PREFACE

The commercially useful bivalve molluscs, such as oysters, clams, mussels, scallops, cockles and abalones are the edible food molluscs, which are produced through aquaculture in several parts of the world. Among these species of bivalve shellfishes some abundantly found in Indian water systems can sustain regular and very productive fisheries in India. Particularly, in Maharashtra state, several species of commercially important and edible bivalves like clams, oysters, mussels, scallops, abalones are found along the coastal area whereas other bivalve shell-fishes like mussels and clams are found both in lotic and lentic freshwater habitats.
The freshwater bivalves are suspension feeder on the primary stage of food chains hence they notably influences the organization and functioning of the ecosystems. Also, they perform efficient role in transformation of energy in food chains coupled with their sessile mode of life. The significance of the shell fishes, in future will be greater as a potential source of food for human beings. Many of the shell-fishes have not yet attended their place on the Governments table that they could. The oysters and mussels particularly along the coastal regions, are much relished. The need for popularizing the shell fishes as food is great, particularly in our country, where the provision of nutritious food is a long standing problem and only means to tackle, it should be tried and if successful, popularized. In several parts of the world, including our India, the shellfishes are exploited for various purposes. Apart from food they are used as bait for fishing and shells for multiple use like preparation of toys, ornaments, utility articles and also in lime and paint industries.

Both the marine and freshwater bivalves shell fishes play an important role as bio-indicator or bio-detectors to detect various environmental fluctuations and aquatic characteristic changes due to natural and man-made calamities. The juvenile bivalves becomes a source of food for many fishes, birds and mammals, hence they
become important component of lower level of aquatic food chain. The freshwater bivalves shellfishes are filter-feeders or collector-filters capable of collecting and filtering huge volume of the water and they are able to detoxifying hazardous substances in aquatic systems. By removing organic materials bivalve can significantly reduces turbidity level and also unionid bivalves are capable of cycling significant quantities of nutrients. The significant role of freshwater mussel in stream system is release of nutrients via excretion have been converted from particulate matter to a soluble form that is usable by primary produces. Generally they remain totally buried under the mud or sand and some have sedentary habitat. A few freshwater and marine species are exploited for Pearl culture and flesh of the species is considered as a "main food" due to their edibility value (rich protein content) and cheap resource. The bivalve molluscs also serve as important ecological sink especially for calcium, phosphate, nitrate etc.

Aquaculture of shell fishes has been started in India through the use of various experimental trials carried out in the National institute of Oceanography (NIO), Goa and Central Marine Fisheries Research Institute (CMFRI) Cochin. Now many experiments are till to be done for obtaining the more yield from the shell-fishes.
The large scale exploitation of bivalve molluscan reserves in India are restricted to the coastal region due to their high commercial and edibility value. Fishing of freshwater bivalve molluscs are to lesser extent owing to their less edibility value. But in most of the Eastern Asian Countries, particularly in Malasia, Indonesia and Thiland, freshwater bivalves like *Anodonta* are mainly exploited amongst the molluscan resources due to their relatively large size, quick growing ability and edibility. The rearing techniques of these mussels using cages in fish-ponds for easy harvesting is being improved in these countries. *Anodonta* species for Pearl culture, is practical in China is widely used to Indonesia and Thiland.

In many places the valves of bivalves are used as Mango - peelers. The advantage claimed for this implement over a knife is that mango does not become stained and its flavour is impaired by contact with steel. The species produces pearls in considerable quantity but of a fair quality. The pearls have reddish tintch and less lustrous than those from the marine pearl oyster. Originally the shells of both marine and freshwater bivalve species were used to prepare lime for white washing of walls. Today, they are used in most of the countries, including our India, in paper, rayon, leather, carbide, cement, and fertilizer industries and also used as shell grit for poultry.
The reproduction of marine and freshwater shellfishes has been studied for a long time, more data are desirable on their annual reproductive cycles with environmental stress in aquatic systems to determine effects on gonads and the accompanying change in the animal body at this time showing in release of gametes and energy storage. A number of studies on the gonad development of marine and freshwater bivalve molluscs have been carried out. The workers like Virabhadrarao, Algara, Swami, Bal and Durves, Nagabhushanam and Mane have contributed much in this field.

