CHAPTER II

REVIEW OF LITERATURE
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Fish has been an important food item in the diet of most Indians from time immemorial. Bloch was the pioneer writer on Indian fishes and his work *Ausladiche Fische*, which was published in 1785 set the ball rolling in the study of Indian fish. Hamilton Buchanan (1822) published his work in *Fishes of Ganges*, which is a milestone in the history of ichthyology in India. Thereafter, Blyth (1860) and Günther (1870), contributed greatly to the field of ichthyology in India. These publications are followed by the great work of Day (1878) in the form of "*Fishes of India and Fauna of British India, Burma and Ceylon*". McClelland (1839) and Bleeker (1853) had contributed immensely to the field of ichthyology, which is acknowledged among fish biologists. The knowledge of the occurrence of fish dates back to 3 millennium B.C. (Hora, 1956). Thereafter, several authors have contributed to the study of taxonomy, ecology and biology of different fish species and only few relevant ones are mentioned here.

**International:**

Several authors have reported different work on the different aspects of eco-biology of various fish species belonging to different species and effect of temperature on several types of fish at varied environmental conditions at the international level. Many workers have also studied the reproductive biology of different fish species. Only a few of them are referred to here.

The ovarian cycle of gobies, *Gillichtys mirabilis*, a marine fish, has been reported by Barlow and Vlaming (1972). Breeding biology of *Galaxias vulgaries* has been studied by Cadwallader (1976). Reproductive biology of
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Sarotherodon mossambicus was studied by Hodgkiss and Man (1978). Marais (1980) studied the aspects of food intake and morphology of alimentary canal of Mugil cephalus, Iza tricuspidens, L. richardsoni and L. dumerli. Balasuriya et al. (1990) studied induced breeding of Indian major carps in Sri Lanka and were successful in production of the fish through induced breeding. Shah et al. (1990) reported induced breeding of Indian major carps in Bangladesh. Khallaf and Authman (1991a; 1991b) have worked on growth and length-weight relationship of Bagrus bayad (Forkal) in the Nilotic canal and reproductive characters like gonadosomatic index, hepatosomatic index and spawning behaviour of the same species in Bahr Shebeen canal in Egypt. Similar work has been reported on Chrysichthys rueppelli (Blgr) from the same canal by Khallaf (1992).

Magdy and Khattab (1992) have reported the effect of temperature on time of stripping of grass carp, Ctenopharyngodon idella and reported that the relation between the time of stripping and water temperature to be linear. Zaki et al. (1993) observed the spawning season of Zebrasoma xanthurum as April – August through gonado somatic index and histological studies and development of the egg in the fish related to the gross changes in the ovary. Elserafy (1993) reported on the biology of Liza ramada in freshwater as well as in marine habitat, and observed allometric growth and better condition in freshwater than marine water. Shenouda et al. (1994) studied some aspects of reproductive biology of Chrysichthys auratus and C. rueppelli and observed that the spawning season of the said fishes was during March – April. Histological changes that take place due to effect of low temperature on testes
in *Mugil capito* have been studied by Zaki *et al.* (1994). Ecological and life history characteristics of *Gymnocephalus cernuus* have been narrated by Lappalainen and Kjellman (1998) in Finland. Khallaf *et al.* (1999) studied effect of lead toxicity on growth and gonadosomatic index of *Oreochromis niloticus*. Ali *et al.* (2001) studied the effect of environmental variables on body composition of *Channa punctata* in Pakistan.

Besides the above-mentioned work, there are several reports on the different species belonging to the genus *Labeo* from countries other than India. Baird (1976) reported reproduction and growth pattern of *Labeo capensis*. Baird and Fourie (1978) studied the relationship between length and mass of *Labeo capensis* in South Africa and reported that the relationship was linear. Mahmoud (1992) reported length-weight relationship, survival rate etc and it was found that some biological characteristics exhibit geographical differences in *Labeo horie* (Heckel). Morphometric and Meristic characters of *Labeo forskalii, Labeo horie, Labeo niloticus, and Labeo coubie* from the Nile, Egypt have been studied by Mekkawy and Mahmoud (1992). A study of age and growth has been done on *Labeo niloticus* and showed significant differences in relation to variation in weight with length, condition and growth of the fish from different localities. (Khallaf and Alne-na-Ei, 1995). Dadebo *et al.* (2003) reported aspects of reproductive biology of *Labeo horie* from Ethiopia, which showed that the relationship of fecundity with total length and total weights were curvilinear while the relationship between fecundity and ovary weight was linear.
Work done in India:

