CONCLUSION

Details of the findings are concluded below-

The clupeoides constitute as one of the major pelagic fisheries of Uttar Kannada District. Fringe scale sardine, *Sardinella fimbriata* from Karwar waters was studied for the biological details. The study was carried out for a period of thirteen months (December- 2011 to December- 2012) and fresh fish collection was done from three study stations, Karwar and Karwar fish market, Baithkol and Majali. Salient findings of the investigation are briefed as hereunder.

Seventeen morphometric characters and their relationship with either head or standard length were studied and the regression equations were obtained. Average ratio obtained for the snout length (Y3), eye diameter (Y4) and post orbital length (Y5) together was 95.5% to the head length and the correlation coefficients were \( r=1 \) showed perfect positive correlation and \( r= \) greater than 0.9 showed highly positive correlation. Thus it is concluded that the relative growth of various body parts of *Sardinella fimbriata* were proportionate.

Meristic counts for various characters were obtained and compared with the earlier findings; it is concluded that the results obtained showed close similarity with those.

Age and growth of fish was assessed the length frequency method. In all, 1575 fish specimens were studied during the given study period. The actual size of *Sardinella fimbriata* was ranged from 40 mm to 170 mm. Maximum numbers of fish were found in the length frequency group 100 mm
to 120 mm (22.92%) and minimum number occurred in 160 mm to 180 mm (5.9%). It is concluded that the growth rate of fish was high in the first year.

Recruitment pattern was studied which showed poly-modal nature and major recruitment was seen from January to May with peak in May which indicates that spawning in fish is prolonged.

Length-weight relationship was studied. The ‘b’ value obtained for females was highest than that of the males; thus it is concluded that females were slightly heavier than males. The ‘b’ values obtained for males (2.858) and females (2.913) were less than ‘three’, thus it is concluded that *Sardinella fimbriata* from Karwar waters shows allometric growth pattern.

Length groups wise and month wise $K_n$ values were calculated. Length wise $K_n$ values for the males and females of *Sardinella fimbriata* were 1.005 and 1.175 respectively. Month wise $K_n$ values in female- *S. fimbriata* showed increasing trend from December to March these higher values were coincided with the development of gonads, thus it is concluded that; overall growth of the fish was well.

Morphology of male and female reproductive organs was studied. Testes and ovaries have asymmetrical two lobes.

Different stages of maturity were classified based on the macroscopic appearance of gonads and microscopic study of intra-ovarian eggs. For the detailed study histological slides were also prepared and observed under Leica EC3 microscope. From the results obtained it is concluded that; overall growth and development of the gonads was well during the study period.
Ova diameters were studied and frequency polygons were plotted. Ova diameters were ranged between 0.180 mm to 0.512 mm. This indicated that the maturation process of *S. fimbriata* was continuous and sequential.

Spawning frequency- It is observed that *Sardinella fimbriata* spawns once in a year for short period of time in batches for definite duration and Peak spawning period for Karwar Coast was from January to April.

Gonado-Somatic Index (GSI) was calculated. During present study GSI values for males were lower than females but followed somewhat similar pattern. This indicates that male matures earlier than that of females and it has been observed that GSI values were comparatively higher during spawning months. Gonado-Somatic Index (GSI) will help to predict the crop; for successful management of fishery.

The size at first maturity- It is observed that males of *S. fimbriata* attain sexual maturity at 100-110 mm and females at 110-120 mm of their standard lengths at Karwar Coast.

Sex ratio in the *S. fimbriata*, the Chi-square test values for pooled data showed significant variation and the relative proportion of males per females in a fish population was good.

Fecundity was studied, during present study no significant variation has been found in between estimated and calculated fecundity of *S. fimbriata*.

Food and feeding in *Sardinella fimbriata*- From the foregoing studies it is evident that the *S. fimbriata* feeds up on phytoplankton as well as zooplankton.
Biochemical composition- The calculated calorific value of *S. fimbriata* was 1.75 k cal /gm (Approximately 2 k cal /gm) thus it is highly nutritive and cheaper source of animal protein.

Fishery review has been taken with reference to all India and Karnataka fish catch. Utilization of *S. fimbriata* is included as part of disposal. *Sardinella fimbriata* was studied for fish parasites; predominantly Isopod-*Argulus species* occurred on the body of *S. fimbriata* as an ectoparasite.