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Man, since early civilization has learnt to derive its protein rich food from different sources of water bodies. Land has limited supply of protein rich food hence man has focused his attention towards the various water bodies for meeting his needs. Scientific attention is required for exploitation and utilization of non-piscine aquatic food resources in an attempt to compensate for the less supply of protein rich food from land.

Fish and prawns are the most significant sources of high quality animal protein for human beings. About 16% of animal protein is consumed by the world population. In Europe and North America, 10% of animal protein is consumed, while in China 22%, Asia 26% and Africa 17% is consumed. FAO (2003) report shows that around one billion people in the world consume fish and prawns as they are important animal protein sources. Fish consumption as animal protein source in Pacific countries was estimated around 100%, in Maldives 85% and in Sri Lanka 55%.

One group of aquatic organisms which is competitive with the fishes and is rather trying to gain a margin over them in terms of commercial gain is that of freshwater prawns and crabs. These creatures are not only good sources of protein and vitamin for us but their continued demand in international market has made their trade to develop as one of the luxury food items.

From the last few decades, the farming of freshwater prawns has increased. Nowadays in the world we can see a spurt in freshwater prawn farming activities. Studies have been conducted to evaluate globally the progress in the prawn farming and also to critically analyze and find the short coming in the freshwater prawn farming and researches.
Since 1995, there has been a great global expansion of freshwater prawn farming. During the last few years a rapid expansion has been shown in China followed by Bangladesh and India. According to FAO (2003), China ranks highest with 128300 mt production of freshwater prawns followed by Vietnam holding second rank with 28000 mt production. In 2001, India became third with over 24200 mt. but according to Anonymous (2003c) in 2002, India exported about 35000 mt.

In Bangladesh, Ahmed (2000) investigated that about an area of 8306 ha was used for the cultivation of *Macrobrachium* sps. in the year 2000 but it gradually increased to 40,000 ha in 2003. The culture of freshwater prawns has given shelter to around 200000 small farmers for their livelihood.

In Brazil, Valenti *et al.* (2001) reported that for the export market and domestic purpose the intensive production of *M. rosenbergii* has been done in Amazonia region of Brazil. In China, improved breed of *M. rosenbergii* was imported from hatcheries of Thailand (Anonymous 2001d). China has been reported to replace the *M. rosenbergii* with *M. malcolmsonii* because it grows faster than the culture of above freshwater prawns and is easily accepted by the consumers. In Jamaica, farming is conducted with polyculture of *Macrobrachium* sps. with Tilapia which has become highly popular. In Malaysia, culture of *Macrobrachium rosenbergii* has been proved popular and is highly practiced (Anonymous 2001i). In Philippines, the culture of *Macrobrachium rosenbergii* in urban areas was highly practiced in metal drums (Anonymous 2001h). Polyculture practices with Tilapia have been conducted increasingly in this area (Anonymous 2001g). In Pacific regions, the eight species of freshwater prawns have been selected for culture as highly potential species (Anonymous 2002a). In Thailand, there was a huge expansion in the field of freshwater production (Anonymous 2001e). In Vietnam, the *Macrobrachium* sps. was reared in the rice field. According to
Buranakanonda 2001 feed for prawns have been developed and farmers were trained to run the hatchery with extension methods.

In India, the *Macrobrachium* culture farming increases year by year. In Andhra Pradesh, the production *Macrobrachium rosenbergii* was estimated about 27,000 mt. and it could be doubled within few years (Anonymous 2003a). The Haryana government tried to use and develop several technologies from Tamil Nadu to enhance prawn farming (Anonymous 2001c). According to Reddy and Rao (2001) in India freshwater prawn farming has been exploited to a greater extent. The polyculture of prawns with carps has been replaced by prawn monoculture (Nandeesha 2003). In India, by 2010 the production of freshwater prawn has increased to 50,000 mt year (Selvaraj and Kumar 2003).

