Chapter 1

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Being large, conspicuous, and easily observed, storks are well known birds wherever they occur (Kahl, 1987). The stork family Ciconiidae includes 20 species and is widely distributed, mainly in the Old World tropics. The family has three distinct subdivisions or tribes: the Wood Storks/Openbill group (six medium sized species), 'typical' storks (five to seven species) and 'giant' storks (six species).

The genus *Leptoptilos* which belongs to the 'giant' storks has three species: *Leptoptilos dubius* (Greater Adjutant Stork), *L. javanicus* (Lesser Adjutant Stork) and *L. crumeniferus* (Marabou Stork). The former two are found in tropical Asia, while the third one is found in tropical Africa.

The richest stork diversity of the world is found in southeast Asia (Luthin, 1987). Of the 20 stork species, 11 are found in this region among which nine species are reported from India (see Luthin, 1987; Kahl, 1987). Except the Painted Stork *Mycteria leucocephala*, eight species are found in Assam (Saikia and Bhattacharjee, 1993, Choudhury 1990), of which the Greater Adjutant Stork *Leptoptilos dubius* is an endangered species. Luthin (1987) has pointed out that among storks it deserves the highest conservation priority.

The main generic characteristics are: the head and neck of the members of this genus are naked except for sparse scattered hair-like feathers, and the crown is bald (Ali and Ripley, 1987). The Greater Adjutant Stork is the largest and 'ugliest' Asian Stork
standing 120-150 cm to the top of the head when erect. Its general colour is slaty-black, grey and white, with a nearly featherless head and neck, a massive wedge-shaped bill and naked ruddy pinkish gular pouch, 25-35 cm long when inflated, hanging from the front of the neck (Ali and Ripley, 1987 Hancock et al., 1992,). The upper parts are slate grey, with a pale band along the wing formed by the pale gray greater secondary coverts. The underparts are white. Dorsally there is a ruff of white feathers around the base of the neck, surrounding a red or orange air sac. The undertail-coverts are white at their bases and dark smoky grey at their tips.

The iris is white to yellowish white. The bill varies from pale yellowish to greenish, more reddish near base. The legs and feet are actually horny brown to dark grey, but often appear pale greyish white or chalky white because they are coated with uric acid from excreta.

It was named ‘Adjutant’ because it walks with the deliberate, measured gait of a military adjutant. Though more common Assamese name is ‘Hargila’ (= bone swallower), it is known in different parts of Assam by different names: Hodong, Dhodong, Jomtokola, and Bamuni bartokola.

Outside India, the Greater Adjutant Stork (GAS) has been found in Nepal, Bangladesh, Myanmar, Cambodia and southern Vietnam (Baker, 1929; Ali and Ripley, 1987; Fleming, 1979). Up through the 1930s, large colonies were reported near Shwaygheen, in the Pegu district of southern Myanmar (Baker, 1929) and it was thought that perhaps all population of GAS went there each year during winter for breeding. These large colonies have been destroyed (Smythies, 1953) and no individual has been reported in
In recent years (Luthin, 1987). In late nineteenth century another large breeding colony of GAS was found in the Sundarban mangrove forests of Bangladesh (Baker, 1929). It is thought to be extinct now (Khan, 1984; 1987). However, in the recent past, few storks are reported from Nepal and Bangladesh (see Rahmani et al., 1990).

The Greater Adjutant Storks were also common in Chiang Rai Province of northern Thailand in the nineteenth century but now the number is much reduced (see Hancock et al., 1992). Very recently, a confirmed breeding population of GAS has been reported from Cambodia and a range of 100-150 birds may be present there (Anon., 1994).

