INTRODUCTION

Wetlands by definition are transitional zones between aquatic and terrestrial ecosystems and are integral to healthy environments. Wetlands sustain all life forms and perform vital functions that contribute substantially towards ecological equilibrium and human wellbeing.

Wetlands are delicate ecosystems and are susceptible to changes even with little change in biotic and abiotic factors. They serve as important feeding and breeding areas for wildlife and also provide place for migratory birds, therefore, wetlands support species diversity. Wetlands are often biodiversity ‘hotspots’ beside functioning as filters for pollutants from both point and non-point sources and are also important for carbon sequestration and emissions (Reid et al., 2005). The earlier studies assessed that freshwater biodiversity is the most threatened of all types of biodiversity and wetlands are found to be the richest sites which hold major share of freshwater biodiversity (Anonymous, 2000).

Birds are important component of biodiversity comprising nearly 10,000 living species (BirdLife International, 2008). Waterbirds belonging to the groups Gaviiformes, Podicipediformes, Pelecaniformes, Ciconiiformes, Anseriformes, Gruiformes, Ralliformes and Charadriiformes are ecologically dependent on wetlands and are susceptible to detect changes in terms of disturbance, pollution, drainage and development (Anonymous, 1996).

BirdLife International (2013) further classified 1,313 species as ‘Threatened’ with extinction (i.e. in the categories of Critically Endangered, Endangered or Vulnerable on the IUCN Red List), representing about 13% of living bird species worldwide. Of these, 197 are considered Critically Endangered and are on the brink of extinction. These species have tiny populations and narrow range of distributions and/or are rapidly declining due to unsustainable agriculture, invasive species, water logging, hunting and other threats.

The greatest threats to avian biodiversity are reported from loss and degradation of habitats. Although some birds occur in two or more habitats but many species are
confined to only one type of habitat. According to BirdLife International (2012) among habitats, grasslands, savanna and wetlands are all important habitats for birds, each supporting about 20% of species (Figure 1).

**Figure 1 : Number of bird species dependent on different habitats**
(Source: BirdLife International, 2012)

**Figure 2 : Map of bird flyways**
(Source: Boere and Stroud, 2006)
Birds have interesting behavior of migration and usually follow preferred routes called ‘flyways’. The Central Asian Flyway extends through 21 countries from the Arctic Ocean in the North to the Indian Ocean in the South. It overlaps with both the Africa-Eurasian flyways in the West, and the East Asian-Australian flyways in the East.

Being located in the core central region of the Central Asian Flyway (CAF) (Figure 2), India has several important migration routes and covers a large intra-continental territory between Arctic and Indian Ocean. Strategic location of India intensifies the importance of the wetlands within its geographic boundaries. India is also a winter terminus for several species of migratory waterbirds migrating from Palearctic region to Central Asia (Ali and Ripley, 2001). The most abundant and regular winter migrants to North India are the ducks and geese (Anatidae), waders (Charadriidae) and cranes (Gruidae) (Ali and Ripley, 1987 and Grimmet et al., 2001). Most of these birds are migratory in nature and undertake annual migrations to their wintering grounds in India through Central Asian Indian flyway.

Since biodiversity is an integral part of ecological heritage, efforts of countries all over the world are directed towards identifying their current biodiversity status. The status of populations of long distance migrants of the Asia Pacific region remained at or below the global average in the year 2005 (Wetlands International, 2010). Further, it was reported that about 71% populations of Asian residents and short-distance migrants are showing decreasing trend and only 9% populations are exhibiting increasing trend (Figure 3).

High level ecological dependency of birds on wetlands intensifies the call for immediate restoration of degraded wetlands and appropriate measures for restoration and management in order to maintain ecological balance. The major activities responsible for degradations of wetlands include urbanization, drainage for agriculture and water system regulation (Shine and de Klemm, 1999).
The significance of the world’s wetlands is increasingly receiving due attention as they contribute to a healthy environment in many ways. It is estimated that freshwater wetlands alone support 20% of the known range of biodiversity in India (Deepa and Ramachandra, 1999).

Wetlands were first recognized as exclusive habitats for water fowl in the convention held at Ramsar in February 1971. It was one of the most important international treaties for conservation of nature and natural resources. Extended efforts of Ramsar Convention for conserving bird habitats include recognition of Important Bird Areas (IBAs). India is also one of the signatory to the convention out of 168 contracting countries. India has 26 designated Ramsar Sites, out of which 3 Ramsar sites are in Punjab i.e. Harike, Ropar and Kanjli.

