ADAMA SCIENCE and TECHNOLOGY UNIVERSITY

OFFICE OF GRADUATE STUDIES

Diversity and Abundance of Wet Land Bird Species in Lake Hora-Arsedi, Bishoftu Town, Oromia Regional State, Ethiopia

A Thesis

Submitted to the Department of Applied Biology

School of Natural Science

in Partial Fulfillment of the Requirement for the Degree of Master's in Biology

BY:
ASKALE GIRMA

Adama, Ethiopia

September, 2017

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September, 2017

Approval of Board of Examiners

We, the undersigned, members of the Board of Examiners of the final open defense by Askale Girma have read and evaluated her thesis entitled" on the Diversity and Abundance of Wet Land Bird Species in Lake Hora-Arsedi, Bishoftu Town,Oromia reginal state, Ethiopia" and examined the candidate.This is,therefore,tocertify that the thesis has been accepted in partial fulfillment of the requirement of the Degree of Master's in Applied Biology.

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Declaration

I hereby declare this MSc Thesis is my original work and has not been presented for a degree in any other university and all Sources of material used for this thesis have been duly acknowledged.

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This MSc Thesis has been submitted for examination with my approval as thesis advisor/supervisor.

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Signature: _____

Date of submission: - 07/09/2017

Supervisor's/Advisor's Approval Sheet

To: _____department

Subject: <u>Thesis submission</u>

This is to certify that the thesis/dissertation entitled

"On the Diversity and Abundance of wetland Bird Species in Lake Hora Arsadi , Bishoftu Town Oromia Reginal State Ethiopia" submitted in partial fulfillment of the requirements for the degree of Master's in Applied Biology' the Graduate program of the department of Applied Natural Science' and has been carried out by Askale Girma Id. No GSU/0398/06' under my supervision. Therefore, I/We recommend that the student has fulfilled the requirements and hence here by she can submit the thesis/dissertation to the department.

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ABSTRACT

The investigation of species diversity and abundance of birds was conducted from February 2017 to May 2017 in Lake Hora Arsedi in Bishoftu town. Point count method was used to investigate the abundance of birds. Observation was conducted by periodically walking along the study area early in the morning and late in the afternoon. Different diversity indices and statistical methods (Chi-square test and correlation) were used to analyze data collected during the field survey. Abundances of birds, their richness and evenness as well as bird's diversity recording were made. A total of 14 bird species grouped under 7 orders and 11 families were recorded. The month February had the lowest species diversity (H'=0.33), species evenness (E=0.13) and species richness (12). The highest species diversity, evenness and richness were recorded in March and April (H'=0.35), (E=0.35) and(S=14), respectively. Variation in abundance of birds was statistically significant between months and different times. Abundance score of frequency of bird species was high during rainy season and uncommon are high during small rainy seasons using encounter rate. Lake Hora Arsedi has a number of natural and human induced bird attractant features. The area possesses favorable places for birds to nest, rest, roost and a good access to food as well as water resources. Maintenance of bird watching records to monitor the effectiveness of management and to ensure early detection of any impact on bird numbers or behavior. Managing the health of water by avoiding the people who are taking shawor inside the lake, washing their closes and swimming.

Key words: Abundance, species evenness, species diversity, Species richness, Birds, Bishoftu.

1 INTRODUCTION

1.1 Background of the study

Birds are among the most easily defined and readily recognized categories of animals, due to the presence of feather, which is unique to them. In addition, to feathers, the development of fore limbs as wings, mostly for flight (VanTyne and Berger, 1959). feathered tail that serves for balancing, steering and lifting; toothless, horny beak and skeleton exhibiting unique adaptations, mainly for flight and bipedal locomotion are characteristics of birds (Wallace and Mahan, 1975).Birds are both visually and acoustically conspicuous organisms of most ecosystems, because they are comparatively easy to identify. Birds have received considerable attention of humans (McLay, 1974). Although, they occupy most of the earth's surface, most species are found only in particular regions and habitats, whereas others are cosmopolitan (VanTyne and Berger, 1959). Patterns of abundance of birds are strongly related to environmental factors, which determine their presence and activity.

The power of flight allows them to move easily through the air and yet they are perfectly adapted to every environment that fit their requirements for successful reproduction and survival (Welty, 1975). Throughout human history, people have always tried to enhance their comfort. Human's, intervened in natural habitats and greatly decrease the area of naturally functioning ecosystems worldwide (Hannah *et al.*, 1994). Diversity and extent of natural habitats will continue to decline as human populations increase and alter lands for development (Petit *et al.*, 1999).

They transformed natural areas by establishing Towns, building houses, gardens, which create entirely artificial environments. Factors determining which species can coexist with human settlement include the presence and patch size of native vegetation as well as competition with exotic species and non-native predators. The structure and floristic attributes of planted vegetation as well as supplementary feeding by humans affect the level of such coexistence (Chace and Walsh, 2006).The effective management of human activities in wildlife areas is an important conservation issue, as the footprint of human influence continues to expand and incidental impacts of human activities spread into more areas.