In India, this stork has been found in Assam, Orissa, Rajasthan, Nepal terai and the Gangetic plain (Ali and Ripley, 1987) but it has now disappeared or has become extremely rare in the whole of its distributional range (Rahmani et al., 1990). They report that outside Assam, till 1980s the GAS was found in a few places in Rajasthan, Tamil Nadu, Delhi, Bihar and West Bengal but not in Uttar Pradesh, Madhya Pradesh, Andhra Pradesh and Orissa. As late as 1940s, large flocks of GAS were seen scavenging on city refuse in Calcutta (Ali and Ripley, 1987; Hancock, 1989) which declined very fast in later years. Some ornithologists declared that this species was undoubtedly on the verge of extinction (Luthin, 1987; Hancock, 1989).

Prior to Rahmani (1989) and Saikia and Bhattacharjee (1989a, 1989b), no proper information about the status and distribution of the GAS in Assam was available. Their preliminary surveys drew attention to the stork specialists, attention to the fact that the major stronghold of the GAS of the world was in the Brahmaputra Valley of Assam.
Basic information on ecology and behaviour of this conspicuous and massive bird is available in Ali and Ripley (1987) and Kahl (1966b, 1970, 1971, 1972a, 1974). Probably due to its rarity, detailed study of its ecology and behaviour was not done. In November 1989, Saikia and Bhattacharjee (1990a, 1990b) discovered the first GAS breeding colonies outside protected areas. They subsequently collected initial information about nesting and breeding. Later, Barooah (1991) also added more nesting colonies of GAS to the list.

Before I started work on this species in 1994, no literature was available about detailed study of its ecology, biology and its behaviour. Only recently Saikia and Bhattacharjee (1996a, 1996b) and Bhattacharjee and Saikia (1996) have published a detailed account of this bird. In this thesis, in addition to presenting my own findings, I have compared their finding also with my results.

The objectives of my study and methods to accomplish them are stated below:

I wanted to know the present status and distribution of GAS throughout the Brahmaputra valley, Assam during breeding as well as non-breeding season. I did an extensive survey from one end of the valley to the other, in the first year of my study (1994-95) during the breeding season of the GAS. This survey provided me the basic information to select a site for intensive study of nesting ecology and breeding biology in the latter two breeding seasons. Besides the winter survey (1994-95), I also did random surveys in 1996 during the non-breeding season.
In addition to counting the storks, I was also interested to know the number of nests and the nesting ecology of GAS throughout the study area. So, along with the population survey, simultaneously I also carried out nest survey. Later, for two successive nesting seasons I concentrated my study on nesting ecology in the intensive study site at Nagaon.

The breeding biology was almost unknown prior to start of my work. I intensively studied breeding biology of GAS in two consecutive breeding seasons.

In the earlier literature, the GAS has been described as scavenging during the non-breeding season in summer. But their flocking behaviour in the post-breeding season was poorly known which encouraged me to study this aspect also. For this purpose I selected two places: urban garbage dump at Guwahati and rural garbage dump at Nagaon.

I have fulfilled the objectives of the study and they are presented in this thesis. The findings are organised in five chapters (excluding the first one, i.e., Introduction). The second chapter, Study Area, describes all the sites of field observations and the intensively study site. In the third chapter, I have presented the present status and distribution of GAS in the Brahmaputra valley. The intensive study of nesting ecology and breeding biology, which are the main bulk of my thesis are presented in the fourth and fifth chapters respectively. And the last chapter deals with the flocking behaviour of GAS during non-breeding season. All the related literature have been reviewed in the respective chapters.
Although I tried to cover all the general aspects of the GAS, yet I feel there is plenty of scope to study this species from other angles too. My study comprises only one survey during the breeding season to know the present status and distribution. However, for a better understanding of population fluctuation as well as changes in the nesting habitats, a continuous long term study is required.

The experiment with ringing or radio telemetry would be useful to know their home range, foraging distance from nesting colony and minimum age of new breeder. I think a minimum of five continuous years' data are necessary to study the reproductive success of the GAS.

There is very little literature on Greater Adjutant Stork in particular, and storks in general. Whatever relevant literature is present, is quoted in different chapters at appropriate places.