SUMMARY AND CONCLUSION

Larvivorous fish in particular are among the most promising biological control agents of mosquitoes. After proper screening on their potentiality as larvicidal fish, based on the relative efficacy and preference for mosquito larvae as food, five species viz., *Channa gachua*, *Puntius sophore*, *Puntius ticto*, *Trichogaster fasciata* and *Trichogaster sota* have been selected for detailed study.

Habitat ecology of the larvicidal fish revealed that the physico-chemical properties like water and air temperature, pH and DO of ‘Bogeepool’ had their maximum values during monsoon season while, free CO$_2$ was recorded to be maximum in post-monsoon and alkalinity in pre-monsoon. The lower values of water and air temperature as well as pH were recorded in winter while values of FCO$_2$ and alkalinity were found their minimum in pre-monsoon and post-monsoon respectively. Among phytoplankton, Chlorophyceae was the most dominant while Cladocera was major group among zooplankton.

Biometry of the selected fish showed positively allometric growth in higher size groups while it was negative in lower size groups. Length
and weight in all the length groups in both the sexes were highly correlated in all the fish species. However, their condition factors were higher than unity throughout the year indicating satisfactory growth condition of the studied species in their natural environment.

Variation in feeding intensity (GSI) was noticed in sexes and seasons, particularly in peak breeding season. Feeding was relatively low in all the species during winter. The RLG value showed no abrupt variation with the increase in length of the concerned fish species. Based on RLG values it may be said that *T. fasciata* basically prefers plant matter, *T. sota, P. sophore* and *P. ticto* are omnivores and *C. gachua* is essentially a carnivore.

The sex of the five fish specimens can be recognized externally only during breeding seasons. The overall sex ratio did not follow the theoretical 1:1 ratio by the five fish specimens. However, *C. gachua, P. sophore* and *P. ticto* are much closure to the mentioned sex ratio. Five maturity stages were observed in the studied fish specimens. Most of the gravid specimens were found during monsoon in both the sexes of all the five fish species. As in other teleost, the GSR reaches its peak prior to spawning. As a whole, the gonado-somatic ratio (GSR) was found to be higher during premonsoon and monsoon in the studied species. Maturation of ova in all the five fish species occurred during the months of April to September except in *T. sota* where it was recorded from July
to August. The 50% maturity ($M_{50}$) revealed that $C. gachua$ mature 50% at 8-11 cm length groups, $P. sophore$ at 5-6 cm, $P. ticto$ at 4-5 cm, $T. fasciata$ at 6-7cm and $T. sota$ at 3-4cm. The mean relative fecundity was recorded maximum in $P. sophore$ and minimum in $C. gachua$ which may be due to larger ova size of the later. The rest of the studied species are moderately fecund. The ovary weight and fecundity have been found to be highly correlated.

The rearing feasibility of all the fish specimens showed 100% survivality in both the phases- one from Sept 2010 to Jan 2011 and another from March to May of 2011. All the fish species showed satisfactory growth under controlled feeding and rearing condition in both phases of the experiment. Water quality of aquarium water was also within the range of BIS (1982).

Feeding efficiency of mosquito larvae in different size groups of fish revealed that larger sized fish consume higher numbers than smaller sized ones throughout the study period. During 1h exposure, larger size group (9.5 cm) of $C. gachua$ consumed highest number of larvae followed by $P. sophore$ (5.7 cm), whereas the least number of larvae was consumed by $T. sota$ of size group 4.1cm. $C. gachua$, irrespective of size groups, consumed mosquito larvae voraciously in all the experimental trials. With increment of space, the foraging behaviour of the fishes changed and possibly required more time to capture and consume the mosquito preys.
During 24 h exposure, all but *T. sota* consumed more numbers of mosquito larvae than they did in 1 hr and 12 hr.

In conclusion, it may be mentioned that if fish are used for controlling mosquito larvae, it must be well planned. For example, fish might be introduced in habitats that dry up rapidly or people may harvest the fish at the end of the wet season but no replenishment when the habitats are flooded again. Prey density and habitat cover are probable factors influencing the air-breathing fishes and mosquito larval interactions. Therefore, for future projects planning, types of fish should be taken into account these potential problems and regular monitoring of the fish populations, with reintroduction of fish when needed. Following suggestions for effective utilization of larvicidal fishes are made:

1. Inclusion of more air-breathing fishes and other hardy fishes like *Glossogobius giuris, Tetraodon cutcutia*, spiny eels etc. based on their potentiality as larvicidal fish;
2. Standardization of stocking density of larvicidal fishes in different types of water bodies
3. Standardization of breeding protocol for larvicidal fishes