Such expanding anthropogenic activity is widely perceived as negative consequences for the wildlife beyond habitat loss. Understanding how animals respond to anthropogenic activities is fundamental to resolving potential conflicts between humans and animals. There are numerous ways in which it is possible to study animal responses or birds, but changes in an animal's behavior or birds are often the most obvious consequences of anthropogenic activities (Beale, 2007). Distribution, abundance, reproductive success and behavior of animal species or birds are often sensitive to habitat change caused by human activities. Birds have been used as bioindicators in a number of studies and have more recently been used as national indicators for sustainable development. They can indicate changes in: vegetation extent, pattern and structure standing water extent, depth, duration and seasonal frequency, water quality and disturbance. Birds are, therefore, valuable as ecosystem change indicators because they often respond to cumulative effects of environmental influences. It has been particularly useful as indicators to evaluate effects of habitat change because they are easy to watch and the populations of many decrease or increase when the land is modified by different activities. They are well-known indicator taxa due to their sensitivity to environmental perturbations, relevance to ecosystem functioning and relative ease in sampling (Posa and Sodhi, 2006). They are indicators and useful models for studying variety of environmental changes (Sutherland and Green, 2004).

Although there are some problems with monitoring birds they are useful taxonomic group to monitor as they are often well known, easily recognizable, simple to locate than many other groups, can be valuable indicators of the state of particular habitats and are also key species for education and public awareness (Urfil *et al*., 2005; Estrella, 2007). Birds are sensitive to both direct and indirect environmental influences. Many of them have adapted with the changes that humans have inflicted on the ecosystem. Birds are important for the ecosystem as they play various roles as bio-indicators of different kind of environmental changes like urbanization (Urfil *et al*., 2005; Estrella, 2007). Wetland environments provide birds with considerable quantities of food and roosting sites especially in gardens and parks (Dorst, 1974). Ethiopian Central Rift Valley (ECRV) area is known to have a number of lakes and hydrological features (Jensen *et al*., 2007) watershed areas, the lakes are known to harbor millions of resident and migratory water-birds.

However, these natural resources have been under threat by unregulated land-use changes happening in the area (Aynew, 2009). The study area, Lake Hora Arsedi, is one of such lakes that are under great threat of land-use changes mainly due to extensive building of houses imply without any purpose surrounding the lake. Many bird species descend on wetlands to feast on the amphibian, shellfish and insect buffet that hovers in and around wetland waters. Due to an abundant availability of food, wetlands are also popular with birds for breeding, nesting and rearing young (Dorst, 1974). Some species could be attracted to such areas since it introduces new exploitable resources such as water, ornamental plants and grasses (Posa and Sodhi, 2006). Birds have adapted to life in wetland areas and look for food in grasses, fishes and rubbish dumps (Morgan, 2004).Many different wetland birds are attracted to a variety of wetlands based on the type of food and cover provided inside and near the vicinity of Lake Hora Arsedi. Lake Hora Arsedi provides a wide variety of natural and human made habitats that offer food, water and cover (Dorst, 1974).

Lake Hora Arsedi is attractive to birds for a different variety of reasons, and the reasons vary with the species of birds involved and the time of year. Each species of bird has its own behavior, habitat preferences, preferred foods, loafing and roosting habits, flocking tendencies, and times of seasonal occurrence. Several different human activities make Lake Hora Arsedi less attractive for birds.These include human disturbance during different activities like increasing the number of fisher man, the number of boats, the number of tourist etc. Buildings can be modified to reduce or eliminate roosting and nesting sites of birds. Once the features that attract birds and other wildlife to the Lake Hora Arsedi are known, they can be removed or changed to reduce their attractiveness. This approach is called habitat manipulation, because it involves alterations of the habitat (or living space) of the birds.

The birds which inhabit and depend on wetland directly or indirectly for feeding, breeding, nesting or roosting are commonly called water birds or wetland birds. Lake Hora Arsedi provides certain birds with nesting, roosting, food, shelter and other facilities (Brown *etal*,2001: Sutherland *et al.,* 2004).The type of food and cover present in a wetland is based on water levels and vegetation composition.