Harike wetland (31°13’S 075°12’E) Ramsar site no. 462 (RCW, 2011), is spread over 51 Sq km in three districts Tarantaran, Ferozepur and Kapurthala (Figure 4). It is also a bird sanctuary spread over 86 sq km. It came into existence at the point of confluence of the two main rivers of Punjab i.e. Sutlej and Beas, after the construction of barrage in 1952. It was declared as Ramsar site in the year 1990.
Kanjli Wetland (31°25’N 075°22’E) Ramsar site no. 1160 (RCW, 2011), is spread over about 183 ha area which came into existence in 1870 by construction of a small barrage on holy river ‘Kali Bein’ in district Kapurthala (Figure 5).

This wetland was included in the list of wetlands of National importance in 1988. Recognizing its hydro-ecological and socio-religious significance, it was included in the Ramsar list in the year 2002.
Ropar Wetland (31°01'N 076°30'E) Ramsar site no. 1161 (RCW, 2011), is spread over an area of 1365 ha and came into being in 1952 with the construction of Ropar barrage over River Sutlej for diversion of water into Sirhind Canal and Bist Doab Canal (Figure 6). Ropar wetland was also included in the Ramsar list of wetlands of International importance in the year 2002.

Fate of biodiversity in Punjab having only 6.1 % area under forests, largely depends upon these wetlands as they provide habitat for different animals like birds, fishes, amphibians and reptiles. Punjab had many natural wetlands along the three major rivers of Punjab (Brar and Chandel, 2012) beside three internationally important wetlands. Small natural wetlands of Punjab had faced high level of degradation due to their unprotected status. Historically wetlands in east of Gurdaspur were once spread in few thousand acres from Pandori in north to Kahnuwan along the Beas river, but are now shrunk to pockets due to the construction of dam upstream of Beas and drainage of this area for conversion of wetland habitat into agricultural lands (Rajashekhar and Jerath, 2008). The main natural wetland pockets in district Gurdaspur are Keshopur Miani, Magarmudian, Shallapattan and Kahnuwan. These pockets are still rich in biodiversity and are home to various endemic and threatened species.

Figure 6: Map location and satellite view of Ropar wetland
(Source: Google Earth)
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Approximately 310 wetland birds are recorded from India (Kumar et al., 2005). Among those Sarus Crane (*Grus antigone*) is the world’s tallest flying bird (Archibald et al., 2003) and the only resident breeding Crane in India and Southeast Asia. Sarus crane (*Grus antigone*) is the globally threatened bird species. Sarus crane population has suffered a rapid population decline due to degradation of wetland habitats (Choudhury et al., 1999). This important bird species is recorded as permanent resident of Kahnuwan and Shalla Pattan Chhamb in district Gurdaspur of Punjab. Sarus crane has also been notified as ‘threatened bird’ in Punjab by Ministry Environment & Forests, Govt. of India (Source: Gazettee Notification no. S.O. 402 (E) dated 04.02.2014).

In recent years, there has been increasing concerns over the continuing degradation of wetlands in particular and rivers and lakes in general due to human activities. Despite regulation to protect notified wetlands, many important unprotected wetlands are continuing to be altered and lost. Richter et al. (1997) analysed the trends of wetland loss and reported that pollution from individual point sources has declined but the impacts of all other stresses and their sources have increased. Dugan (1990) opined that 65% of wetland disturbances are of human origin, while the remainders have natural origins.

Our National economic policy prioritizes crop production and is thus leading to reclamation of sensitive ecosystems including wetlands for agriculture. Current loss rates in India can lead to serious consequences because most of the residing human populations around the wetlands are resource dependent (Anonymous, 1994).

Researchers are more concerned with conservation and restoration of identified and notified wetlands but there is scanty previous documentation on ecological characteristics of natural wetlands with special reference to avian biodiversity. And it is an established fact that a detailed faunal study of wetlands is necessary after short intervals. Therefore the outcome of this project will be very useful for future management of these wetlands.

The present study on natural wetlands of Gurdaspur has been undertaken with following objectives:
To identify ecological factors affecting avian biodiversity in the wetlands.

➢ To assess fish faunal diversity in the study area and their conservation status.

➢ To assess ecological factors affecting the habitat and strategies for the wetland conservation.