GENERAL SUMMARY AND CONCLUSION

The freshwater bivalve shell fishes like *Lamellidens corrianus*, *Lamellidens marginalis*, *Indonaia caeruleus* and *Parreysia corrugate* and *Parreysia cylindrica* are abundantly found in both lotic and lentic water systems of Maharashtra State.

The analysis of physico chemical features of the habitat water from the field of *Parreysia cylindrica* showed that water temperature fluctuated within a small range during the study period (18.0 to 32.5°C). High water temperature (30.0 - 32.5°C) was observed in summer i.e. in the month of April and May and low temperature (18.0 – 22.5°C) in winter i.e. in December and January. The dissolved oxygen contents showed higher values from (6.012 to 8.8135 mg/lit/hrs) compared to those from other parts of Maharashtra.

The solubility of oxygen was found to depend on the temperature and level of water. The dissolved oxygen level decreased to minimum (6.012 - 6.117 mg/lit/hrs) in summer and in winter it increased to maximum i.e (8. 564 - 8.8135 mg/lit/hrs) and (6.400 – 6.698 and 7.150 – 7.6294 mg/l/h during pre-monsoon and post-monsoon season.
The fluctuations in the dissolved oxygen in monsoon could be due to the increased water level and turbidity and higher values in winter could be due to increased biotic activity like photosynthesis of algal biomass.

The hardness of water in terms of carbonate fluctuated in very wide range, (110 - 122 ppm) on July, (117 - 123 ppm) on September during monsoon. pH was usually fluctuated in a narrow range i.e. (8.3 – 8.6) on April, (7.91 – 8.14) on May during summer, (9.15 – 9.47) on July, (8.64 – 8.93) on September, during monsoon and (8.91 – 8.40) on December and (8.2 – 8.67) on January during winter. Higher values of hardness were obtained during monsoon (117 - 123 ppm) whereas very low values were obtained during the winter season (88 - 100 ppm) and summer season (84 - 103 ppm). The increase or decrease of hardness is not a permanent feature of the habitat water and likely dependent on the level of water. Lower values of hardness in winter showed much depletion in calcium, which has considerable impact on the growth of the shell of the bivalve.

The rate of oxygen consumption of *Parreysia cylindrica* showed seasonal patterns as well as the reproductive activity of the animal. Low rate of oxygen consumption was observed during
winter and monsoon in all most all the animals i.e. small and large sized bivalves compared to other seasons. This might be due to low temperature and low food availability. High rate of oxygen consumption was observed in small sized during summer followed by monsoon season.

The rate of ammonia excretion in *Parreysia cylindrica* was found to be depleted in small sized bivalves as compared to large sized bivalves particularly on July and August of monsoon seasons. It was found to be weight specific and also dependent upon physiological state of the organism. During April and May of summer season, the rate of ammonia excretion was found to be elevated in small sized animals than large bivalves. This could be co-related with the gametogenic activity of the animals. The rate was found to be increased in summer and winter and decreased during monsoon i.e. during the period of increase in water levels of rivers. During this period increases flow of water and also turbidity. This might be resulted in increasing rate of ammonia excretion. The males and females individuals showed reproductive stages (gametogenesis, maturation of gametes and spawning) during this period these reproductive stages possibly had 110 impacts on the rate of ammonia excretion.
The environmental factors were the determinant of the change in O: N ratio. The O: N ratio was found to be high in small sized animals as compared to the large sized bivalves. It was found to be increased in monsoon season with the onset of favorable conditions and the rise in metabolic rate, the O: N ratio also increased. This was observed in small sized animals on July of monsoon season. The male and female animals showed gametogenesis, maturation and lysis of unspawned gametes.

The respiratory rate increased in small sized animals on April and May this period coincides with slow gametogenic activity of the animal. High temperature and low oxygen content caused increased filtration rate to meet the increased oxygen demand for the body maintenance metabolism. The day length gradually increased in summer, water level along the blanks of river decreased and animals were exposed drastic condition. The seasonal study also showed weight specific oxygen consumption i.e. increase in oxygen consumption when the body weight decreased and vice versa i.e. with the gonad maturation and spawning. The males and females showed the spawning during this period.
The changes in biochemical reserves like protein, lipid and glycogen showed a close relationship with the reproductive activity and the favourable environmental conditions. It was observed that the contents were increased, when the gametes were matured in July and showed a decrease during winter, when the spawning activity was at its peak. The metabolic rate was also lowered in this period, when the conditions were favourable in monsoon and winter increased in water level, low turbidity, decreasing temperature and metabolic rate was slightly increased, the animals build up their body reserves. During April the animals showed continued gametogenic stage. During this period the protein and lipid content decreased and glycogen increased in small. The decreased levels of these contents were probably due to nourishment for development of the gamete. The increase in glycogen content could be accounted for the increased metabolic demand, when the temperature was high, water level was decreased and dissolved oxygen content was low.

Sexes are separate in Parreysia cylindrica but there is no distinct sexual dimorphism. But just broader shell valves are found in few female animals.
Accessory reproductive organs are gills. Both outer and inner gill lamina serve as marsupia, however, incubation of developing embryo and glochidia, occurred mainly in the outer demibranch. This condition was observed in September, Hepatic tubules and gonads are intertwined in each other. This condition suggests ready supply of nourishment for development of gonads. Apart from this, nutritive cells, lipid globules and lysis of mature gametes also occurred during gametogenesis.

The reproductive stages consist of gametogenesis, maturation, spawning and recovery. Resting period was not observed. The gametogenic activity begins in May and follicle showed the presence of sperm morulae, spermatocytes and spermatids. In female gametogenesis starts in April, more pronounced in large size. Proliferation of small oogonia took place during the period from July, both the males and females were in maturation phase. A partially spawning condition was seen in females in May.

The study on digestive tubules of Parreysia cylindrica showed that ducts and tubules grouped in the form of small lobules, separated by interlobular connective tissue. Each tubule is bounded by muscle fibers. The tubule consist of two types of cells
(1) digestive and (2) Secretory cells. The amoebocytes are found scattered in the interlobular connective tissue. Three types of digestive phases namely holding, absorption and fragmentation was observed in majority of the tubules of small and large sized bivalves. Fragmentation of spherules occurred with the onset of rainy season i.e. during monsoon. Holding phase occurred in monsoon period i.e. in July and August in small sized bivalves. Absorption phase occurred from winter to early summer. The absorption of the food took place before arrival of the monsoon and the tubules entered in fragmentation phase, with the commencement of monsoon. This period also corresponded with the spawning activity of the animals. Holding phase was observed on August when the animals showed subsequent gametogenesis, maturation and spawning conditions. In winter, the absorption phase was dominant.

Thus seasonal pattern of digestive tubules in holding, absorption and fragmentation was observed. The water level remained high and turbidity was less in May of summer and July of monsoon, the tubules were in holding phase. The seasonal pattern was depended on the food availability and favourable
environmental conditions like temperature, dissolved oxygen content, hardness of water etc. and level of habitat water.