CHAPTER 3

MATERIAL AND METHODS
3.1 **Study Area**

Hokarsar (34°, 06' N lat; 74°, 05' E long.; 1584 m.a.s.l.) is an important and well protected reserve for ducks and geese managed by Directorate of Wildlife Protection, J&K Government situated in the centre of the valley, about 10 km to the west of Srinagar on Srinagar-Baramullah Highway. The wetland is more or less semicircular in outline, extending in an east-west direction with a recorded surface area of 9.0 sq. km. (actual area of the wetland at present is about 5.0 sq. km.). It is fed by perennial Dooganga stream that originates from Dooganga watershed in Pir Panjal range of the Himalayas and Sukhmarg stream from the west. The wetland is surrounded by a
group of villages on its north, south, south-west and east sides. On the north lies the village Lewal Bora and on the northwest is Zainkot village, where an Industrial Complex including HMT has come up during recent years. On the east, are the villages of Khushipora and Haji Bagh. On the south, are the villages of Suyalpurn and Tharamulla and on the south-west is the Gota Bora hamlet. The wetland drains into river Jhelum on the north west by a small stream near village Sosyay. The weedy and extensive morass provides a home and cover for a variety of avifauna and thus plays an important role in the actions and co-actions of the ecosystem.

3.2 Methods

For purpose of present investigations, the wetland was divided into six sub-units (Fig.2), within each of which, the population of birds was estimated once every two weeks by visual census and transect method (Watson, 1965; Gaston, 1975).

From November to March, when the wetland lacks almost all emergent vegetation that otherwise conceal the birds; visual counting was very conveniently employed. An estimate was obtained without disturbing the birds, by scanning each part of the study unit from good viewpoints, with the help of 10 x 50 and 20 x 50 field binoculars.

From April to October, the transect method was used for all counts. The method entailed moving along a series of transects to and fro to cover the units; attempting to
identify the species and count the number of birds of each species (cf Jenkins and Gaston, 1962).

Terms used in defining the relative abundance of each species are those used by Pull (1964) and McCaskie (1970):

- **Very abundant** — Over 1000 individuals per day.
- **Abundant** — 201 - 1000 individuals per day.
- **Very common** — 51 - 200 individuals per day.
- **Common** — 21 - 50 individuals per day.
- **Fairly common** — 7 - 20 individuals per day.
- **Uncommon** — 1 - 6 individuals per day.
- **Rare** — 1 - 6 individuals per season.
- **Very rare** — Infrequent occurrence.

The birds were identified by studying their characteristic features in accordance with the identification keys evolved by Bates and Lowther (1952), Whistler (1963), Ali (1979) and Fleming et al. (1979). The activity of each bird species was watched throughout the day.

### 3.2.1 Feeding Biology

There is no ideal method for the study of food of
birds and it is rather impossible to use any single method without a bias (Vacaries, 1912; Collinge, 1927 and Hartley, 1948). The three methods that are generally followed are:

i) Numerical method recommended by Mason and Lefroy (1912).

ii) Gravimetric method used by Rorig (1903) and Mukherjee (1969-1976).

iii) Volumetric method used by Ford, Chitty and Middleton (1930), Lay (1940) and Campbell (1945).

For the analysis of various food items, a combination of these existing methods as recommended by Narang and Lambs (1980), was used during the present investigation.

Birds for study were collected from within the study area mostly by capturing and shooting with double barrel gun. The capturing was done before and after the
shooting season, with the permission of Chief Wildlife Warden, J&K Government, about 80% of the birds were shot and captured between 0900 hrs and 1100 hrs IST. Each shot or captured bird was labelled with accurate information, i.e. name, sex, time and place of collection and then packed in polythylene bags and carried to the laboratory, where the entire gut of the bird was removed by the technique of Harrison (1960) and analysed for food contents. The guts which were not examined within six hours of collection were preserved in 4% formalin, after tying the severed ends of oesophagus and intestine to prevent loss of contents. The preserved samples were first thoroughly dehydrated for 3-5 minutes in running water. Each gut was dissected and the contents of oesophagus and gizzard were washed repeatedly in various mesh sized sieves. The contents were then spread over a piece of blotting paper for a few minutes to remove the excess of water from them. The contents were weighed on Electronic Single Pan Balance, Model Hagenau NIV S/3-3, accurate to 0.005 gms. The volume was calculated by water displacement method in graduated cylinder true to 0.01 ml.