Wetlands with both dense and sparse stands of vegetation provide food and cover for specific types of birds. Birds are all over the time, they are drawn to the water for drinking, eating, bathing, roosting and protection; especially during the morning time and then they are warm up their body by wrapping their wings after they returning from the water come to near the lakes out of the water body. Wetlands have profound ecological and economic importance.The wetlands of Hora Arsedi are facing tremendous anthropogenic pressure, which can greatly influence the structure of the bird community. Lake Hora Arsedi consists of congregated water birds. It is surrounded by forest which consists of different trees or woodlands, grasses and within the forest different houses cafeteria and hotels and also other different buildings. The lake water, its shoreline, the woodland and wet grassland habitats also serve as roosting and stop-over sites for a diverse and abundant assemblage of resident and pale arctic migratory bird species Ethiopian Wildlife and Natural History Society (EWNHS, 1996). Although, the lake and its associated habitats harbor various species of birds in large numbers, a combination of socio-economic and climatic factors has resulted in the loss of biodiversity of the lake (Abebe, 2003).

Mostly they are highly productive but ecologically fragile, liable to degradation and degeneration under the prevailing anthropogenic pressure. The loss of water bird habitats through direct and indirect human interferences has led to a decline in several water bird populations. Therefore, it is vital to understand the underlying causes for the decline in populations and to control these trends in order to prevent the loss of key components of the biodiversity of wetland habitats. Among wildlife species, birds have been more susceptible to environmental changes through land-use changes (Kolecek *et al*., 2010). Particularly, alteration of environment of freshwater lakes by land use changes is known to have negative effect on water-bird community structure (Hill-Lukkarinen *et al*., 2011).Monitoring of wetland birds provide valuable information on the ecological health and status of wetlands and can be a vital tool for developing awareness regarding the conservation value of the wetlands. Most bird species of Africa's bird live in highlands. In Ethiopia they live in Lowlands, river banks, wet lands, dams, lakes, forests, shrubs and grasslands. The number, diversity and color of birds found in the country have power to interest even the non birders.

Wetlands shelter countless species of fauna and flora, of which the most widely appreciated are the birds. Many wetlands are renowned because of their birdlife. Indeed, around 12% of all African bird species are found in and around wetlands. In Ethiopia, 204 (around25%) of bird species are wetland-dependent. Although, many of these birds are known, much about their habitats remains un investigated (Pulliam, and Danielson, 1991,).Human activities threaten the existence of many birds by destroying their habitat or directly affecting their survival and reproductive success. To describe basic bird movement patterns at the Lake Hora Arsedi, it is important to quantify the over flying rate in relation to species, flock size, flight direction and bird behavior. Land owners should protect existing wetlands and restore former wetlands when feasible. What follows are general management considerations that apply to most wetland.How these factors are influenced by environmental conditions and human activity also requires examination. Studies should also focus on the birds and human activities such as fisher men and boat user (Blokpoel, 1976).Lake Hora Arsedi is site known for diversity and abundance of bird species. The community assemblage of bird population in the area consists of collection of populations of different densities that require similar environmental condition. Lake Hora Arsedi has a number of habitats available to support diverse bird species. Lake Hora Arsedi was found to be characterized by birds of high diversity. The vegetation structure and rainfall played important roles in determining the species diversity and richness of the birds. The present study focuses on gathering information on the abundance, species richness, species evenness and composition of birds in the area.

1.2 Statement of the problem

Anthropogenic factors can have major impacts on ecosystem functioning and stability, which are often reflected in changes to biodiversity that includes birds. This is because abundance and diversity of the birds' community are changed. Thus; effective management of human activities in wildlife areas is an important conservation issue, as the footprint of human influence continues to expand and incidental impacts of human activities spread into more areas. Such expanding anthropogenic activity is widely perceived as negative consequences for the wildlife beyond habitat loss alone. Understanding how animals respond to anthropogenic activities is fundamental to resolving potential conflicts between humans and animals.

There are numerous ways in which it is possible to study animal responses, but changes in an animal's behavior are often the most obvious consequences of anthropogenic impacts (Beale, 2007). The abundance of animal species is often sensitive to habitat change caused by human activities. Birds have been particularly useful as indicators to evaluate effects of habitat change because they are easy to watch, and the populations of many decrease or increase when the landscape is modified by such activities. Different literature has noted that changes in surface water as a result of land-use changes have made a significant impact on local biodiversity like birds. Bird species richness and abundance are influenced by local resource availability and vegetation composition, the overall habitat quality. Bird community structure is negatively affected by changes in land-use and land cover as well as different human disturbance like as moving around without any permission increasing number of fisher man, number of boat and any work around the bird's habitat. Lack of quality of habitats for birds found in Lake Hora-Arsedi in Bishoftu town, So, species diversity, its richness and evenness have been not identified. Lack of resources to get enough information is also one of the problems to do the research.

1.3 OBJECTIVES OF THE STUDY

General Objective

To investigate the species diversity, abundance and species richness of birds at Lake Hora Arsedi in Bishoftu town.

Specific objectives

- To determine the diversity of birds in Lake Hora-Arsedi in Bishoftu town;
- To determine the abundance of birds in Lake Hora-Arsedi.
- To investigate and determine the habitats of the Birds in Lakes of Hora-Arsedi.
- To study species evenness in Lake of Hora-Arsedi.

