CHAPTER I:
INTRODUCTION
CHAPTER I: INTRODUCTION

1.0 INTRODUCTION

The North-East India lies at the crossroads of the Oriental Region within Indian subcontinent with tropical semi-evergreen and moist deciduous forests in the lowlands of North-East boarder extending from the south and west into the subcontinent, and east into southern China and South-East Asia. In the plains of Assam, the wetlands and grasslands support a distinct group of birds, many of which ranges to the Gangetic plain in the west and the wetlands and grasslands of South-East Asia in the east. Himalayan temperate and sub-alpine zone forests extend from northern Pakistan and adjacent Afghanistan through north-east India to south-west China, and at high altitudes alpine habitats support many birds characteristic of the mountains of central Asia. This area probably supports the highest diversity of bird species in the Orient (Crosby, 2004).

1.1 IMPORTANCE OF WETLANDS IN LIFE SUPPORT SYSTEM

Water is the most abundant single substance in the biosphere which has the central role in mediating global-scale ecosystem processes, linking atmosphere, lithosphere and biosphere by moving substances between them and enabling chemical reactions to occur. Spatial and temporal differences in the availability of water and its solutes are important determinates of ecosystem richness. Freshwater forms the habitat of large numbers of species at the Earth’s surface which represent a substantial sector of the Earth’s biological diversity. Wetland systems support thousands of people, by providing
goods and services to them, directly or indirectly. They help to check floods, prevent coastal erosion and mitigate the effects of natural disasters like cyclones and tidal waves and also stores water for a longer period. Their capacity during heavy rainfall to retain excess flood water that would otherwise cause flooding results in maintaining a constant flow regime downstream, preserving water quality and increasing biological productivity for both aquatic life as well as human communities of the region. Due to extensive food chain and immensely rich bio-diversity they support, the wetlands are also called as "biological supermarket". Many birds including waders and herons are closely associated with wetlands and water margins. Relatively few, including divers, grebes and ducks, are restricted to river and lake systems. Wetlands are often key feeding and staging areas for migratory species (Groombridge and Jenkins, 1998). Many wading birds and waterfowl like egrets, herons, cranes etc. nest in wetlands and many other birds such as storks, kingfishers, tree ducks etc. are completely or partly dependent on wetlands for their existence.

Wetland ecosystems are not isolated units but closely integrated into the structure and function of the landscape and the inland wetlands are dependent on their terrestrial catchment areas while coastal wetlands are also influenced by the sea. This means that the logical and ecologically correct procedure for the restoration of a wetland has to start on land within the landscape (Bjork, 1994).

Wetlands are valuable to society in overt, recognizable ways, notably through their productive functions and wetland fisheries are a crucial source of animal protein for much of the developing world (Prentice, 1995). Today wetlands continue to provide
livelihood to the rural people in Asia, especially in South and South-East Asia, where vast population inhabit the lowland wetlands along the great sluggish streams and floodplains that characterize this part of the globe (Giesen, 1995). Wetlands plays various important roles in the environment by performing a number of crucial functions like reducing river flush, preventing sediment deposits in riverbeds, preventing loss of fertile soil, ensuring the optimum level of high quality ground water, cleansing drinking water, removing pollutants, preventing undesired water logging, etc., besides supporting a diverse range of birds, animals and plants and providing immense scope for eco-tourism. A wetland can transform into a climax forest over a period of time (Urfi, 2004).

Freshwater eco-systems occupy only 0.8 percent of Earth's surface (Mc Allister et al., 1997), but species richness is high. An estimated 12 percent of all animal species live in freshwater and many others including humans depends on fresh water for their survival (Revenga et al., 2000).

In India there are about 2,167 recorded natural wetlands, covering an area of about 1.5 million hectares, besides 65,254 artificial wetlands with about 0.25 million hectares (Choudhury, 2000). India supports rich variety of wetland habitats with covering a total area of 58,286,000 hectares (18.4% of the country), of which 70% areas are under paddy cultivation (Patar, 2005). The wetlands of North-Eastern parts of India supports a bewildering array of birds' species, majority of which are now very rare outside the India (Wolstencroft et al., 1993).
1.2 Wetlands of North-East Region and Avian Species