India is one of the important countries of the world for aquaculture. In the field of total fish production of the world, India is placed at third rank. Prawn constitutes one of the important foreign revenue earners for India and its revenue reached up to Rs. 7,555 crore in 2007 - 2008. In the last few decades, the world has seen a doubled aquaculture system i.e. of 8.5 kg (1950) to 16.0 kg (2006). A report has been established by Food and Agricultural Organization which shows per capita average demand in 2010 of about 18.5 kg and in 2015 of about 19.3 kg globally for all seafood. In the global fish market, India contributes about 2.5% of the total world’s fish production of 4.5%. India has raised sea food export to about thousand dollars to billons dollars including prawns and shrimps as a major part of export earnings (Thomson *et al.*, 1986 and Sakthivel, 1988). In the foreign market, the prawns and shrimps are considered to be as luxury food items. In comparison to the marine prawns, the freshwater prawns are also exploited to large scale and proved as good earning source. In today’s world the prawn culture is a field to which most of the countries have shown their interest because of its high profit value.
In prawn and prawn products, the export earnings increased from Rs. 17 million (1960) to Rs. 686 million (1974) and during the last 15 years, in India the catch has increased up to 200,000 tons from 68,000 tones. In 1979, the export was 53,676 tones fetching foreign exchange of Rs. 2,238 millions. In 1982, the export was 54,787 tones fetching foreign exchange of Rs. 3,015 millions. In 1983, the export was 86,169 tones fetching a price of Rs. 3.623 millions. In 1989-90, the export of prawns being 57,824 tones fetching foreign exchange of Rs. 4,633.5 millions. In 1991-95, the export of prawns being 65,404 tones fetching foreign exchange of Rs. 7,659.21 millions. In 2000 and onwards, the export of prawns being 78,598 tones fetching foreign exchange of Rs. 9,563.15 millions.

The knowledge of prawn biology particularly on food and feeding habits, length-weight relationship, condition factor and reproduction is a very important fact. It is not only to fill the lacuna of academic knowledge but also for knowledge utilization in technologies for aquaculture progress.

More than 30 families and around 100 species of macrocrustaceans are distributed worldwide. Macrocrustaceans are aquatic animals living in fresh, brackish and marine water. Generally the crustaceans are directly or indirectly useful for the human welfare and economic progress. It may be said that crustaceans keep up the nutritional balance of fish life. They form an important diet of mankind which has a great nutritive value. Prawns, shrimp, lobsters and crabs are the chief items consumed. *Macrobrachium* such as crabs, lobsters and prawns are attracting scientific attention for their exploitation as fisheries resource for the profit of human being (Ananthkrishan 1982 and Jhingran 1983). They are marines and found close to the bottom or swimming in mid water with planktons. There are several species which live in estuaries, rivers and lakes but none are found in the terrestrial region.
The distribution of *Macrobrachium* species throughout the world is in tropical as well as in brackish water. Around 85 species of the genus *Macrobrachium* are known to be commercially significant, having a considerable demand in the local as well as in international market. Apart from this *P. indicus, P. monodon, P. merguiensis* are having high demand in the aquaculture for their cultivation and larval study in estuarine water. Subramanian (2000) reported the prawn fishery off Cuddalore in northern Tamil Nadu coast. It was studied for 1972-74 and 1986-88 with abundance of bathymetric pattern and species were highlighted along with the change in two spells quantitively.

Few freshwater larger species like *Macrobrachium rosenburgii, M. malcolmsonii* and *M. choparai* have significantly contributed to commercial fisheries (Holthuis and Rosa, 1965) but there are several small size prawns which do not have the same status of marketing like *Macrobrachium lamarrei lamarrei, Macrobrachium kistnensis* are likely to be said as minor prawns but presently do not attract the attention of scientists.

Freshwater prawns, *M. gangeticum* and *M. malcolmsonii* are the few larger species having a great potential to aquaculture. Recent studies have been conducted to study the different aspects like distribution, growth, breeding pattern, migration and maturation of *Macrobrachium* spp. by several investigators such as Kanaujia (1989) and (2003), Kanaujia et al. (2000), Kanaujia et al. (2001), Kanaujia et al. (2005), Mohapatra (2001), Manush et al. (2007), See et al. (2008), Das and Tiwari (2008), Soundarapandian (2008), Soundarapandian et al. (2008), Akintola and Bakare (2011), Shanju and Geraldine (2011), Sriputhorn and Sanoamuang (2011). Vinay and Deshmukh (2002) reported the biology of non- penaeid prawn *Acetus indicus* (small prawns) from coastal waters of Bombay. Mossolin and Bueno (2002) reported a relationship between reproductive peaks and months with rainfall and temperature in Brazil in freshwater caridean species.
Macrobrachium lamarrei lamarrei (H. Milne Edwards) is widely distributed in tarai region of Kumaun Himalayas. The freshwater prawn of present interest belongs to the category of minor prawns. It generally generates a universal appeal with unique taste, high unit value and ever increasing demand in the market as it has been given a prime importance. The target species in terms of availability and size compete well with other exploitable species of smaller prawn and thus constitute an important local food resource.

