \( W_o \) = observed weight (g)
\( W_c \) = calculated weight (g)

**RESULTS**

Relationships between length and weight of *Catla catla*, *Labeo rohita* and *Cirrhina mrigala* evaluated through regression equation and the condition factors have been tabulated (Table I). Deviation from the cube law is evident in growth of length and weight. In each species body weight varied more than cube of total length (*Catla catla*: 3.379 times, *Labeo rohita*: 3.353 times, *Cirrhina mrigala*: 3.177 times). All the specimens were healthy with length-weight exponent exceeding 3, but *Catla catla* was most robust of the three as it was putting on more weight/unit length. Next were *Labeo rohita* and *Cirrhina mrigala*. This was also indicated by the condition factor which was as high as 1.366 in *Catla catla* compared to a value of 1.198 in *Labeo rohita* and 1.035 in *Cirrhina mrigala*. High coefficient of
correlation between length and weight, and small standard error of mean of condition factor implied strong progression in growth of length with that of weight. Relative condition factor also did not differ appreciably from 1.0, showing lack of appreciable difference between observed and empirically calculated weight (derived from the regression equation).

DISCUSSION

The three species of major carps, *Catla catla*, *Labeo rohita* and *Cirrhina mrigala* showed remarkable compatibility. Their growth and biological condition were fairly good when cultured in combination in closed environment of the pond. The interspecific differences in the character of growth and ponderal index may be due to genetic constitution and/or nature of interaction with environmental factors. The carps differ in functional and place niches. Habitat partitioning vis-a-vis trophic and spatial segregation of these 'sympatric' carps is an important aspect of their biology. Earlier studies (Khan and Siddiqui, 1973; Jhingran, 1982) have explicitly indicated that *Catla catla* feeds in the surface layers of water, *Labeo rohita* prefers middle-zone whereas *Cirrhina mrigala* is largely a bottom feeder. Author considers this zonation in food procurement an adaptation to minimize interspecific competition for
food and space and maximize exploitation of food resources of the various segments of environment. Inasmuch as hydrological conditions and qualitative as well as quantitative production of food items varies with the habitat zone, the influence which such factors exert on fishes is understandable. In stationary water of ponds the upper layers of water are more oxygenated and rich in plankton. This can account for better growth of *Catla catla*. Jafri *et al.* (1978) and Mustafa (1978b) have presented elaborate accounts of the hydrobiological factors of pond environment and their influence on ichthyofauna. Profound effect of oxygen and food supply on survival and health status of the inhabitants was especially emphasized.

It is likely that the differences in the efficiency of food utilization, conversion of food into flesh, nutritional efficacy and calorific value of the respective diets result in growth rate variations. Of the three species *Catla catla* consumed more proteinaceous diet containing as much as 58.4% of animal matter in the form of zooplankton (Das and Moitra, 1963). It is very well documented that growth of fish is very closely related to protein intake (Delong *et al.*, 1958; Dupree and Sneed, 1966; Nose and Arai, 1972; Mustafa and Jafri, 1977; Haque, 1984; Rahman, 1984). If the views of Mustafa and Ansari (1983) expressed for *Gudusia chapra*, a teleostean fish of tropical reservoirs of India,
are given credence, the 'routine' variations in the growth
as observed in *Catla catla*, *Labeo rohita* and *Cirrhina
mrigala* are too small to linked to genome. They can at
best be related to ecological factors.

The range of intraspecific variations in growth were
narrow and limited. Since fishes of the three stocks were
virgin and did not acquire maturity, the differences in
condition do not owe to events in the internal environment
like gonad buildup or breeding cycle; there remains the
possibility of external factors, particularly thermal
regimes and food supply that may cause fluctuations in
fishes' condition. Detailed information on the influence
of the multitude of such factors is available in the work
of Jafri *et al.* (1978), Mustafa (1978b) and Mustafa and
Ansari (1983). In tropical environment, even external
factors did not profoundly effect the condition (*K*) as
indicated by small standard error of this parameter (Table I).
It is also evident from the same table that the relative
condition factor (*K*<sub>n</sub>) also did not differ appreciably from 1.
There was little discrepancy between observed and calculated
body weight. This shows that progression between length
and weight was fairly constant and even if pulses of
growth in the two variables (length and weight) were not
entirely coincident in terms of time, the encroachment
was large enough. This is against the views of Qasim (1957)
who reported that growth in weight alternates with that in length in *Blennius pholis*.

**SUMMARY**

Length-weight relationship and condition of three species of major carps, *Catla catla*, *Labeo rohita* and *Cirrhina mrigala* were studied. Body weight of fishes grew more than thrice the body length. *Catla catla* was most robust of the three, followed by *Labeo rohita* and *Cirrhina mrigala*. Condition factor maintained the same progression as length-weight exponent. Relative condition factor did not differ appreciably from 1. Data exhibited remarkable constancy in growth of length and weight.