ABUNDANCE

Birds are ideal bio-indicators and useful models for studying a variety of environmental problems (Newton, 1995). The North-East India probably supports the highest bird diversity in the Orient, with about 950 of the c. 1,250 bird species known from the Indian subcontinent (Saikia and Bhattacharjee, 1990a; Birand and Pawar, 2004). The global distributions of 24 avian species are restricted to this region. The Eastern Himalayas and Assam plains are newly recognized as an Endemic Bird Areas within Indian Sub-continent and owing to the presence of large numbers of natural water bodies, viz. rivers, beels or wetlands and ponds as well as the forest ecosystem (Choudhury, 2000), the state of Assam within the North-East Region (NER) of India, is in the characteristics position in Key Wetland Regions for Threatened Birds in Asia (Bird life International, 2002). There are about 1,392 riverine and tectonic wetlands in Assam, which are extremely rich in nutrients and have immense production potential which are characteristically shallow basins mostly rich in plankton, which supports the life of other vertebrates along with the invertebrates in a wetland (Dey, 1981). A total of 950 species and sub-species of birds have been recorded in Assam, of which about 160 species affect wetlands and about half of these are migratory (Saikia and Bhattacharjee, 1995). Scientific management of these wetlands is not only fulfilling the feeding requirements of the local people but also save the life of wetland birds and animals, thus improvising the economy of the region.

Assam is bestowed with a large number of natural water bodies in the form of
rivers, streams, beels, ponds, reservoirs etc. upon which large part of population of the area is partly or fully dependent. Assam has a total inland water bodies of 0.14 million hectare under ponds or tanks, beels, reservoirs, swamps and other low lying water bodies besides an average 4,820.00 km. area under major and minor rivers (Govt of Assam, 1992) These natural water bodies are highly potential for aquatic biodiversity including fish.

In Assam, flood plain lakes constitute an important resource of inland water bodies. These lakes have appreciable fishery potentials and are the integral component of the river Brahmaputra and Barak. The flood plain areas of these rivers and their tributaries are widely interspersed with flood plain lakes of various dimensions and forms. These lakes are formed as a result of meandering of rivers into mature valleys of wide flood plains. The frequent occurrence of earthquake in the North-Eastern region has induced the shifting of river beds and this factor together with the heavy rainfall in the region leads to the formation of ox-bow type, lake-like or true tectonic depressions. The lakes are of two types: those which retain continuity with the parent river are termed as open or live type while those which are cut off from the parent river are termed as closed or dead type. Again, these ponds, lakes or water bodies may be seasonal or perennial. The flood plain lakes or so-called ‘beels’ of Assam, cover a total area of 1,00,853.61 hectares and constitute 27.78% of the total water resource of Assam. There exists a total of 1,392 numbers of beels, out of which 430 are registered and the remaining 766 are non-registered beels (Statistical Hand Book of Assam, 1997).

The ecological studies of natural water bodies get least attention in Assam in
general and East Assam in particular though Assam is rich with natural water bodies viz. Rivers, streams, ponds, lakes, reservoirs etc. But the present state of affairs of these water bodies is quite disheartening as most of our water bodies including the lakes have gone wild, vastly infested with aquatic weeds and uneconomical fish species. Moreover considerable human interferences have led to the degradation of physico-chemical and biological qualities of these water bodies. The negligence of natural water bodies has greater impact on the economy of Assam.

1.3 ECOLOGICAL INVESTIGATIONS IN WETLAND HABITAT

Ecology deals with biological productivity of inland waters and with all its casual influences that determines it. Casual influences involve meteorological, physical, chemical and biological factors that determine the water quality and productive potential. Ecological considerations are of prime importance rather pre-requisite for chalking out rational managerial practice on scientific lines and for insuring sustained optimum protection of various aquatic fauna including the local as well as migratory birds, an insight into abiotic and biotic pool is must. In other words, the ecology of aquatic birds i.e. the relationship of aquatic birds with their physical, chemical and biological environments must be known in order to check their population, which is decreasing day by day. The growth of the aquatic animals depends on the ecological conditions of water bodies.