1.4 Research Questions

The research questions are:-

1. What is the abundance and species richness of wetland Bird species are found in Lake Hora-Arsedi?
2. What is the abundance of wet land bird species in Lake Hora-Arsedi?
3. What is the diversity of wet land bird species in Lake Hora-Arsedi?

1.5Scope of the study

This study was conducted in Lake Hora-Arsedi in Bishoftu town, east shoa Zone, Oromia Region, Ethiopia. In this study, the abundance of wetland bird species would be identified in the study area; or this study is delimited to Lake Hora Arsadi, Bishoftu town, Ethiopia.

1.6 Significance of the study

The study would be helpful in investigating the abundance of bird species found in Lake Hora-Arsedi in Bishoftu town. Moreover; this study could be used as reference for those who want to conduct similar studies. Also, would have significance in providing awareness to community to use wisely and safely. Finally, the study would also help experts of natural resources and Country Development Agencies to make detailed analysis of the effects of Birds and developing their conservation. The result of this study would help to take conservation measures by concerned authorities or conservation agencies.

2. REVIEW OF RELATED LITERATURE

2.1 Wetland Bird species.

Bird Life International is a Partnership, non-governmental conservation organizations working in more than 100countries, with a special focus on birds. The Bird Life Partnership works together on shared priorities, policies and programmes of conservation action, exchanging skills, achievements and information, and so growing in ability, authority and influence. The first Important Birds Area inventory to cover a whole continent was published for Europe in 1989 (Jones 1989). Ethiopia has long been recognized for its richness in natural resources. Ethiopia possesses the fifth largest floral composition in tropical Africa (Brenan, 1978). There are about 926 bird species listed for the country, of which 21 are endemic and 19 are globally threatened (Lepage, 2006). There are two categories of wetland birds: wetland specialists and generalists. Specialists are those that nest, feed and roost in wetlands.

Wetland specialists are wholly dependent on aquatic habitats, and cannot survive without them. Examples are ducks, gulls, herons, waders, crakes, the Black-crowned crane, etc. Generalists are those birds that are frequently found in wetlands, but are sometimes seen in other habitats as well, such as ibises, some weavers, warblers, plovers etc. Cranes, for example, are generally regarded as terrestrial birds. But breed exclusively in wetlands, especially favoring seasonal grass swamps (Green & Hirons, 1991).Most wetland birds depend, partially or entirely, on aquatic habitats to complete their life cycles. Many of these bird species are migratory and the variety and numbers of such birds, on their breeding grounds, migration stop-over sites, and wintering grounds, have been reduced due to several factors. According to Wetland International of global water bird populations are decreasing or heading towards extinction.

A standard method facilitates comparisons among the different water birds. Many bird groups rely on wetlands for food, shelter, water and living space. The more diverse a wetlands, the greater variety of birds it will attract. Multiple wetlands in close proximity, connected by grass/woody corridors, result in greatest wetland bird abundance and diversity. Healthy wetlands are dynamic and diverse. In addition, biologists at the Natural Resources Research Institute have compiled and georeferenced data from the North American Breeding Bird.

Many bird species rely on wetlands for all or part of their life cycle. Water birds can use a range of different wetland habitats including swamps, lagoons, mudflats, estuaries, embayment and open beaches, freshwater and salt lakes, rivers, flood plain wetlands and dams (Jones 1989).Water birds depend on free-standing water to feed by swimming, wading or diving or to establish nesting sites. These include waterfowl (ducks, geese, and swans), grebes, pelicans, cormorants, crakes, rails, ibis, egrets, herons and shorebirds (or waders). Some water bird species, for example, glossy ibis (*plegodis falcinelluss*), freckled duck and blue-billed duck, are thought to breed almost entirely within wetlands. Many bird species use forested wetlands as well as forested uplands, feeding on the abundant insects associated with trees. These birds are not depending on wetlands because they use both habitats equally well.

Some birds, such as wood ducks, are found primarily in forested wetlands and are dependent on this wetland type many migratory birds are wetland dependent, using wetlands during their migration and breeding seasons. Some wetlands are on the migration path of waterfowl and other migratory birds and provide stopover locations for traveling birds(Jennings, 1975).These birds might feed in agricultural fields during the day and return to the shelter of wetlands during the night about one-third of North American bird species use wetlands for food, shelter, and (or) breeding (Kroodsma, 1979). Thus, widespread draining and altering of wetlands has affected bird populations. During their life cycle, migratory water birds cover considerable distances in order to find the best ecological conditions and habitats for feeding, breeding and raising their young. However, migration is a perilous journey, presenting a wide range of threats.

Only a small number of birds are actually threatened by natural events. Human activities are the source of most dangers migrating birds are exposed to flying over long distances means crossing many international borders and entering different political areas with their own environmental politics, legislation and conservation measures. It is clear that international cooperation between governments, NGOs and other stakeholders is needed along the whole flyway of a species in order to share knowledge and to coordinate conservation efforts.

