CHAPTER 3

3. Review of Literature

Several studies have been conducted in Khangchendzonga BR so far focusing on flora, fauna and several other studies on use of natural resources and traditional knowledge of different tribes living in the buffer villages of Biosphere Reserve.

3.1. Faunal Studies

Studies on birds and butterfly communities and their habitats were studied in Prek and Churong chu watersheds of Khangchendzonga BR along a very popular (Yuksam-Dzongri) tourist trekking corridor (Chettri, 2000a). Bird community of Yuksam-Dzongri trekking trails was studied by Chettri et al., (2001) and checklist of birds of same location was documented by Chettri (2000b). The relationship between birds and butterflies of Yuksam-Dzongri trekking corridor with respect to different vegetation variables was studied by Chettri et al., (2005). Adjacent to the Khangchendzonga BR, at the Teesta basin in Sikkim, long term ecological studies had been carried out on the distribution and resource use pattern of reptiles (Chettri, 2007). Ganguli-Lachungpa et al., (2007) describes the significance of Khangchendzonga BR landscape as Important Bird Area. Acharya (2008) studied on the distribution pattern of bird communities along the elevation gradient of eastern Himalaya. Chettri (2010) studied on the relationship between woody tree, bird and butterfly.

3.2. Floral Diversity

Plant diversity in Khangchendzonga BR was taken up by Maity and Chauhan (2002) and Chauhan et al., (2003). Studies on impact of grazing on plant diversity and productivity along tourist trekking corridor in the Khangchendzonga BR was taken up by Singh et al., (2003). Diversity of vascular plants in the entire Khangchendzonga BR was assessed and documented through a major study carried out from 1999 to 2004 (Maity, 2004). Maity and Maity (2007) described the wild flowers of Khangchendzonga BR. Study by Chettri et al., (2009) recorded new herb species, Ceropegia hookeri, from Yuksam-Dzongri trekking trail which was not reported after its discovery by Clarke in 1909 from Zemu Valley, located in the northern part of the Biosphere Reserve. Occurrence of new species of Panax has been reported from West Sikkim (Sharma and Pandit, 2009). Conservation and population of Rhododendron maddenii around Khagchendzonga BR has been assessed by Badola and
Pradhan (2010). Discovery of new population of rare species of *Rhododendron niveum* along Tholung-Kishong trekking corridor in Khangchendzonga NP was reported by Badola and Pradhan (2010). Another long-term study (1999-2005) on effect of anthropogenic pressures on the natural resources was carried out in Khangchendzonga BR with more emphasis on the buffer zones of Khangchendzonga NP and in the fringe villages was carried out by Chettri (2005). Among the non timber forest produce, Chettri et al., (2005) recorded 94 species from *Yuksam-Dzongri* trekking corridor of Khangchendzonga BR. Among the recorded 94 species, 8 were used for construction, 42 as food, 31 medicinal, 8 decoration and 5 for fiber and incense. Singh and Sundriyal (2005) recorded high floral diversity as well as high nutrient and mineral content in most of the species from alpine pastures. Beside this, the collection of these plants species for medicine, incense and tea-substitute by the local people in addition to grazing was reported. Assessment of scientific use of firewood and fodder values of local communities in *Yuksam-Dzongri* trekking corridors showed the congruence between the local preference and high values for fodder and fuel wood properties (Chettri and Sharma, 2009).

3.3. Ethnomedicine

Maity et al., (2004) reported 21 flowering plant species collected regularly by the Lepcha and Nepalese community from Khangchendzonga BR, while Chettri (2005) documented the use of 110 plants species as ethnomedicine by the Lepcha tribe in Dzongu Valley bordering Biosphere Reserve. In the cultural landscape of Khangchendzonga NP, research on ethnography of the local inhabitants and the detailed investigation on the available literature on them in India had been carried out by Arora (2004). Chettri (2005) documented 110 plant species used as ethnomedicine by the tribal people in Khangchendzonga NP. Use of ethnomedicinal plants by the Lepcha tribe of Dzongu has been documented by Pradhan and Badola (2008).