An environment basically influences the growth and survival of any living organism. Its growth directly correlates with several environmental factors such as temperature, pH and dissolved oxygen which play an important role on the survival and growth of aquatic organisms. A significant relationship is seen between environment and living organisms.

One of the significant environmental factors is temperature which influences the metabolic activity of living organisms (Hutchinson 1957). According to Jone (1990), environmental factor directly and indirectly affects the rate of survival and reproduction of any aquatic organism. In winters several aquatic organisms are subjected to a change from higher range temperature to a lower range temperature and it is opposite in summers as they face comparatively to higher range of temperature. A temperature variation $10^0\text{C}$ to $40^0\text{C}$ was recorded in swamp water. Crustaceans generally hold a temperature range of $0^0\text{C}$ to $29^0\text{C}$. Several person as Hair (1971), Tomescu and Radu (1971) and McLeese (1956) have worked on the study of the several variations of temperature on prawns. A very low temperature and high temperature about $>30^0\text{C}$ adversely affect the rate of production as reported by Philipose (1960). Biological and chemical factors with temperature change can affect the biological productivity and metabolism of the organisms which was reported by Hutchinson (1957).
Sharma et al. (2009) studied to determine the effects of environmental stress factor on Indian white shrimps *Fenneropenaeus indicus* (H. Milne Edwards, 1837). In the opossum shrimp *Neomysis awatschensis* a study has been done by Hair (1971) on upper lethal temperature and thermal stock tolerance and the higher temperature from 28°C to 30°C showed a better production due to proper availability of nutrient which results in good growth rate. McLeese (1956) investigated on American lobsters for the effects of different temperature on their survival. Spoor (1955) and Brett (1956) reported that in the aquatic organism the varying temperatures have direct relationship with lethal limits. The above studies were basically made on marine prawns. In the present study, the tolerance in different temperatures over a 12 hrs period was observed and it was found that a lower lethal temperature was 4°C and upper lethal temperature was 36°C for juvenile and adult prawns both.

Another important factor that requires for the survival of aquatic organism is dissolved oxygen. It regulates all the metabolic activities. Dissolved oxygen is found either through the process of photosynthesis or through the diffusion from the atmosphere. According to Boyd and Pillay (1984) for the survival and growth of prawns a concentration of 6-9 mg/l of dissolved oxygen was required. In water, low dissolved oxygen leads to suffocation in prawns while a high concentration leads to air bubble disease followed by mass mortality. Odum (1971) state that for a balanced nature of an ecosystem a net production of 8 g dissolved oxygen m⁻² was required. A decreased concentration of dissolved oxygen with increased water temperature was reported by Sharma and Saini (1992). No studies have been done on dissolved oxygen with survival of prawns. In the present study 100% mortality was recorded at 2.5 ppm of DO concentration and above 2.5 ppm DO concentration variable were shown but above the DO of 3.5 ppm in
the juvenile, mortality did not occur while in adult mortality did not occur at the DO above 4.5 ppm. The mortalities were recorded after 8, 16 and 24 hrs.

According to Powers (1930), Lowndes (1952), Spoor (1955) and Brett (1956) another important factor that affects the survival and reproduction is pH. Very few literary articles are available in relation to survival of freshwater prawns. Newcombe (1955) reported the study on tolerance of different pH on *Parastacoides tasmanicus*, a crayfish. Davies and Ozburn (1969) investigated the study on *Daphnia pullex* for tolerance of varying pH. Philippose (1960) suggested that a pH ranging from 7-8 was good to support the aquatic life. For maximum productivity a pH range of 5.9-8.5 for fish was given by Alabaster and Lloyd (1980). In the present study the juvenile showed no mortality between the range of 6.75 to 8.75 and in adult the range was 6.50 to 9.00. Juvenile were having a poorer tolerance of pH levels towards alkaline and acidic sides than in adult.