Teratological development of embryos may result in deformed or malfunctioning of larvae which do not survive and they not show hatching. Reproduction may be influenced by behavioural changes of the adult during spawning season. Davis stated that animals behaviour and the production of nutrients may be considerably affected in presence of environmental stress, like pollutants. The workers like Kinne, Cohen and Pinkerton, Keith, Loosanoff, Galtsoff and Chipman, Brease and co-workers have shown that environmental stress like salinity changes, insecticides, oil and detergents and inorganic pollutants considerably affect the animals in aquatic system. Many workers have used histological and physiological aspects as a tool in determining the stress effect on animal body.
The reproductive physiology of molluscs is of special interest due to their importance as food for man. Besides this, human activities tend to concentrate among marine shores and cause considerable toxic stress.

According to workshop on "Controlled Reproduction on Cultivated Fisheries Resources," conducted by the European Inland Fisheries Advisory Commission and Food and Agricultural Organization of the United Nations (EIFAC), the controlled reproduction of fisheries resources at different times of the year is Central Problem in aquaculture operation further more, without controlled reproduction genetic selection is not possible and the aquaculturist is limited to the genetic characteristic of the natural stock which may not be best suited to the requirements of aquaculture such as rapid growth, disease resistance and low stress responses in crowded conditions.

During reproduction the freshwater bivalves shed thousands of the gametes at a time, fertilization is external and larvae produced called 'Glochidia' are carried out for a short period as a parasites on gills of fishes and salamanders and later settled on suitable substratum. Being a component of ecological food chain, these
animals are not able to migrate from one place to another, and hence they remain under severe environmental stress.

Many scientists have been shown much interest to study the ecological and physiological aspects of bivalve molluscs, since past few decades. Though the research work on the biology and fisheries of commercially important shell fishes contributing to the substantial catches was started comparatively recently in India, there have been considerable preliminary and some detailed investigation on various species of local importance and the result obtained are of some help to make effective attempt in advancing the modern trends in research on various aspects of physiology and eco-physiology. Some notable contributions on clams, mussels, and oysters are from Mumbai, Sindhudurg and Ratnagiri coasts in Maharashtra, while freshwater mussels are from only Thane, Kolhapur and Aurangabad districts.

Freshwater bivalve like Lamellidens corrianus, Lamellidens marginalis and Indonaia caeruleus, Parreysia corrugata are abundantly found in both lotic and lentic freshwater bodies throughout year in Maharashtra. Lamellidens marginalis, Lamellidens corrianus, Indonaia caeruleus inhabit the different river systems in Aurangabad district. Among these Lamellidens marginalis, Lamellidens corrianus, Indonaia caeruleus found
abundantly throughout year in Godavari river at Kaigaon and Paithan near Aurangabad. The research on these species occurring in Godavari river, has been carried out on the aspects of seasonal toxic effects of same pesticides and metal salts by (Akarle, Muley, Rao, Kulkarni, Vedpathak and Gokhale). The pucity of information on size specific variations in physiological aspects and considering the abundant distribution of *Indonaia caeruleus* throughout the year, the present study was undertaken from Godavari river at Paithan, to study the size specific variations in oxygen consumption, ammonia excretion, O:N ratio, biochemical diversions, reproductive cycle of the field population and changes in the digestive tubules.

These aspects have been studied on the samples (with small, medium and large size) collected from a fixed locations along the bank of Godavari river at Paithan near Aurangabad on full moon period of all the seasons over a period of two years to understand the interaction of several physical, chemical and biological factors in the environment on the physiological events in the animals. To get additional information on some physiological aspects, the experiments were conducted to study the size specific changes in ammonia excretion and oxygen : nitrogen ratio. The biochemical
analysis was done to know the amount of the organic constituents chanibalized and utilized in the whole body.

The entire data collected are framed under six sections:

1) Changes in oxygen consumption;
2) Changes in ammonia excretion;
3) O : N ratio;
4) Biochemical changes;
5) Histology of the gonad (Reproduction) and
6) Histology of digestive gland (hepatopancreas)

Introduction and Material and Methods are given in the beginning of the Result as sectioned above—where as Discussion and Bibliography are given at the end of the Results. Finally General Summary and conclusions have been given.