3.4. Management and Development

Contingent valuation surveys was conducted by Maharana et al.,(2000a) in Khangchendzonga NP and found that foreign tourist were willing to pay at the top followed by local community and domestic tourist for the maintenance of the park. Some studies stressed that the villagers/local community must be involved in decision-making for the developing grazing regulations, and their traditional knowledge to be given due respect for the proper management of the protected area and to prevent conflict arising in the Biosphere
Reserve (Krishna et al., 2002; Singh et al., 2002, 2003). Interrelationship between alpine vegetation, landscape parameters, and land use patterns in the alpine zone of Khangchendzonga BR has been assessed by one long term ‘action research’ which also helped to develop a long term conservation plan and its implementation (Tambe, 2007). Tambe and Rawat (2009) depicted economics and ecology of the pastoral system in Khangchendzonga NP and found that sheep has been replaced by yaks.

3.5. Indigenous/Traditional knowledge

Skill of bird identification techniques using local knowledge by the Lepcha tribes can be applied in the biodiversity assessment programme (Acharya et al., 2009). A study by Tambe and Rawat (2009) suggested that the shepherds had an immense traditional knowledge on the fodder resources, medicinal plants and wildlife which is supported by high nutrient content in the fodder resources they prefer to graze their sheep. Thus, they can be involved in the conservation as well as the park management.

3.6. Socio-economic Studies

Economics of livestock grazing was studied and its impact on the environment was assessed in North Sikkim, particularly in the Lhonak and Rangyang watersheds of Khangchendzonga NP (Paljor, 1995). At the similar study sites, the impact of grazing on plant diversity and productivity (Singh, 2000) and socio-economic aspects such as the economic benefits and conservation linkages of tourism in the context of Khangchendzonga BR were also assessed simultaneously (Maharana, 2000). Socio-economic studies on the evaluation of the sacred Khecheopalri Lake in Khangchendzonga BR were carried out by Maharana et al., (2000a). Environmental economics of Khangchendzonga NP along with the usability of the calculating methods has also been assessed by Maharana et al., (2000). Krishna & Sharma (2002) worked on the landscape change, resources status and human dimension in Khangchendzonga BR. Krishna et al., (2002) worked on the landscape change, resource use pattern and conflict prevention in Khangchendzonga BR.

