3. MATERIAL AND METHODS

The material for all-India and statewise annual landings was taken from published accounts available in literature (CMFRI 1969, and FRAD 1980 & 1992). Statewise and coastwise percentages in all-India annual catches were calculated from it and the percentage of mackerel in marine fish landings computed. Distribution of mackerel in space and time along the coasts of India is projected with the help of landing data extracted from the records of the Fishery Resources Assessment Division of CMFRI for 5 years during 1976 to 1980.

Data on the fishery and biology of the Indian mackerel was monitored regularly at Manassery in Cochin thrice a week during July 1965 to June 1980. The season commences with the entry of juveniles in fishery and culminates with the exploitation of old ones. Broadly the trend of fishery shows the season to fall during July-June. But practically it may be longer or shorter; and longer ones overlap with each other. Through observations on length distribution, the young ones and adults appearing in such overlaps were singled out and appropriated to their proper seasons and all estimates and studies done. A sample of 25 fish caught by the non-selective gear, the boat seine Thangu vela was studied in the laboratory per day of
observation for total length (tip of snout to end of upper caudal lobe) and weight. The lengths were made into groups of 5 mm intervals and used for size distribution. The day's catch in weight and number of fish was made from this and monthly and annual estimates obtained. The effort used for exploitation and the catch of mackerel per unit of effort were estimated. Through length studies, the rate of growth of mackerel was found out and their age fixed. With its help, the age composition in commercial catches in numbers from season to season was found out and used in mortality estimation.

Total lengths in millimetre and weight in grams of individual fish recorded from samples collected at Manassery for 15 seasons up to June 1980 and later for another season from the mackerel landed in the Cochin Fisheries Harbour by purse seine during July 1980 to June 1981 were utilized for finding length-weight relationship by least squares method. An unweighted average and a pooled value of the length-weight relationships for 16 seasons were found out. The 'b' value from season to season were put to 't' test against the pooled value and the isometric one.

Length-weight relationship between male and female were worked out for 4 seasons from July 1977 to June 1981. Similarly
the length-weight relationship between indeterminate fish (sizes below 120 mm) and fish where sexes were different (sizes 120 mm and above) were also computed and their significance tested. The formulae used for the calculation of length-weight relationship and those utilized for testing significance of variation are given at each chapter dealing with them.

A regression between 'a' and 'b' values of the length-weight relationship of 16 seasons was worked out and used in testing the equations got in this study and those available in our literature for three-dimensional growth, mistakes sorted out and rectified.

Shifting of modal and average sizes from month to month in commercial catches were used to find out the rate of growth and age of the mackerel. From the mean-age/length structure growth parameters such as L∞, K and W0 were calculated. The t0 was calculated further and the formulae adopted for these computations are indicated in each case. The growth parameters were checked and the curve fitted in a diagram by von Bertalanffy's equation.

From the reduction in number of fishes of a given age-class in a season to the successive age-class of the following season
or seasons, mortality was calculated. Relating the total mortality with effort, as also to mean environmental temperature; and from the rate at which the population reduces to 1% level in an unfished state during its effective life-span, the total mortality was split into fishing and natural mortality. Methods adopted for these calculations are elaborated at suitable places with references in the text.

Calculation of maximum sustainable yield was tried without success by the relation between annual catch against effort. Estimation of yield per recruit, eumetric fishing and yield curves, the rate of exploitation, standing stock and annual stock were hence done by methods indicated in respective chapters dealing with them and the potential yield in India calculated.

All observations are compared with past findings, suitability noted down and future prospects of fishery touched upon with recommendations in the chapter on discussions. The observations and findings are duly substantiated with tabulated data and or with appropriate illustrations.