INTRODUCTION
CHAPTER - I

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1.1 General

Wetland birds, those that are ecologically dependent on water bodies, are highly endangered due to loss of habitats, hunting pressure and other threats. Many wetland birds are migratory undertaking annual long distance or local migrations between their breeding and non-breeding grounds. Therefore the threats in two different habitats and the type of threat might differ in breeding and feeding sites. Wetland birds include sea birds, shore birds and waders, and vital components of wetland ecosystems (Arun Kumar et al. 2003). There are about 242 wetland bird species and 67 wetland supported bird species among the 1300 species of birds recorded in the Indian subcontinent are recorded in India (Grimmett et al. 1998; Manakadan and Pittie, 2001). Of these, 125 are migrants, among which 102 species are winter migrants, 10 are summer migrants and 3 are passage migrants.

Approximately 12% of Asian birds are globally threatened (Arun Kumar et al. 2003). Wetland birds comprise about 10% of the globally threatened species and 20% of Asian threatened species. Many species are close to extinction through disturbance or loss of their habitats, as well as through intensive hunting pressure.

The majority of the wetland species in the Indian subcontinent are common and a quarter (24%) are rare (Manakadan and Pittie, 2000). Of which, 34 are globally threatened species, 34 are critically endangered and one conservation dependent.

Many studies have been conducted on the wetland bird species in India, but little information exists on the assemblage structure as a whole. Assessing the wetland assemblage would provide information on the common and rare species, migratory behaviour and habitat usage. This would be important for the conservation of wetland biodiversity and for assessing threats to particular species and to ecosystems.
The main threats to water birds are the loss and degradation of habitats, over exploitation of wetlands and pollution (Scott, 1984; Jagtap, 1985; Parnell et al. 1988; Hussain, 1990; Balachandran, 1993; Arun Kumar et al. 2003). Many species are close to extinction due to these threats.

1.2 Wetland birds

Wetland birds include sea birds, shore birds and waders, are vital components of wetland ecosystems (Arun Kumar et al. 2003). There are about 242 wetland bird species and 67 wetland supported bird species among the 1300 species of birds recorded in the Indian subcontinent (Grimmett et al. 1998; Manakadan and Pittie, 2001). Of these, 125 are migrants, among which 102 species are winter migrants, 10 are summer migrants and 3 are passage migrants.

Approximately 12% of Asian birds are globally threatened (Arun Kumar et al. 2003). Wetland birds comprise about 10% of the globally threatened species and 20% of Asian threatened species. About 34 of the wetland birds are globally threatened species, 34 are critically endangered and one conservation dependent (Manakadan and Pittie, 2000). The main threats to water birds are the loss and degradation of habitats, over exploitation of wetlands and pollution (Scott, 1984; Jagtap, 1985; Parnell et al. 1988; Hussain, 1990; Balachandran, 1993; Arun Kumar et al. 2003). Wetland birds that are migratory face different types of threats in their breeding and feeding sites.

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1.3 Wetlands of India

The Ministry of Environment and Forests has identified about 2,175 wetlands in India covering about 4.1 million hectares (Alfred and Nandi, 2000), of which, 93 are major wetland sites and 19 are Ramsar sites, the wetlands of international importance (Asian Waterbird Census, 2001). Many of these wetlands are wintering grounds for migratory birds.

There are 465 Important Bird Areas in India (Islam and Rahmani, 2004). Many of them are wetlands and host important migrant and resident water birds. Chilka Lake in Orissa hosts 211 bird species, of which, 86 are waterbirds, and the lake is known for ducks and waders (ZSI, 1995; Balachandran et al. 2003). Keoladeo National Park (NP), Bharatpur hosts atleast 350 bird species which include the Siberian Crane (Grus leucogeranus) and ducks (Vijayan, 1991).

Great Rann of Kutch in Gujarat is known for flamingos (Islam and Rahmani, 2004). Wular Lake in Jammu and Kashmir is known for ducks and geese. A total of 110 waterbird species have been recorded in Point Calimere, out of which 34 are migratory. The commonest groups are the flamingos, ducks, waders, gulls and terns (Sugathan, 1982). Pulicat Lake in Andhra Pradesh and Tamilnadu is known for flamingos, ducks and waders (Daniel, 2004).