Ecological investigations of various fresh water ecosystems have been done by a number of workers both in India and abroad as well. Moyle (1946) established a
significant and direct relationship between phosphorous content and productivity in Minnesota lakes. The cosmopolitan nature of freshwater organisms, the flora and fauna of a pond in New Zealand were studied by Byars (1960) by comparing similar works from North America, Europe and Asia. Hutchinson (1967) observed that in smaller lakes there is generally a complicated succession of maximum and minimum in the phytoplankton population throughout the year. Lewis (1973) while working on the lake Maint in Philippines stated that high transparency in a productive lake can be explained either by high rate of production or by an extensive vertical distribution of photosynthesis. Wilson et al., (2006) studied the biological aspects of Chew valley and Blagdon lakes in England and revealed that the phytoplankton of both the lakes is basically similar in that it is characteristic of eutrophication. Buergi et al. (1985) stated that seasonal variations in the trophic structure of phytoplankton communities in different lakes and revealed that increased nutrient supply causes an explosive development of small algae and herbivorous zooplankton.

In India, considerable emphasis has been given during the last few decades, on the ecological investigations of various natural water bodies. Das and Srivastava (1956) made quantitative studies on freshwater plankton of a fish tank in Lucknow and observed inverse correlation between phyto- and zoo-plankton. George (1961) observed summer periodicity of rotifers in five tanks in Delhi. Michael (1964) observed a very high degree of correlation between atmospheric and surface water temperature. Sreenivasan (1966) made fairly extensive studies on a series of fresh water lakes and reservoirs in Madras State in relation to productivity.
Thus, the limnological investigation of the physico-chemical parameters of these water bodies will be the prime requisite for the successful implementation of various fish culture programs (Mishra et al., 1998) as well as various conservation programmes to conserve rare, threatened and endangered wetland dependent birds and other animal species along with the wetlands of India. Enough works has been done so far on the physico-chemical parameters of different types of water bodies in India, of which the works of Das and Srivastava (1956), George (1966), Michael (1969), Singh (1988), Kant and Raina (1990), Jindal and Kumar (1993), Singh (1999), Balachandran and Rahmani (2005) etc are worth mentioning. Again though there have been a good numbers of references relating to the studies on competition and distribution of plankton and other biotic species including the fishes are present (Chacko et al., 1953, Chacko and Krishnamurthy, 1954; Bhuyan, 1970; Dey, 1977, 1981; Nasser, 1977, Hunter and Witham, 1984; Khillare, 1987; Pandey et al, 1989; Singh, 1990; Dutta et al., 1993; Mishra et al., 1998), only a few literature were available on these lines when the works of Assam is concerned (Bhuyan, 1970; Borah, 1998; Sarmah, 1998).

About 5.26% birds of Asia are threatened and 27% of the total birds do not have enough information to know them due to less emphasis paid to them (Chandler and Langman 1995). Avi-faunal surveys in the region go back to the end of the 19th century, but there was little subsequent ornithological activity until the last decade or so (Young, 1900; Lack, 1954, Krapu, 1979; Bellrose, 1980; Crabtree et al., 1989; La Barbara, 1989; Ringelman, 1990; Katti et al., 1992; Mauser et al., 1994, Singha, 1995, Raman et al., 1998; Choudhury, 2000; Raman, 2001) Besten (2004) has studied the visit of waterfowls

1.4 THE COTTON PYGMY- GOOSE

The tree ducks or wood ducks acts as ecological indicator of both the terrestrial as well as aquatic ecosystems by depending on both wetlands or ponds where they feeds, and lands where they form nests in the trees. The Cotton Pygmy-goose (*Nettapus coromandelianus coromandelianus* Gmelin) (also known as Indian Cotton teal) is the smallest tree or diving ducks of about 13 inches in length, male with summer plumage and has a black collar glossed behind with green round the lower neck, upper plumage dark brown glossed with metallic-green or purple. The female had a brown line through the eye, the head and neck being speckled with brown marks and becomes wavy lines on the breast. In winter male loses its collar and resembles the female except for the white wing bar and some of the green gloss on the upper plumage and wings (Whistler, 1986)
The Cotton Pygmy-goose (CPG) has a large range, with an estimated global extent of occurrence of 1,000,000- 10,000,000 km². It has a large population estimated to be 59,000 - 1,100,000 individuals. Global population trends have not been quantified, but the species is not believed to approach the thresholds for the population decline criterion of IUCN Red List. For these reasons, this species is considered as Least Concern (Birdlife International, 2004). The Red List Category and Criteria of the species is thus LC ver 3.1 (2001). The sub-species *N. c. coromandelianus* Gmelin occurs in South-East Asia with no record of occurrence in Australia and has a status of Least Concern. It is resident but local, practically throughout the Indian Union. It is distributed from plains to c. 300 meters altitude. Though distributed all over the India, not recorded from Kerala till 1983 (Ali and Ripley, 1983), but 1160 individuals were recorded in Asian Waterfowl Census-1993 (Mundkur and Taylor, 1993).