The necessary legal framework and coordinative instruments for such international cooperation is provided by international agreements such as Agreement on the conservation of African-Eurasian Migratory Water birds. Kingsford, (2000) pointed out that the construction of dams affects the estuarine and coastal ecology; there by reducing the amount of water reaching flood plain wetlands.

2.1 Wetlands

Wetlands are complex habitats, which support highly adapted characteristic fauna and flora. Most wetland birds depend, partially or entirely, on aquatic habitats to complete their life cycles. Many of these bird species are migratory and the variety and numbers of such birds, on their breeding grounds, migration stop-over sites, and wintering grounds, have been reduced due to several factors (Yilma, and Geheb, 2003). The highest number of water birds is often found in wetlands which have the greatest diversity of plant species and vegetation types, or where there is permanent water. Wetlands are biologically productive and provide feeding grounds for a diverse range of resident and migratory water birds. Wetlands are so variable that their appearance and boundaries fluctuate over time. These dynamic changes are what make wetlands difficult to define (Yilma, and Geheb, 2003).

Wetlands are a distinctive group of habitats between aquatic and terrestrial ecosystems (ponds, swamps, marshes, lakes, flood plains, river banks, deltas etc). These habitats are becoming increasingly recognized as the most productive natural resources, because of their ability to fulfill a range of functions and produce a number of products that are socially and economically beneficial to the local community. The geographic location of a wetland may determine how and when birds will use it as habitat. Wetlands are the most productive ecosystems in the world, yet they have suffered more loss and degradation than any other ecosystem (Veech, and Christ, 2007.One of the best known functions of wetlands is to provide a habitat for birds (Whelan, Wenny, and Marquis, (2008). Humans have known the link between birds and wetlands for thousands of years. Prehistoric people drew pictures of birds and wetlands on cave walls, scratched them onto rocks, and used them in the design of artifacts and Native American lore provides accounts of bird hunts in wetlands.

Wetlands are important bird habitats and birds use them for breeding, nesting, and rearing young. Birds also use wetlands as a source of drinking water and for feeding, resting, shelter, and social interactions. Some waterfowl, such as grebes, have adapted to wetlands to such an extent that their survival as individual species depends on the availability of certain types of wetlands within their geographic range (MacArthur, 1961).Wetlands provide a variety of habitats and food sources for birds to live and reproduce. Many water birds move regularly to newly flooded habitats to feed and breed before a wetland dries down. Some semi-permanent, permanent and coastal wetlands can provide refuge for species when wetlands in other regions are dry for long periods (MacArthur, 1961).

The Lake's shoreline, lake water, and associated wet grasslands and riverine wood lands provide important feeding and breeding habitat for birds. The more diverse a wetlands, the greater variety of birds it will attract the lake and its associated habitat diversities are important sources of food and nesting for many bird species, a combination of anthropogenic pressures and negative climatic factors have led to biodiversity losses Multiple wetlands in close proximity, connected by grass/woody corridors, result in greatest wetland bird abundance and diversity (Conway, 1995).

2.1.1 Factors Affecting Wetland Birds

The relation between wetlands and birds is shaped by many factors. These include the availability, depth, and quality of water the availability of food and shelter; and the presence or absence of predators (Conway, 1995). Birds that use wetlands for breeding depend on the physical and biological attributes of the wetland (Pulliam and Danielson, 1991).Birds have daily and seasonal dependencies on wetlands for food and other life-support systems. The value of a wetland to a specific bird species is affected by the presence of surface water or moist soils and the duration and timing of flooding. Water might be present during the entire year, during only one or more seasons, during tidal inundation, or only temporarily during and after rainfall or snowmelt. At times water might not be present at the land surface, but might be close enough to the land surface to maintain the vegetation and foods that are needed by birds. Birds may use wetlands located in depressions in an otherwise dry landscape, along streams, or in tidally influenced areas near shorelines.

2.1.2 The Importance of Wetlands to Birds

Birds score high on many of the broad criteria defined for selecting indicator taxa. Wetlands are important habitats for avian populations throughout the world. Because of the great variety of wetlands, bird adaptation to and use of wetland environments differs greatly from species to species. Birds' use of wetlands during breeding cycles ranges widely. Some birds depend on wetlands almost totally for breeding, nesting, feeding, or shelter during their breeding cycles. Birds that need functional access to a wetland or wetland products during their life cycle, especially during the breeding season, can be called "wetland dependent".Other birds use wetlands only for some of their needs, or they might use both wetland and up land habitats. More than 1,900 bird species that breed in North America, about 138 species in the conterminous United States are wetland dependent (American Ornithologists' Union, 1983). Many bird species use forested wetlands as well as forested uplands, feeding on the abundant insects associated with trees.