After recording the weight and volume, the contents were transferred into petro-dish and sorted into organic and inorganic components. The organic material was further separated into animal and plant items (Plate 1) and then identified as accurately as possible. Invertebrates, seeds and vascular plants were identified with the aid of the
guides by Pennak (1953), Ward and Whipple (1959) and Martin and Barkley (1961). Frequency of each food item was noted; any item of food less than 0.005 gms in weight and 0.01 ml in volume was referred to as a trace only and used in the frequency of occurrence.

The segregation of food items was a very tedious process because the food particles tended to adhere to each other. The seeds were separated with the help of forceps, needles and brushes. Individual items were separated using magnifying glasses, and weighed and measured.

The diurnal activity patterns and the feeding methods of waterfowl were also recorded. The activity patterns were assigned to one of four categories in accordance with Dwyer (1975):

1) Feeding — any activity associated with feeding (grubbing, grazing, dabbling, upending and diving).

2) Comfort — all activities involved with body maintenance (grooming and bathing).

3) Locomotory — movements with an apparent direction, often preceding or following feeding activity.

4) Floating — resting on water, not associated with feeding.

The feeding postures were grouped into:

Grubbing — where bill pokes below soil surface.
Surface picking — the taking of food item from
the surface of the substrates or
off plants.
Dabbling
bill under water.
Tipping
where the head and neck were
under water.
Upending
where bird tips over and submerges
the front half of its body.
Giving
where the whole body was submerged.

Food overlapping between any two species of birds
was studied by comparing their dietary items as also the
feeding postures (Horn, 1966; Orians and Horn, 1969).

The overlapping between two species, x and y, in
which the percentage of food i in each is represented by xi
and yi, respectively was then calculated from the formula:

\[
\text{Overlap} = \frac{2 \sum \text{xy}}{\sum x^2 + \sum y^2}
\]

Overlap calculated by this formula can vary from
0, with no overlap, to 1.00, with complete overlap.

The type and amount of food available in the
wetland was also studied. The monthly benthic samples were
taken with a 0.25 m diameter net of 0.5 m gauge from study units 1-4. Four samples were taken at each site with the help of the net, which was swept for 12 meters. A sieve with 1.0 mm mesh size was used for the extraction of animals from the samples and the sorted animals were weighed after drying between filter papers and later on preserved in 5% formalin.

Ten liters of water collected by a Van Forn type water sampler was sieved through a plankton net having 60 meshes/cm. The material collected in the plastic tube, attached to the lower end of the net was fixed and preserved in 5% formalin.

The zooplankton counts were made in triplicate in a Sedgwick Rafter Cell as per Welch (1948) and the average of these counts was used to calculate the numbers of various genera and hence of various groups and the total zooplankton in one cubic meter of the water.

The photographs were taken with a 35 mm Pentax Camera in nature, using 200 mm zoom.

3.2.2 Breeding Biology

Study units 1, 2 and 3 were selected for collecting data on the breeding biology of the Indian Moorhen - Gallinula chloropus indicus Blyth. All the three units were characterised by thick growth of emergent vegetation - Typha angustata, J. laximani, Eutomus umbellatus, Phragmites
Communis, Poa arvensis and Saccharum spontaneum and most of the Moorhen nests were located in these. Any residing place of the bird with one or more eggs was classified as a nest. During the laying season each nest site was visited daily and the newly laid eggs were weighed to the nearest gram, marked and numbered with waterproof ink, and placed properly in the nest without disturbing the arrangement of other eggs. After laying, the eggs were weighed regularly till they hatched. On hatching, each chick was weighed to the nearest gram and its wing and beak measured with the help of Vernier callipers. At each nest, the type and height of vegetation cover and its condition and shape, size and position of the nest and its concealing arrangement (whether open or covered from above) was recorded.

The movements of the parent birds during incubation period were observed using a 10 x 50 x field binoculars from an observatory point situated slightly above the nest at about a distance of 12 meters. This did not appear to disturb the birds. The nests were observed from dawn to dusk, as most of the young hatch during daytime.

The exact date of laying was calculated by back dating, assuming that one egg was laid per day (Sullion, 1954). Hatching was defined as the time at which all eggs had hatched. Hatching success calculations were done in accordance with Mayfield (1975) and Johnson (1975).
Two chicks were reared in the laboratory from hatching to 65 days of age. Records of food consumption and growth were kept for these captives. Food was provided to the chicks between 8:00 hrs - 20:00 hrs. A combination of Ceratochilum demersum, Potamogeton crispus, P. lucens, P. patens, P. nodosa, Polygonum amphibium, P. hydropiper, Lemna minor, L. gibba, Gambusia affinis, fingerlings of Cyprinus carpio, and a large number of small insects were made available throughout the rearing period and were readily eaten by the chicks.