The species *N. coromandelianus* is native to Australia, Bangladesh, Cambodia, China, Hong Kong, India, Indonesia, Japan, Lao People’s Democratic Republic, Malaysia, Myanmar, Nepal, Oman, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, Taiwan, Province of China, Thailand and Vietnam. But the species is vagrant in Bahrain, Iran, Islamic Republic of Iraq, Jordan and Maldives (Bird Life International, 2004).

Rapid invasion of the wetlands by introduced weeds, particularly water hyacinth *Eichhornia crassipes* and exotic ponded pastures like *Hymenachne amplexicaulis* causes to decline the numbers of *N. coromandelianus albipennis* in Australia (Beruldsen, 1977), which is also more or less true for the South-east Asian sub-species *i.e* *N. c. coromandelianus* Gmelin.
The Cotton Pygmy-goose leads a more or less semi-aquatic life with overgrown ponds and broad dykes and channels being the usual habitat, where it generally feeds on aquatic vegetation and is very gregarious in habit. It forms flocks of 8 - 12, but sometimes less than 8 and occasionally more than 12. They use wetlands, ponds or streams for feeding purpose and big trees for nesting. Sometimes they can pass whole day or more days by sitting and feeding on the aquatic area. A total of 9,304 individuals have been counted from 61-sites all over the country (Power, 2006), but around 300 birds have been counted in Assam during the period of conduction of Asian Waterfowl Census, 2005.

The Cotton Pygmy-goose exhibits a number of morphological adaptations to a largely terrestrial existence. They have a slightly longer middle toe and a more or less short femur differences compared to other dabbling ducks. They are the smallest of our local dabbling ducks with comparatively greater number of primaries and strong flight muscles relative to the mallards (Livezey, 1993).

1.5 TAXONOMY OF COTTON PYGMY-GOOSE

The Cotton Pygmy-goose is unique behaviorally, genetically and in life history traits. It is a taxonomically distinct sub-species in the waterfowl family. It is grouped under Order-Anseriformes (Waglar, 1831); Family-Anatidae (Vigors, 1825); Subfamily-Anatinae; Tribe-Anserini; Genus: *Nettapus* (Brandt, 1836) and Species: *coromandelianus* (Gmelin, 1789). The Cotton Pygmy-goose is a relatively long-lived species (maximum
known lifespan 10 to 15 years in wild) with a high reproductive rate. Having evolved with avian and reptilian predators despite of mammalian predators, the goose are more active flier and prefer to flush out rather than to freeze.

The genus *Nettapus* Brandt 1836 has three species: Green Pygmy-goose *N. pulchellus* (Northern Australia and Southern New Guinea), African Pygmy-goose *N. auritus* (Sub-Saharan Africa) and Cotton Pygmy goose *N. coromandelianus* (South-east Asia) The species *coromandelianus* has two sub-species with *N. c. albipennis* Gould 1842 (Australian) and *N. c. coromandelianus* Gmelin 1789 (South-East Asia)

The vernacular names of the species are as such as *viz.* , *Adibashi* Pet-petro, *Assamese*: Ghila hanh, Nak khes-khesi (Upper Assam), Lur-lun (Chandubi, Kamrup), *Bengali* Bali hans; *Bodo (Kachari)*: Pet-pedresh; *Hindi*. Girri, Girija (Ali & Ripley, 1983); *Mishing*: Kopet peret; *Nepali*: Rukh hans and *Rabha* Chili hans.

The study was prepared to test the following two hypotheses

**Hypothesis-I.** The population size and the distribution pattern of Cotton Pygmy-goose is dependent on the vegetation structure of the wetland habitat,

**Hypothesis-II.** Breeding of Cotton Pygmy-goose is related to availability of the potential feeding sites and nesting habitat
1.6 Objectives of the study

The main objectives of the present study are as follows:

1. Intensive study to assess the distribution localities and population size of the Cotton Pygmy-goose in the wetlands of Eastern Assam.

2. To prepare the distribution map of Cotton Pygmy-goose in the study area.

3. To investigate the feeding habits and habitat use type of the species in the study area.

4. To study the breeding biology of Cotton Pygmy-goose.

5. To recommend the important wetlands for future conservation action plan of the species in Eastern Assam.