According to Jahilal et al. (1979) the small size prawn is highly popular as a protein and vitamin rich food for poor folk. According to Sankolli et al. (1978) and Jahilal et al. (1988) minor category prawns were considered as potential culture species due to their several characteristics like high survival rate and early maturation. In tarai region a disorganized fishing on *Macrobrachium lamarrei lamarrei* is conducted by the local people. To the best of my knowledge no biological data on this species exist in literature except a brief survey noted by Tiwari (1955). So, it was really interesting to study the certain aspects of ecology and reproductive potential of *Macrobrachium lamarrei lamarrei* (H. Milne Edwards) which may be of much help for their commercial exploitation.

Food is a necessary requirement for living organism. Nutritious food is the major source of energy and governs all the physiological and metabolic processes. For revealing the food preferences of any particular
species the knowledge of its feeding is necessary which in addition helps in the culture of the particular species by providing food of its choice. According to Silas (1978) and Kurain and Sebastian (1976) few literature in respect of food and feeding habits are available in our country. The study of food and feeding is significant for academic as well as commercial point of view. According to Marshall and Orr (1960) a majority of prawns feed on variety of foods but still there are few specialized feeders. New (2005) reported that in order to establish the farming status, the food and feeding study was conducted on *Macrobrachium rosenbergii*. Lee *et al.* (1992) found that the shrimp *Lucifer faxoni* can continuously feed on food if food is present.

*Macrobrachium lamarrei lamarrei* was observed as omnivorous in nature. Under the laboratory conditions in its gut plant food, animal food, sand and debris were obtained. It could feed on any type of food available at that time but if they have a choice between plant food and animal food then they chose the animal food. In comparison to other prawns a very few information regarding the food of *Macrobrachium lamarrei lamarrei* was known. Dall (1968) reported that in Australian commercial penaeid, *P. esculents, P. plebejus, P. merguiensis* and *Metapenaeus bennettae* the gastric mill was mostly comprises a huge amount of annelids jaws, chitin fragments, fish scales, setae and sand as unrecognizable material. Kurian and Sebastian (1976) investigated that prawns feed on organic matter because they choose to live in benthic regions.

Panikar (1952) investigated that minute organism, algae and detritus are the food of young penaeids. According to George (1972) several food preferences of prawn species like *Metapenaeus affinis* prefer vegetable food whereas *Metapenaeus monoceros* prefer animal food. According to Petrusewicz and Macfadyen (1970) by an animal an amount of food which
is ingested in to new formed tissue or used for respiration is known as assimilation. According to Schindler (1971) in decapods crustaceans the type of food affects the assimilation rate.

Kuttyyamma (1974) studied that several seasonal variations in feeding pattern of prawns occurred. Like in the monsoon season the plant food was highly present in *M. affinis* and *M. monoceros* similarly a huge amount algae was present in *P. indicus*. But in *Macrobrachium lamarrei lamarrei* a variation with season in the contents of food was shown. During the months of monsoon (June/July to September) a rise in food contents with huge amount of unidentified material like chitin fragments, annelids etc are found while a decrease in the plant food was noticed. A percentage of sand and debris was also highly noticed due to the presence of soil micro organism obtained in the rain. According to Williams (1955) in prawns unidentified food was the part of their diet. Moriarty (1977) reported that the diet of prawns also comprises of micro flora and microfauna as well as bacterial colonies from substrate.

Few articles are available on the seasonal variations on the basis of gastrosomatic indices (GSI) and feeding indices (FI) in freshwater prawn *Macrobrachium lamarrei lamarrei*. According to Hynes (1950) correlation has been shown between feeding rate and food availability with sexual cycle in fishes. In *Macrobrachium lamarrei lamarrei* a one year observation was conducted to find out the GSI and FI. It obtained that the gross feeding intensity was related with seasonal variations but not with food availability. *Macrobrachium lamarrei lamarrei* was omnivorous in nature and has a huge range of food material.