1.4 Conservation of Indian Wetlands

The important wetlands in India are notified as National Parks and Wildlife Sanctuaries under Wildlife (Protection) Act, 1972. The Act provides legal measures for effective protection of the faunal species and their habitat. About 22 wetlands and 11 lakes have been identified for intensive conservation and management of waterfowl habitats. Keoladeo National Park is identified as World Heritage Site for conservation of its unique habitats and fauna. Gulf of Mannar is identified as Marine Biosphere Reserve for in-situ conservation of the large extent of habitats and its rich bio-diversity.
Wetland Directories are prepared at national level and state level for identification, dissemination of information about the wetlands and to get the co-operation from different sectors of society for the conservation of wetlands. Conservation of urban lakes is gaining momentum in many of the states in recent years and their rehabilitation has been taken up since 2000.

Participatory management with the participation of the local communities has been initiated in many wetlands with a conservation objective. Awareness and education programmes, and ecotourism activities are being conducted among the local communities.

1.5 International and National Protection Measures

The need for conservation of rare and endangered waterbirds and their habitats has been given serious consideration at the global level since the early 1960’s. International agreements have come into force among many countries from the year 1971 onwards to protect the migratory birds and their habitats. The International Biological Programme (IBP) with its project AQUA and the International Union for Conservation of Nature and Natural Resources (IUCN) provided the initial impetus. One major effort is the Ramsar Convention (1971), which provides the framework for international co-operation for the conservation of wetland habitats. As on now, over 1,414 wetlands in 144 countries have been declared as Ramsar Sites.

The UNESCO has identified wetlands and other habitats with unique characteristics as World Heritage Sites (Kelleher and Kenchington; IUCN, 1991). The Global Biodiversity Convention became operational in 1993. The Convention recognized *in-situ* conservation represented by Biosphere Reserves, National Parks and Wildlife Sanctuaries and other forms of protection as the predominant conservation strategy. The IUCN provided the objectives and framework for appropriate legislative measures in the World Conservation Strategy for an overall policy on wetlands.
One of the major objectives of the International Council for the Preservation of Birds is developing an international network for the conservation of waterfowl and their habitats. Similarly the International Wildfowl Research Bureau was formed for collection of data, liaison for co-operative efforts in bird censuses and for coordinating international programmes.

Convention on International Trade in Endangered Species (CITES) came into existence in 1973 and 167 countries have become contracting parties to CITES so far. Biosphere Reserve Program of the UNESCO is a step in the preservation of many endangered species in their natural habitat (Gopal, 1993).

1.6 Indian Conservation Policies

There are two aspects to the conservation of wetland biodiversity in India. One is the conservation of wetland species. For conservation of species and habitats, Indian Wildlife Board was formed in 1952 for initiating measures. Legal measures were then provided by the Wildlife (Protection) Act, 1972 enacted by the Government of India for protection of the wildlife, their habitats and to control the wildlife trade in India. This Act has given way for the notification of National Parks and Sanctuaries which included wetlands and wetland birds (Gopal, 1993). The National Wildlife Action Plan of 1982 clearly set out directives for the protection of representative ecosystems and habitats (RGICS, 1995).

Many agreements for conservation of water birds were made by India with other countries (Gopal, 1993). These are:

1) Convention between Republic of India and the USSR: The convention was signed by India and Russia for conservation of migratory bird species between the two countries. The convention develops joint projects of mutual interest on migration and nesting of Siberian Crane and Common Cranes and exchange scientific information on wetland management and conservation of fauna etc.
(2) Convention on Ramsar Sites: Ramsar Convention is the convention among 167
countries at present. The convention aims at conservation of wetlands of international
importance and conservation of endangered migratory waterbirds.

(3) Convention on International Trade in Endangered species (CITES) of Wild
Fauna and Flora for conservation and protection of wildlife and natural resources.

Water Pollution Act was formulated in the year 1974 to protect the water bodies from the
pollution. The Environment Protection Act, 1986 prohibits setting up of industrial projects
within 25 kms from the ecologically sensitive areas such as National Parks and Sanctuaries.
Formulation of Coastal Regulatory Zone Authority (CRZA) rules by the GOI prohibit
destruction of wetlands along the coast. The CRZA prohibits setting up of new industries or
expansion of the existing ones up to 500 m from the high tide line on the landward side as well
as in the inter-tidal zone (GOI, 1990).