These birds are not dependent on wetlands because they use both habitats equally. Some birds, such as wood ducks, are found primarily in forested wetlands and are dependent on this wetland type. Many migratory birds are wetland dependent, using wetlands during their migration and breeding seasons. The availability or influence of water is a very important wetland feature to birds. Determining physical or biological factors include water depth and temperature, presence or absence of vegetation, patchiness or openness of vegetation, type of vegetation, foods, water chemistry, type of soils, and geographic or topographic location**.** It is globally understood that wetlands play important role in ecological, economic, social and cultural functions.Management of natural resources using system wide concepts to ensurethat all plants and animals in the ecosystem are maintained at viable levels in native habitats and that basic ecosystem process (e.g. nutrient cycling) are perpetuated in definitely"(Burnside and Rasmussem, 1997).The sum of the wetlands functions, products, and attributes that are derived from the individual biological, chemical, and physical components of ecosystem and their interaction. Any variations in any of these wetland features will cause subtle, but distinct, differences in bird use. Wetlands provide food for birds in the form of plants, vertebrates, and invertebrates. Some feeders forage for food in the wetland soils, some find food in the water column, and some feed on the vertebrates and invertebrates that live on submersed and emergent plants.

Vegetarian birds eat the fruits, tubers, and leaves of wetland plants (Mitsch, and Gosse link, 1993), Water temperatures influence food production. Invertebrate production in the water column may ultimately depend on water temperature and the ability of a wetland to produce algae. Cold water might not be a hospitable environment for small animals and plants that some wetland birds eat. However, water that is too warm also might not produce foods that some birds prefer. Wetland vegetation provides shelter from predator and from the weather (Mateos, 2004). The presence or absence of shelter may influence whether birds will inhabit a wet land or a nearby upland area. Predators are likely to abound where birds concentrate breed or raise their youngs.

2.2 Important Bird area in Africa

International Secretariat and, increasingly, by national IBA(Important Bird Areas) coordinators in individual countries, the actions of many individuals and organizations have coalesced into a large scale IBA (Important Bird Areas) Programmed in many parts of the world. So far, this has resulted in the production of 40 national IBA (Important Bird Areas) inventories. Worldwide (including 12 in Africa), as well as region an inventories for Africa (Evans, 2001).Building on these inventories, the IBA (Important Bird Areas) Programmed for the last decade has addressed site-oriented research and action, encompassing habitat management, monitoring, education, advocacy, national and international legal protection a total of 1,230 IBAs (Important Bird Areas) have been identified in Africa currently. A large amount of data has been collected by the Africa Birdlife Partnership and other experts, across seven core variables used to indicate the conservation status of these IBAs (Important Bird Areas) (Evans, 2001).

There are many areas of important Bird areas in Ethiopia as well as in the world.The first IBA (Important Bird Areas) inventory to cover a whole continent was published for Europe in 1989 (Grimmett and Jones 1989).Facilitated since 1990 by a coordinator at the bird Life International Secretariat and, increasingly, by national IBA coordinators in individual countries, the actions of many individuals and organizations have coalesced into a large scale IBA Programmed in many parts of the world. The wetland with in an individual IBA (Important Bird Areas) can qualify as a potential Ramsar Site under several Ramsar criteria.

2.3Bird Habitats

The major habitats around Lake Hora Arsedi are shrubs, grasses, forest, rocky area, cliffs, and reed beds and the lake itself. Water retention high, making the area prone to inundation. The flat land particularly where water lies in the rainy season, is grassland with a mixture of palatable indigenous grasses and reeds. The marsh supports a variety of grasses sedges and climbers (Evans, 2001). One of the most striking features of Lake Hora Arsedi was the extensive papyrus beds. Other large plants in the reed beds were Tapha,Echinochloa spp.grasses and polygonum.Several aquatic plants,including *Nymphaea coerulea*, were noticeable. Unfortunately,the invasive *Eichhornia crassipes* was recently found in some of the tributaries in the East and North eastern parts of the lake (Solman 1973).\.

The lake and its associated habitat diversities are important sources of food and nesting for many bird species.The birds which inhabit and dependant on wetland directly or indirectly for feeding, breeding, nesting or roosting are generally known as water or wetland birds. Trees in ornamental settings or woodlots provide roosting habitats for species of small, flocking birds. Trees also provide nesting sites for raptors which are commonly struck at Lake Hora (Lyon and Caccamise, 1981). The Tree and bushes were also nesting and roosting sites for some of birds. Bird response to grass of different heights differed by species due to the different patterns of habitat use by the birds (Solman 1973).