Growth of any organism is governed by its diet. The organic fertilizer enhances the natural productivity of water bodies so that sufficient aquatic organisms should be available throughout the growing season (Louis *et al.*
Vijayagopal et al. (2008) studied to determine an appropriate protein ratio with energy calorie on Indian white shrimp *Fenneropenaeus indicus* by performing an experiment on six compounded feeds which includes fishmeal, groundnut oil cake, clam meal and shrimp meal. Protein is the major source required in the diet for the proper growth of prawns. A variation in the protein requirement of shrimps has been shown like in *P. californiensis, P. vannamei* about 30% to 35% proteins required (Colvin and Brand 1977). In *P. indicus* about 43% protein was required (Forester and Beard 1973). It has been observed that more than one protein source was proof better in the growth of shrimps. In crustaceans carbohydrate nutrition information is limited but diet increase in glucose reduce the growth of the prawn. An attempt was made by AniKumari (2004) to find out the optimum duration and maximum enrichment levels of three probiotic organism viz. saccharomyces boulardii, Lactobacillus platefarull and Bacillus sublilis in *Arlemia nauplii* during the larval rearing of the shrimp *Penaeus monodon* (Fabricius, 1798).

In prawn culture, feasibility can be estimated by food conversion ratio. In *M. lanchesteri* with *Tubifex* worms the FCR was calculated as 10:1 by Ponnuchamy et al. 1981. Forester (1986) reported that for tropical prawns a FCR of 2:1 was required before the economic viability of their culture. In the present study of *M. lamarrei lamarrei* a different composition diet experiment was conducted to estimate the FCR. It was estimated that 9.71:1 for pure vegetarian diet (soyabean), 7.92:1 for non vegetarian diet (fish meal) and 5.44:1 for compound diet (soyabean and fishmeal both).

Relative growth rate is an important aspect of an aquatic organism. From the point of human consumption, the prawn meat accompanies only the abdominal parts of the body. The growth results in to certain alternative between the body parts (Hartnoll 1982 and Simpson et al. 1960) and
therefore, according to Bisht et al. (2002) the study of relationship between the growth of abdomen and other body parts may provide important information for the determination of ideal size for fishing. A minor category freshwater prawn *Macrobrachium lamarrei lamarrei* is widely distributed in tarai region of Kumaun Himalayas and has a great potential species for aquaculture. According to Gyananath and Sarojini (1986), a strong relation between sexual maturity and linear growth has been observed. It is interesting to estimate the average length and size at which the animal attains the maturity. The study will exhibit a profit linked for harvesting. A growth rate of 2.0 mm and 4.0 mm per month was recorded in *M. kistnesis* by Kulkarni (1972) while in the month of June and October a growth rate of 20 mm per month was recorded in *M. rosenbergii* by Raman (1967). Generally females grow larger than males in few species. The growth rate in male and female *Crangon affinis*, a sand shrimp was quite similar despite of both having a little difference in size.

Analysis and estimation of length of known weight and weight of known length is generally known as the study of length-weight relation. Jhingran (1951) observed a length-weight equation by determining ‘n’ value of exponent and ‘c’ constant.

Rounsefell and Everhart (1953) reported that the weight of prawns or fish would vary as the cube of length. Beverton and Holt (1957) and Ricker (1975) state that for yield equation to estimate the no. of specimen and their present population the study of length-weight relation is very significant. The knowledge of length-weight relation is the first important thing besides the other things in order to know the assessment of the animal under the several geographical conditions (Malhotra and Chauhan (1984). Mello (1973) investigated that the study of length-weight relationship and their curves which helps to know the natural prawn population. In several prawns the length-weight relationship was determined like in *M. rosenbergii* (Rao
1967), *M. holthuisi* (Lobao and Lona 1979) etc. Almost similar relationship was shown between male and female.

The biologists used to determine the relative condition factor in order to evaluate the robustness of specimens. It is very unfortunate to say that nothing is known about condition factor of prawns. According to Narasimham (1970) the fluctuation in condition factor was not related to the sexual cycle. In *M. lamarrei lamarrei* in both sexes the values does not relate to the sexual cycle.

