Crustaceans include the edible species lobsters, prawns, shrimps, crabs dwelling in marine and freshwater habitat that are commercially important because of their high nutritional contents. Many workers all around the world have been studying physiological aspects of crabs related to respiration, excretion, reproduction, growth, molting and sensory physiology (Webster, 2000; Beltz, 2001 and Sosa, 2005).

The process of reproduction is essential for the continuation of life and it can be examined in terms of molecular, cellular, physiological, and behavioral adaptations of individuals to its environment. It is an important event demanding a high expenditure of energy during which the animals have to donate much of their metabolic energy for the production and maintenance of gametes and for taking part in breeding. As the reproductive activity of the animal is delicately controlled by the different principle, it is logical to believe that the physiological processes are also suitably modified in relation to the reproductive cycle. The knowledge gained by elucidating the proximate factors controlling reproduction can provide a better understanding of the evolution of life history and reproductive strategies in different environment.

Reproduction in crustaceans is seasonal in which a course of gametogenic cycle is completed by ripening or maturation of gametes in the gonad and egg laying in the brood pouch of a female and followed by reproductive spent or quiescent period. Therefore, the annual reproductive cycle can be subdivided into pre-reproductive, reproductive, and post-reproductive stages in
accordance with sequence of happening of each event in a year that determines the pattern of breeding cycle i.e. either semi-annual, annual, biannual or continuous breeding (Giese and Perse, 1974). Annual reproductive cycle in marine as well as brackish water crustaceans was also studied by many workers (Joshi, 1980; Nagabhushanam and Kulkarni, 1982; Koga, 1995; Garner, 1995; Paul et al 1997; Kumar and Ferguson, 2000).

The body size is one of the most important parameters of the life cycle of crustaceans to know and its estimation has been attempted by many different methodologies (Gonadal development, presence of spermatophore, etc.) by Conan and Comeau, 1986; Paul, 1992; Sainte-Marie et al 1995. Mantel and Dudgeon (2005) in *Macrobrachium hainanense* observed that gonad maturation in male and female occurred at 12-18 mm CL and 15-17 mm CL respectively. Maria and Leme (2005) reported that female, *Sesarma rectum* attains physiological maturity at 18 CW. Veronica and Lopez (2006) in *Aegla uruguayana* stated that gonad maturation, in male and female occurred at 19 mm CL and 17 mm CL respectively.

Gonad index is a function of breeding cycle in marine and estuarine crustaceans (Giese, 1955). Giese (1959) formulated a co-relationship between gonad maturity and body weight. Same methodology was applied by Farrooqui (1980), Reddy (1982), Mirajkar (1985), Sarojini (1986). The index that determines the reproductive status of marine invertebrates is based on the observation of gonad maturation at the macroscopic and
microscopic levels, by observing their form, weight and colour (Lopez-Greco and Rodriguez, 1999).

Oogenesis is an energetically expensive reproductive process that can be divided into several phases. The latter phases of oogenesis, periods characterized by the accumulation of yolk proteins in the growing oocytes and by significant increase in oocyte diameter, are referred to as primary and secondary vitellogenesis (Meusy and Charniaux-Cotton, 1984; Meusy and Payen, 1988). Lee and Lee (1970) reported the ovarian cycle and oogenesis of *Penaeus japonicus*. Histological observation of gonads reports reproductive cycle and physiological maturity in the crustaceans. The simultaneous observation of carapace length, gonad index and histological data leads to conclusion about breeding cycle (Pillai, 1960, Jyoti, 1974). The process of oogenesis has been studied in marsh crab, *Paratelphusa hydrodromous* by Adiyodi (1969). Differentiation of oocytes and vitellogenesis progresses reported in *Uca pugilator, Cambarus clarkia* and *Libinia emerginata* (Wolin et al 1973). Jayalakshmi (1986) made some observations on cyclic changes in ovary of *Macrobrachium lamorii*. Amato and Payen (1978) studied the spermatogenesis in *Pontastacus leptodactylus*. Joshi and Khanna (1986) reported oogenesis and spermatogenesis in freshwater crab, *Potamon koolooense*. In freshwater crab, *Gecarcinus steniops*, the oogenesis and folliculogenesis were studied by Santhama and Adiyodi (1991). Trinadha Babu et al (1991) in marine crab, *Portunus sanguinolentus* described the histological details during the

Sexual dimorphism is the existence of physical differences between the sexes, other than differences in the sex organs. Examples include colour, size, and the presence or absence of parts of the body used in courtship displays or fights. Sex differentiation can also be defined as the process leading to the development of phenotypically dimorphic individuals within a species. Differences in body size and shape can be caused by factors other than reproductive success.