2.4 Wetland Bird Species in Bishoftu Lakes.

Ethiopia, has firmly established itself as one of Africa's top birding destinations. That is regularly hits the top of the list of favorite African birding destinations. Despite the fast-expanding population, the entire country is packed with avian species and one cannot fail to enjoy the myriad of bright birds, special mammals, spectacular scenery and superb coffee and wonderfully friendly people! Due to the dry conditions in many parts of the country the bird is also often relatively easy and there are so many endemics and specials on offer. Ethiopia possesses a great diversity of lakes; rivers and wetland ecosystems. As a result, Ethiopia is a center of biological diversity with ample endemism, As well as Its has a diverse number of both terrestrial and aquatic bird species and one of the most significant in Africa and its diver's habitat type definitely contribute for the immensely diverse avifauna.

The number of species varies in literature but the most commonly cited number is 861 species of birds Ethiopian Wildlife and Natural History Society (EWNHS, 1996).However a recently published book on the birds of Ethiopia and Eritrea by Ash and Atkins, (2009) minimized to 837 species. The Ethiopian aquatic ecosystems are found in many areas and include the major rivers and lakes that are of great national and international importance. The country is well known for its richness in its water potential. There are about 30 major lakes 12 major river basins and over70 wetlands that are located in different ecological zones of Ethiopia. From this seven creator lakes are found in Bishoftu town. Bishoftu is prosperous in 7 (seven) creator lakes & which have beautiful scenery. They are: Lake Hora Arsedi, Lake Bishoftu, Lake Babogaya, Lake Kuriftu, Lakekilole, LakeMagarisa and Lake cheleleka. From these birds are mostly seen in Lake Hora Arsedi and Lake Cheleleka.

I Hora Arsedi

II. Lake Bishoftu

This lake has Maximum depth of 85m & it is the deepest of all surrounding lakes (Mohr, 1961). The attractive feature of the lake is its scenic beautiful surrounding rocky steep invites for sight seeing and nature admiring. It has attractive different Hotels & Resorts such as Pyramid Resort & Hotel,Dream land Hotel & Resort & Bishoftu Afaf Hotel and resort as well as some under constrictions like Engineer Hailele'ul Resort, Negash Resort(Wood *et al.,* 1976).

III. Lake Babogaya or Lake Bishoftu Guda

Lake Babogaya is nearly the same size of Hora but much deeper. It is situated at north-east of Hora lake with along asphalt ring road. The presence of fishes, different kinds of water bird species like ducks and geese as well as the surrounding of greenish vegetation on its ridge especially endowed with breath taking beauty make this lake become popular (Betre Alemu, 2000).This lake is developed by many International Hotels & Resorts such as Babogaya Resort, Adulala Resort, Leisak Resort, Salayish Lodge & Park, Elam Lodge, View Point Lodge and Additionally Ethiopian Maritime Ships Institution…etc.

IV. Lake Kuriftu

Very close to the Babogaya Lake, Lake Kuriftu has now become one of the country's best known resort centers. The privately owned resort center, kuriftu resort, is an ideal place for tourists to visit and stay in (Mohr, 1961).

V. Lake kilole

Kilole Lake is at the distance of 12 km from Bishoftu town. It is the farthest of the lakes in the area. Birds like water flows, African fish eagles, cormorants, Egyptian geese, duck, plovers, etc. are easily seen around the lake (Mohr, 1961).

VI. Lake Magrisa

Meaning "green lake", is about 9 km away to the south west of the town just behind the Air Force base. The lake looks green because of its algae. It is more dramatic, colorful and beautiful when viewed against the backdrop of the surrounding hills. Though scenic and beautiful, it is a quite lake with no activity around it (Betre Alemu, 2000).

VII Chelekleka

Chelekleka is in a shallow pan into which fresh water seeps and flows from the surrounding cultivated slopes. Water fills the muddy depression during the rainy season and persists well into the dry season. The two highland ranges of Telltale and Sofa, on the north-eastern side of the swamp, are the main catchments for Chelekleka. Because of its shallow nature, the lake's shoreline is wide. The size of the inundated area varies dramatically from year to year, although, recently the size of the swamp has been reduced through the construction of flood-control dykes in the feeder streams, and channeling run-off from the town into Bishoftu Lake.

It is formed by the rains which are periodically the feeding ground for about 100,000 flamingos. Many bird species rely on wetlands in Bishoftu lakes for all or part of their life cycle. Water birds can use a range of different wetland habitats.

Water birds depend on free-standing water to feed by swimming, wading or diving or to establish nesting sites (Mengistu,2000).These include pelicans, cormorants, crakes, ibis, egrets, herons and Abdim's stroks (Kitsch and Gosse link, 1993).