The culture of an organism as a fishery resource requires the basic knowledge of male-female sex ratio, size related sexual maturity, ovarian and brood fecundity, breeding pattern including gonadosomatic index, hepatosomatic index, ecofactors with relation to the breeding pattern, the life cycle and the histology of that organism.


Factors that had a significant influence in fishery resource are sex ratio, size related sexual maturity and fecundity. Brood and ovarian fecundity has an important role in prawn culture. In the prawn culture fecundity along with egg loss is directly related with production of prawn. For the successful rearing of prawn the knowledge of fecundity is necessary. Several works has been done on fecundity along with the study on egg loss of freshwater prawns. Several workers like Pandian and Balasundaran

Most of the studies on breeding pattern of crustaceans are related with morphology of gonads, colour or shape of gonads, gonadosomatic indices and hepatosomatic indices. Some other related work has been done by Gyananath and Sarojini (1986), Lawerence *et al.* (1979), Primavera (1980), King (1948), Rajyalakshmi (1980) and Rao (1968). GSI estimation was done to know the population of reproduction at a time. Its cycle of reproduction was reported by Giese (1959), Rodrigues *et al.* (1978). Santos (1972) reported that in a very simple way GSI was calculated to show a linear relationship between body weight and gonad weight. To calculate the nutrient from hepatopancreas to gonads during gonadal maturation is known as hepatosomatic indices (HSI) (Pillay and Nair, 1973, Giese and Pearse, 1974).

The studies of histology of gonads were mainly conducted to bring the changes in a cycle form present in them. Histological changes give a proper picture of maturation of testes and ovary. Several works on histological examination were done by Agarwal (1985), Motoh (1978),
Weiglus (1976), Goldstein and Lauris (1975) and Subramanyam (1987). In different crustaceans, a diverse pattern of seasonal cycle of testes and ovary was investigated by Baker and Rosof (1927), Black (1966), Diwan and Nagabhushan (1974) but the workers who examined through histology are very few like Goldstein and Lauria (1975), Joshi and Khanna (1982 a & b) and Agarwal (1985). So an attempt has been made to study the gonadal maturation through histological examination.

According to Gyananath and Sarojini (1986), Kulkarni and Nagabhushanam (1982), Chandran et al. (1982), Jeol and Sanjeeva Raj (1982), Joshi (1980), Rahaman (1967), Boolootain et al. (1959), different breeding patterns like annual breeding, biannual breeding and continuous breeding exhibits in several crustaceans in different locations. According to Rajyalakshmi (1980), Giese (1959) and Krishnaswami (1967) the fluctuations in breeding pattern was directly concerned with ecofactors. It includes the factors which are water depth, pH, dissolved oxygen, carbon-dioxide and temperature. In marine organism the breeding pattern was correlated with different environmental factors (temperature, rainfall etc) which were reported by Paul (1942) and Krishnaswami and Krishnam (1967). Giese (1959) investigated that temperature had an important effect on growth and maturation. In micro crustacean a relation between reproduction and lunar cycle was obtained by Gifford (1962). Variations reported in reproduction are very difficult to observe on the basis of ecological factors. With respect to freshwater prawns very less information is known.

Several works have been written on penaeid larvae by Muthu (1982), Kurata and Shigueno (1979) and Cook (1968) and on freshwater prawn work has been done by Jahilal et al. (1982). Several larval development studies has been done like in *M. malcolmsonii* by Kewalramani et al. (1971),
M. shokitai by Shokita (1973), M. potiuna by Sollaud (1923), M. intermedium by Williamson (1972), M. rosenbergii by Ling (1969). Antony (2005) reported the distribution and occurrence of planktonic shrimps of the genus Lucifera in the EEZ of India. Abraham (2005) studied the reproductive physiology of Metapenaeus monoceros (Fabricus). Abdussamad (2006) observed the variations of penaeid post larval in the backwaters of Cochin in ingress, recruitment and abundance in relation with site location, tidal, lunar and seasonal rhythms. Uno et al. (1969) reported larval development of Macrobrachium rosenbergii. For the high yield of seed production and culture practice the study of larvae was taken in to consideration. The motive to study the larvae, post larvae and juveniles are commercially and specifically oriented for high yield production of seed of any particular specie. An attempt has been made to develop a study of larvae on Macrobrachium lamarrei lamarrei. It seemed that it was an abbreviated type of larval development in which animal body was large but comprises lesser amount of eggs and exhibits free swimming larval stages.