3.7. Studies on Galliformes

Gleaning of literature specific to the study species revealed that studies on the ecology of these species are limited. There have been a few intensive studies on the galliformes in China, Nepal, Malaysia, India and Pakistan but most of the available literatures are on surveys and short term studies. Ahmed and Kaul (1997) carried out pheasant survey in
Arunachal Pradesh. Sathyakumar et al., (1993) studied the ecology of kalij and monal pheasants in Kedarnath Wildlife Sanctuary. Khaling et al., (1999) studied the ecology of the satyr tragopan in Singhalila National Park, Darjeeling. Information available on Himalayan monal is anecdotal and have been obtained from different surveys (Gaston et al., 1981; Lelliot, 1981; Gaston et al., 1982, 1993; Lamba et al., 1982; Sharma and Pandey, 1989; Gaston & Garson, 1992; Choudhary, 1993; Kaul & Garson, 1993; Sharma, 1993; Kumar, 1997; Yahya, 1993a; Ramesh et al., 1998; Jandrotia, 1999 and Sathyakumar, 2004). Sathyakumar et al., (1993) gathered information on relative abundance of monal and habitat utilization of this species was studied by Bisht et al., (1989) in Kedarnath WS. Kumar (1997) did the first ever intensive study focusing on the ecology of Himalayan monal in Kedarnath Wildlife Sanctuary, Western Himalaya. Identification of key habitat for monal has been identified by several workers (Lelliott and Yonzon, 1980; Young and Kaul, 1987; Inskipp and Inskipp, 1993a & b; Kaul et al., 1995). Chandola-Saklani et al., (1989) and Sharma and Chandola-Saklani (1993) studied the behaviour and seasonal movement of kalij pheasant in Garhwal. Survey of pheasants in Shimla hills was carried out by Sharma and Pandey (1989). Abundance and habitat use studies was carried out by Ahmed and Musavi (1997) in Ranikhet (Uttarakhand, India). Similar studies on white-crested kalij were conducted by Iqbal (1992) in Kumaon (Himachal Pradesh). Preliminary surveys on the status and distribution on the abundance of pheasants in Beas valley was carried out by Pandey (1993). Sathyakumar et al., (1993) studied on the abundance and habitat of monal pheasant and kalij pheasant in Kedarnath Wildlife Sanctuary. Literature on the status and distribution of satyr tragopan were available from the pioneering works of Jerdon (1864), Bebbe (1918-1922), Meinertzhan (1926), Whistler (1926) and Ludlow and Kinnear (1937). Ludlow (1944) has reported satyr tragopan from Chumbi Valley adjacent to Tibet in Sikkim. Reports of satyr tragopan are available from all over Nepal Himalayas (Lelliott and Yonzon, 1980; Froster and Lelliott, 1982; Roberts 1983 & 1987; Picozzi, 1985 & 1987; Inskipp, 1989; Amatya, 1997; Maskay, 1997). Satyr tragopan is reported from Sikkim in thick canopy of tree or climbers in the Khangchendzonga NP (Pazo, 1982; Lepcha, 1997). The satyr tragopan distribution in Bhutan has been reported by Ali et al., (1972); Inskipp and Inskipp (1993a); King (1995 & 1996); Bishop (1997); Tymstra et al., (1996). Survey of galliformes from northeast India includes the distribution, status and conservation of galliformes in the northeastern region of India (Choudhury, 2005; Ghosh et al., 2002). A study on the extraction and use of galliformes by indigenous ethnic groups in northeast India has been carried out (Hilaluddin et al., 2004;
Hilaluddin and Ghosh, 2005). A number of works have been carried out on galliformes in specific protected areas in different parts of northeast India such as Maenam Wildlife Sanctuary, Sikkim and Dibang-Dihang Biosphere Reserve, Arunachal Pradesh (Ahmed, 1999; Ghose and Fingu, 2002). In the other states of northeast India, species specific works has been carried out such as those regarding the distribution and conservation status of the satyr tragopan, the blyth’s tragopan, monal pheasant, mountain peacock Pheasant, Manipur bush quail (Ahmed et al., 2003; Ahmed and Kaul, 1997; Ghose et al., 2002; Kumar and Singh, 2000; Choudhury, 2006). Literature review on pheasant population in Himalaya revealed that Himalayan monal, koklass and kalij pheasant can be found in the Western Himalaya. Ramesh (1999) reported the presence of western tragopan from Jammu & Kashmir through Himachal Pradesh and east up to Uttarkashi district in Uttarakhand, but it seems to be absent further east.

The status and distribution of monal, koklass and kalij pheasants in Nanda Devi Biosphere Reserve were established from the surveys conducted by Lamba et al., (1982) Sathyakumar (2004). Severinghaus (1979), Khan and Shah (1982) and Shah (1993), who conducted their studies in Pakistan attempted to monitor the population and habitat use respectively. Besides these two studies, other information available on these species have come from status surveys and alongside studies on other animals ( Gaston et al., 1981, 1983; Gaston & Garson, 1992; Gaston et al., 1993; Choudhary, 1993; Kaul & Garson, 1993; Pandey, 1993; Sathyakumar et al., 1993; Sharma, 1993; Ramesh et al., 1999 and Jandrotia, 1999; Sathyakumar, 2004). Responses of galliformes to anthropogenic pressures in buffer zones of Nanda Devi Biosphere Reserve has been investigated by Bhattacharya et al.,(2007).

From the available knowledge based on galliformes, the dearth of ecological studies on these species in eastern Himalaya is very evident. Only few short surveys have been carried out so far. The ecology of galliformes in the more humid and denser habitats of eastern Himalaya is still remained unexplored. In the context of the highly diverse yet highly fragile ecological features of eastern Himalaya, this major information gap on the galliformes, one of the prime aspects of mountain ecology, can be proved as the major hindrance in the way of proper conservation and better management in current as well as in future scenario.