Literature is available on different aspects of biology of fish species belonging to various genus from different parts of India. The role of environmental temperature on sexual maturation and breeding of fish has been studied by several investigators like Hora (1945) and Chaudhuri (1960). Chaudhuri (1960) performed experiments on induced spawning of Indian major carps and successfully used pituitary extract as inducing agent for captive breeding of Indian Major carps. Bisht (1974) studied seasonal histological changes in testes of *Schizothorax richardsonii*. Bisht and Joshi (1975) studied seasonal change in ovaries in the same fish species. Eco-biological studies and reproductive behaviour of mahaseer have been reported by Nautiyal and Lal (1978) from cold higher altitude. Similar study has been conducted at comparatively high altitude in hill-stream fishes (Lal, 1980; Lal and Mishra, 1980). Nandesha et al. (1990) were successful in experiments on induced spawning of Indian major carps through single application of ovaprim-C in place of pituitary extract. Influence of temperature and pH on oxygen consumption on *Naemacheilus botia* has been reported by Chahande and Jadhav (1997) and according to them with rise in temperature and pH the rate of oxygen consumption also increases. Reddy et al. (1997) examined the effect of cadmium and mercury on ovarian maturation in *procambarus clarkii*. Impact of mercury on respiratory metabolism has been reported by Jagadeesan and Vijayalakshmi (1998) in fingerling of *Labeo rohita* and reported dropped oxygen consumption with increase of mercury level. Similar study has been done on Common Carp by Ramesha et al. (1998) and reported some
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behavioural changes during exposure period due to presence of mercury and cadmium. Length-weight relationship of *Glyptothorax* was studied by Subba and Ghosh (2000). Venkatesha Moorthy *et al.* (2001) studied the food and feeding habits of bottom feeder species of mullet, *Valamugil seheli*.

A brief report on some work on various species of the genus *Labeo* has been summarized here. Mookerjee and Ganguly (1949) studied the life history of *Labeo gonius* and reported the food and feeding habits of *Labeo calbasu*, *Labeo gonius* and *Labeo rohita* from Bengal having warm climatic condition. Food and feeding habits of *Labeo gonius* were also studied by Alikunhi (1952). Hora and Pillay (1962) mentioned the feeding habits of *Labeo bata*, *L. calbasu*, *L. fimbriatus* and *Labeo kontius*. Motwani *et al.* (1962) described the fisheries of *Labeo pangusia*, *Labeo gonius*, *Labeo bata* and *Labeo rohita*, from Brahmaputra river system. Breeding behavior of *Labeo Bata* from Bhakra reservoir was reported by Bhatnagar (1964). Kamal (1967) worked on gut of *Labeo rohita*. Ponderal index of *Labeo fimbriatus* from Narmada River was reported by Bhatnagar and Karamchandani (1970). The length-weight relationship of *Labeo bata* has been reported by Rao and Rao (1972). Ponderal index of *Labeo gonius* from Narmada River was reported by Bhatnagar (1972). Food and feeding habits of *Labeo gonius* have also been studied by Parameswaran *et al.* (1974). Length-weight relationship of *Labeo gonius* at low altitude and riverine condition has been studied by Parameswaran *et al.* (1974). Length-weight relationship in *Labeo calbasu* has been studied by Pathak (1975). Pathak (1975) described the food and feeding habits of *Labeo calbasu* from Loni reservoir. The relative condition factor and length-weight
relationship of *Labeo bata* from the Kali River, Uttar Pradesh, was reported by Chatterjee *et al.*, (1976; 1977). In *Labeo calbasu*, several authors have worked on reproductive biology (Pathak and Jhingran, 1977). Length-weight relationship also has been studied for *Labeo gonius* at low altitude and riverine condition by Chatterjee (1980). Mustafa (1985) tried hypophysation experiments on *Labeo rohita* with human chorionic gonadotroprin in the Andaman. Sharma *et al.* (1986) reported the induced breeding of *Labeo gonius* in Rajasthan having warm climatic condition. Reproductive biology of *Labeo gonius* has been studied by Joshi (1987) in Rajasthan at riverine and warm climatic condition. The effect of pollutants on brain development of *Labeo gonius* at Udaipur has been studied by Bhatnagar *et al.* (1989). Similarly age and growth of *Labeo gonius* from Kali River, Uttar Pradesh was studied by Chatterji (1992). Khanna, 1996 authored the work on food and feeding habits of different *Labeo* species.

The above-cited review of literature reveals that though there are reports on the various aspects of ecobiology of *Labeo* species but no report has been found on *Labeo gonius* from the North-Eastern Region of India especially at mid-altitude region of Meghalaya with comparatively low temperature. This is the first record of successful induced breeding experiment of *Labeo gonius* at low temperature and high altitude (1496m MSL).