According to Browdy and Samocha (1985), Brown et al. (1980), Lee and Fielder (1982), a unique technique for raising the seed production was indulged for culture of crustaceans by unilateral or bilateral eyestalk ablation completely named as artificial breeding. Central Marine fisheries research institute of Cochin made a partial successful attempt to develop prawns through eyestalk ablation. It has been shown that the degree of gonadal development in prawns by eyestalk ablation or hormone injection depends on the season of the year and phase of ovarian cycle (Bomirski and Klek 1974) and the effect of injection of extracts of brain, thoracic ganglion and eyestalk ablation on gonadal maturation have been studied (Bisht et al. 2007). So, in the conclusion it was very necessary to understand the environmental and hormonal factor of reproductive cycle. The techniques
will particularly help the species to exploit successfully for the commercial purposes. Soni et al. (2007) reported the larval biology of three Macrobrachium spp. viz. M. rosenbergii, M. malcolmsonii and M. gangeticum widely distributed in Indian riverine system in order to develop new technology for seed production on large scale in hatchery.

According to Adiyodi and Adiyodi (1970) and Highnam and Hill (1977), there are several hormones which control the breeding activities. In the reproduction of decapods different hormones are involved in which growth inhibiting hormone (GIH) was one of the important hormone which originates from para-ganglionaris X organ of the neurosecretory cells in the eyestalk. While the other hormone was growth stimulating hormone (GSH) which originates from brain and thoracic ganglion by their neurosecretory cells (Hinsch and Bennett 1979). According to Nagabhushanam and Diwan (1974), Panouse (1943) and Otsu (1963) an increase in the weight and size of gonads occurred by removal of eyestalk (experimentally) due to GIH. In prawns and crabs a precious induce maturation of ovary and testes were investigated through the injections of brain and thoracic extracts due to GSH by Kulkarni et al. (1981), (1984). According to Agarwal (1985) and Matsumoto (1958) in the several crustaceans a correlation was established between cyclic development of gonads and neurosecretory cells. According to Rangnekar et al. (1971) and Carlisle (1954) in general a inhibitory effect was shown by injections of eyestalk extracts whereas for the gonads a stimulatory effect of brain and thoracic extracts and eyestalk ablation but at the species level different alterations have been found to be existing. So in order to explore more about freshwater prawns regarding the role of GIH and GSH from the extracts of brain and thoracic or extracts of eyestalk several experiments were demonstrated. According to Carlisle (1954) on shrimp Lysmata seticaudata and Aoto and Nishida (1956) on prawn
*Pandalus kessleri* no gain in size and weight had been observed but a significant development had been attained in the ovaries during the eyestalk ablation. Similarly no effect of brain hormones and thoracic ganglion was found in testes of crab *Scylla serrate* (Rangnekar et al. 1971). So in crustaceans more studies should be conducted to develop more information about brain and thoracic ganglion as well as eyestalk ablation. Zacharia and Kakati (2002) investigated the ovarian maturation of eyestalk ablated species *Fenneropenaeus merguiensis* under the environmental conditions and reported that for females, induced maturation unilateral eyestalk ablation, high salinity, optimum temperature and good water parameter are necessary.

The freshwater prawn *Macrobrachium lamarrei lamarrei* (H. Milne Edwards) is by the virtue being a good source of animal rich protein and widely distributed in Kumaun tarai region, Uttarakhand. Despite all these features, no attempts have been made in this direction so far by the biologist. With the objective to develop the ecological and reproductive potential of *Macrobrachium lamarrei lamarrei* (H. Milne Edwards), the findings are complyed in the thesis with several aspects as follows:

- Physio-chemical parameters.
- Food and feeding habits.
- Growth studies.
- Breeding pattern.
- Tolerance on varying temperature, dissolved oxygen and pH on survival of prawn.
- Experimental (induced) breeding studies on prawn reproduction.