Preface
Reproduction is an important physiological phenomenon which is necessary for the continuation of the species. Most of the vertebrate species in general and amphibians in particular reproduce seasonally when favorable conditions exist. Synchronization of gametogenesis with favorable environmental factors ensures successful perpetuation of the species. Changes in temperature, photoperiod, humidity and rainfall affect gametogenesis in anurans and establish different types of reproductive patterns viz., continuous and discontinuous cycles (Jørgensen, 1992; Huang et al., 1997). Temperate species show clear-cut alternation in gonadal activity and quiescent periods correlating with annual climatic cycles (Rastogi, 1976; Jørgensen et al., 1986). The species that inhabit a hot and constant humid climate, exhibit continuous or potentially continuous cycles (Inger and Greenberg, 1963; Rastogi, 1976; Jørgensen et al., 1986; Montero and Pisano, 1990; Prado et al., 2005).

A great deal of diversity in gonadal cycles is found in anurans of Indian subcontinent. The gametogenesis is continuous in some species viz., *Rana cyanophlyctis*, *R. hexadactyla* and *Bufo melanostictus* whereas, in others like *R. tigerina* and American tropical toad, *Bufo marinus* it is typically cyclical (Saidapur, 1982, 1983, 1986; Lofts, 1984). In tropical species, due to hot and humid conditions the breeding phase is extended unlike in temperate species wherein it is restricted to a very short period. Among the tropical species that inhabit the Indian subcontinent the reproductive cycles can be classified into continuous and potentially continuous types (Saidapur, 1983, 86; Pancharatna and Saidapur, 1985) depending on the geographical location and prevailing climatic conditions.
Since climatic factors serve as extrinsic factors regulating reproductive activity same species inhabiting different climatic and geographical regions might exhibit different patterns of gonadal activity. There is a need to understand the biology, especially reproductive cycles of species that inhabit different geographical regions and climatic factors, since populations of many species are dwindling due to anthropogenic activities and habitat destruction. The information will be useful in evolving conservational strategies.

The pre-breeding phase or recrudescence phase is an important phase of gonadal cycle in seasonally reproducing animals and seasonal breeding activity requires a great deal of preparation such as synchronization of gametogenesis in male and female, development of accessory reproductive organs and secondary sexual characters. Both extrinsic (climatic conditions, availability of food and proper breeding grounds) and intrinsic (hormones, nutritional status) factors do influence gonadal recrudescence (Licht, 1984; Callard and Kleis, 1986; Whittier and Crews, 1987; Saidapur, 1989; Sarkar and Shivanandappa, 1989). The extrinsic and intrinsic factors should go hand in hand to initiate gametogenic and breeding activities.

Any factor that affects the onset of seasonal recrudescence, might adversely affect subsequent gonadal development and breeding. Hence, animals might forgo breeding for the entire season. Physical and social stressors are known to affect gonadal functions in vertebrates (Greenberg and Wingfield, 1987; Guillette et al., 1995). For instance, due to overcrowding and low humidity, ovarian recrudescence was inhibited in the lizard Anolis carolinensis, (Summers, 1988, 1995).
Generally under stressful situations, the HPA (hypothalamo-pituitary-adrenal) axis is activated (Guillette et al., 1995). Involvement of HPG (hypothalamo-pituitary-gonadal) axis in regulation of gonadal activity is also well documented in vertebrates. However, information on the interaction of these two axes and subsequent effects on the reproductive functions in lower vertebrates is scanty. There is meagre information on stress/stress hormone induced alterations in gametogenic and steroidogenic activity in lower vertebrates. In addition, it is not known gonads are refractory to gonadotropic stimulation under stressful conditions. Corticosterone is a major stress related hormone in vertebrates (Greenberg and Wingfield, 1987; Herbert, 1995). Any type of stressful situation is known to elevate plasma corticosterone levels. Hence, exogenously administered corticosterone mimics stressful situation experienced by the animals in wilderness and this model can be utilized to understand many aspects of stress induced alterations in reproductive functions. Among the vertebrates, amphibians were the first to experience the land environment and reptiles are first successful land vertebrates. Hence, comparative studies on stress and reproduction in these groups might generate information to fill many lacunae and will be helpful in generalizing the concepts.

In view of all the above facts, the present investigation was carried out to investigate:

1. the pattern of testicular and ovarian activity in the frog *Fejervarya* (*Rana*) *limnocharis* to understand the seasonal reproductive cycle;
2. whether or not exogenously administered corticosterone affects the testicular and ovarian recrudescence in the frog *F. limnocharis* and the lizard *Mabuya carinata* and
3. whether or not the gonads of corticosterone treated *F. limnocharis* and *M. carinata* respond to gonadotropic (FSH) stimulation.
The findings of the present study are presented in three chapters each dealing different aspects as detailed below.

Chapter 1 deals with the pattern of testicular and ovarian activity in the frog *F. limnocharis*, previously known as *Rana limnocharis* or *Limnonectes limnocharis* (Dubois and Ohler, 2000). This study was aimed at investigating the different phases of reproductive cycle of this species and the duration of the different phases. The chapter reveals periods of highest, moderate and lowest gonadal activities during two consecutive calendar years. The seasonal reproductive cycle of the lizard *M. carinata* is well established (Shivanadappa, 1978; Shivanadappa and Sarkar, 1979; Shekarappa, 1979; Sarkar and Shivanadappa, 1989; Yajurvedi and Chandramohan, 1993). Hence the pattern of testicular and ovarian activity of the lizard *M. carinata* was not studied in the present investigation.

In the chapter 2, the focus is on to find out whether exogenous administration of corticosterone has any effect on the seasonal gonadal recrudescence in the frog *F. limnocharis*. The chapter also attempts to explain the influence of corticosterone on hormonally (FSH) induced gonadal recrudescence in the frog *F. limnocharis*.

Chapter 3 embodies the findings on corticosterone induced alterations in the testicular and ovarian activity in the lizard *M. carinata* using protocols similar to the experiment in *F. limnocharis* (chapter 2).

In the present investigation, two species of vertebrates, the frog *F. limnocharis* and the lizard *Mabuya carinata* were selected as models to study the effect of corticosterone, a major stress related hormone on the gonadal recrudescence as both the species face various types of stressors in their local
habitats, such as habitat destruction, anthropomorphic activities, competition for food and predation.

This preface forms the general introduction of the thesis and only important references have been cited, however, each chapter consists of separate introduction where pertinent research work has been referred. Results of the study are presented with the help of tables and graphs and are statistically analyzed using appropriate tests. The histological changes in testis and ovary are presented through photomicrographs.

The results of the present investigation are discussed separately in each chapter under the heading 'Discussion' in the light of investigations carried out by earlier workers in the same field. A separate summary follows each chapter which includes briefly the results and conclusions drawn. At the end, a general summary is presented to correlate the observations of different chapters. The list of references cited in the text of different chapters are alphabetically listed under the heading 'Bibliography'.

Inferences drawn in the present study are based on histology, histometry, follicular dynamics and biochemical investigations. The serum levels of sex steroids were measured (EIA) only in the lizard *M. carinata* as it was very difficult to get enough amount of blood sample from the frog *F. limnocharis* as adults are of very small size and weigh only 2 to 3.5 g. The author is aware that the findings of the present study have to be confirmed by direct methods, such as *in vitro* studies and molecular approach is needed to confirm the conclusions drawn. However, the present study adds a few new observations to our knowledge on stress on the gonadal recrudescence in two groups of vertebrates.