1.7 Research by Indian Institutions

The Bombay Natural History Society (BNHS) was the pioneering institution in India for
bird studies. The BNHS implemented the Bird Migration Project during the period 1980–1991.
About 1,83,230 birds of 545 species were ringed at 35 field sites throughout the country during
the 10-year project period. Large quantity of information was collected on bird populations,
structure, movements and their habitats. Information was also collected on the longevity, site
fidelity and effect of pollution on species.

In the year 1969, the BNHS initiated a bird ringing programme at Point Calimere. About
1,379 birds, of which 57 species of land birds and 38 species of water birds were ringed during
the period 1980-1991. About 70 water birds ringed earlier were recovered during the year 1990-
91. The recovered data has provided information on life span of species such as Little Stint
(Calidris minuta), Lesser Sand Plover (Charadrius mongulus), Wood Sand Plover (Tringa
glareola) and Broadbilled Sandpiper (Limcola falcinellus). The recovered data also provided information on site fidelity of species to their wintering sites. The long term studies showed decline in population in Greater Flamingo (Phoenicopterus ruber), Grey Plover (Pluvialis squatarola), Ruff (Philomachus pugnus), Crab Plover (Dromas ardeola), Turnstone (Arenaria interpres) and Avocet (Recurvirostra avosetta) due to habitat alteration by chemical industries (Hussain, 1991).

The BNHS initiated bird ringing in Keoladeo National Park in 1980. About 15,571 birds belonging to 141 species were ringed. Of these, 24% were geese, 39% were aquatic birds excluding herons and egrets and 33% were non-aquatic birds (BNHS, 1998). The recovery data provided information on site fidelity of the migratory species to the wintering sites. The recovery data also provided information on life span of species such as Spotted Sandpiper (Actitis maculata), Temminck Stint (Calidris temminckii), Black-winged Stilt (Himantopus himantopus), Ruff (Charadrius mongulus) and other non-aquatic birds. The BNHS had initiated bird ringing programme in Pulicat in 1990-91 and has ringed 1,568 birds belonging to 31 species (Hussain, 1991).

1.8 Studies in Pulicat Lake

Pulicat Lake which is an estuary along the eastcoast of Andhra Pradesh and Tamilnadu is rich in bio-diversity. It is a wintering ground for many local and long distance migrants. About 215 bird species were recorded in the lake (Prakash Rao, 1998; Manakadan and Kannan, 2003; Manakadan and Sivakumar, 2004). Productivity of lake was estimated to 30 kg/ha/year and about 1200 tonnes of fish and prawns were harvested annually (Kaliyamurthy, 1974). The lake is the feeding ground for Grey Pelicans (Pelecanus philippensis) breeding at Nelapattu (Nagulu, 1983; Manakadan and Kannan, 2003).
Over fishing is a threat to birds because birds are ensnared by fishing nets. Measures suggested were the ban on small nets and declaration of no fishing zones (Manakadan and Kannan, 2003). Siltation is an ongoing problem and siltation rate of 1m per century is a threat to the survival of the lake (Sanjeeva Raj, 1995-96). Conservation of mangroves and further afforestation with mangrove species is required to prevent further siltation of the lake (Narasimhulu, 1995). Effluents released from the aquaculture ponds into the lake have highly toxic effect on zooplankton (Nanda kumar, 2001).

1.9 Objectives of the Study

The objectives of this study were to assess population changes and habitat usage of 28 selected species of water birds in Pulicat Lake. Detailed assessments of population trends and habitat usage of birds have not been undertaken so far and has important implications for the management of wetland diversity in Pulicat.

The main objectives of this study were:

1. To study the population trend of waterbirds at Pulicat Lake over a six year period.
2. To look at the relative abundance and seasonal movements of 28 common species of wetland birds.
3. To assess habitat preferences and feeding profiles of the selected species.
4. To see whether there is an association between migratory pattern, habitat usage and feeding profile of species.