Sexual dimorphism can arise as a consequence of competition between the sexes over resources, or because the sexes use different resources. Crustaceans show sexual dimorphism in their external morphology and sexual differences in the several body parts relative to carapace length, and it has often been used to examine the relationship between morphometric differences among populations of species. Morphometric maturity is related to change in the relative growth of secondary sexual characters (relative to a somatic character of reference, such as carapace length) at the onset of sexual maturity. It has been widely used in population biology and fisheries (Hartnoll, 1974; Mingawa and Huguchi, 1997; Pinheiro and Fransozo, 1998; Goshima et al 2000; Conan et al 2001; Flores et al 2002). The structure such as chela in males,
pleopod and abdominal width in female grow abruptly on attaining sexual maturity and this phenomenon is utilized to differentiate the mature and immature population in many decapods, which are not sexually dimorphic (Hartnoll, 1982). Sexually immature males and females have very similar external morphologies and ornamentation, and most of the sexually dimorphic characters are acquired in the last few molts.

The reproductive characteristics of a species are a result of the interaction between various endogenous and exogenous factors. Factors such as temperature, salinity, food availability, photoperiod and lunar cycles could determine the periodicity and extension of the reproductive period of a species, as well as its fecundity. Fecundity can be defined as the number of egg prior to next spawning season. Fecundity of crab varies from species to species and also varies within the same species due to different factors such as age, size, nourishment and ecological conditions of the water body. Brachyuran crab show great diversity of embryonic development, especially owing to a significant variation in egg size. In brachyuran crabs, female incubate their eggs, which remain attached to the pleopods and covered by abdomen from spawning to hatching. The incubation period varies with species and temperature.

Allometric relationships between fecundity and crab size variables have been attributed to the fact that egg mass is limited by the space available for the accumulation of reserves and gonadal development inside the cephalothoraxes. The wide variability in
carapace shape affects the volume reserved for gonadal development and, consequently, spawn size, since the egg mass and the volume of the body cavity usually present similar allometries. Thus, the abdominal size reached during the pubertal molt in brachyurans will be adapted to accommodate the maximum number of eggs produced by a species. Reproductive output per brood is strongly correlated with body size among brachyuran crabs. According to Hines (1982) and Henmi (1989), a lack of relationship between body size and fecundity may have several causes, such as individual variation in egg production, seasonal food availability, and multiple spawning, in addition to natural egg loss. Brachyuran crabs usually carry their eggs attached to the pleopodal setae, forming partially exposed mass of eggs, as occur with Stenorhynchus seticornis (Cabo, 2005). Arshad (2006) in blue swimming crab, P. pelagicus stated that number of eggs increases linearly with increase of carapace length, carapace width, body weight and weight of oviposition.

Hormonal role in the reproduction of invertebrates has long been established and it is well known that physiological and behavioral processes in crustaceans are regulated by neurohormones. In crustaceans many functions have been attributed to the crustacean eyestalk hormones, brain hormones, thoracic ganglion hormone and gonadal hormones. Maturation of the gonads in crustaceans is regulated by two antagonistically acting neurohormones; one is the gonad inhibiting hormone (GIH) from the sinus gland, the second is the gonad stimulating hormone (GSH) that is found in the brain.
and thoracic ganglion (Fingerman, 1997). Eyestalk ablation in crustacean brings about changes in their physiological functions such as growth and reproduction. In crustaceans many functions have been attributed to the crustacean eyestalk hormones. Eyestalk ablation in crustacean brings about changes in their physiological functions such as growth (Kamaguchi, 1971; Nakatani and Otsu, 1980) and reproduction (Adiyogi, 1970; Hisch and Bennett, 1979). Eyestalk ablation brings about rapid maturation of the ovary in some cases and in others previous vitellogenesis does not take place.

The freshwater crab, *Barytelphusa cunicularis* is abundantly available in ponds, lakes and rivers in India particularly in Marathwada region. In addition to its availability, favorable size, good nutritive value and appreciable catch per unit are some factors that have made it commercially important species in the market. With this view, knowledge about its morphology, reproduction, fecundity, sexual dimorphism and neuroendocrine control in reproduction is not only necessary in aquaculture and but it also important to determine the legal size of catchments and to restore normal population of animals in natural habitat. Such type of studies has potential to upgrade the quality of life of rural population through a direct impact on their socio-economic status.

The present work was carried out on freshwater crab, *Barytelphusa cunicularis*. In this work, reproductive cycle with monthly variation in the gonad index was studied; it also describes monthly
variation in carapace length and size at physiological maturity, with the aid of histological observations.

Sexual dimorphism in *Barytelphusa cunicularis* was studied. It was found that major and minor chela in male, abdomen and pleopod growth in female grow at different rates in the mature and immature phases, and such changes are abrupt on the onset of puberty.

Present work also explores fecundity of freshwater crab *Barytelphusa cunicularis*. It also reports relationship between fecundity and sexually dimorphic characters and also states that these characters could be indicator for fecundity. As well as the work was carried on neuroendocrine and endocrine control over reproduction and sexual dimorphism in *Barytelphusa cunicularis*. Eyestalk ablation and administration of brain hormone, thoracic ganglion hormone that caused rapid changes in the development of gonads and of secondary sexual organs.

The international pattern of for thesis compilation has been opted and specifically the ‘Howard bibliography format’ is followed.