2.5 Bird Status and Abundance

2.5.1 BirdStatus

The Status of Birds such as cormorants, hammer cops, ducks, geese, herons, king fisher's, darters and stroks Species are adopt from different sources of Bird guide Books (Sinclair and Ryan,2003; Redman *etal*, 2009) and Avi-base Ethiopia (Lepage,2006). However, the relative abundance of the species at Lake Hora Arsedi area is consider based on the different studies of the author. A group of cormorants sometimes referred to as the Florida sub species is thought to be re-expanding north ward, and managers suggest that birds in South Carolina may belong to this group. Birds are among the best monitors of environmental changes and have been used to assess the environment throughout the history as "biomonitors" and the changes in their population, behavioral patterns and reproductive ability have most often been used to examine the long term affects of habitat fragmentation. Hence they are the good indicators of ecological status of any given ecosystem. Individuals of most species were not distributed randomly and most populations exhibit fluctuations in abundance across space and over time. Species composition of Lake Hora may affect the relative attractiveness of forest around the lake for birds and other mammals.

2.5.2 The Abundances of wetland Birds in Ethiopia

The relative abundance of bird species during seasons might be related to the availability of food, habitat condition and breeding season of the species. The distinct seasonality of rainfall and seasonal variation in the abundance of food resources result in seasonal changes in the species abundance of birds. The distribution and abundance of many bird species are determined by the composition of the vegetation that forms a major element of their habitats. As vegetation changes along complex geographical and environmental gradients,

a particular bird species may appear, increase or decrease in number, and disappear as the habitat changes (Lee & Rotenberry, 2005). Relative abundance of avian species was determined using encounter rates that give crude ordinal scale of abundance.

2.5.3Feeding and roosting

Water birds use a range of wetland habitats to source a variety of food. This helps meet the specific dietary needs for different water bird species, with many being either fish-eaters (piscivores), plant eaters (herbivores), or invertebrate feeders (Blake, 1992). Fish-eating birds include some of the larger water birds such as pelicans, cormorants, herons, egrets and Hammer kop. Wetlands with deep, open water attract diving ducks such as musk ducks and hardheads. These birds feed on aquatic plants and animals, particularly yabbies, freshwater shellfish and mussels. Grazing waterfowl such as the Australian wood ducks, black swans and plumed whistling ducks are often found roosting on grassy banks of a wetland or 'bottom up' feeding on wetland plants. Reeds and rushes provide cover for shoreline foragers including crakes, rails and swamp hens (Lepage, 2006).

Mudflats and shallow water are rich feeding areas for feeders of invertebrates such as cormorant, ibis, egret, goose, Hammer kop and Heron. Birds that usually eat insects may start to eat berries to supplement their diets. Birds will start to look for reliable sources of food for winter time survival. And, in the fall, many birds began forming flocks. Flocks of birds are better able to find food and protect themselves from predators. The wetland birds are in general being heterogeneous in their feeding habits. The habitat by supporting different aquatic fauna like fishes, crustaceans, invertebrates, water plants and planktons as the primary feed and also surrounding forest land. Daily activity patterns of birds are influenced by several factors including weather, season and habitat (Bull, 1997), even though, activity patterns are likely to differ among species (Blake, 1992).Biotic factors affecting species distribution and interspecies interaction as well as the resources that are essential for a species or a group of species have a non-uniform distribution in space (Nabaneeta and Gupta, 2010). The African fish-eagle launches from its perch, swoops low over the water, and at the critical moment throws both feet forward to seize hold of its target with powerful talons. Small fish are carried through the air into a tree, but larger catches are dragged through the water to the shoreline.

When the pied kingfisher perched often bobs its heads up and down and will sometimes raise its tail and flick it downwards (Blake, 1992). Herons stalk the shallows, snipe feed in the long grass at the water's edge while grebes, ducks and cormorants feed in the open water. Water birds have specific adaptations which enable them to exploit particular niches with in a wetland and limit direct competition with each other. For example, certain water birds feed on shallow flooded areas and mudflats, while others graze upon submerged and floating plants or dive to catch aquatic invertebrates in deeper water. The Abdim's stork and Egyptian goose diet consists mainly of locusts, caterpillars and other large insects, although the birds will also eat small reptiles, amphibians, mice, crabs and eggs and roosting around the shoreline of the lake in the grass and reeds (Fig. 1).

Figure 1 Egyptian Goose roosting, at HoraArsedilake.
Source; Photo-AskaleGirma(April 2009).

2, 5.4 Bird identification

Bird identification is the basic components of bird watching; however most amateur bird watchers start trying to identify birds from pictures or descriptions. Experienced and experts on the other hand have those picture as well as other clues in their mind. The following key points will help beginners to identify birds while they are in the field. Those are: Size, Shape (body shape, Beak, Wings, Tail and Legs).Songs and calls, Habitat (Hammick, 2002). Observing is more than just looking at a bird, it is nothing any an usual markings, shapes or colors that can help clarify the bird's identity. When observing birds, look for this characteristic in addition to size and habitat mentioned.

Bill**:** shape, color, length, curve and markings will show how the bird uses its bill and can be a key for proper identification. Also observe the size of the bill compared to the bird's head and how high up on the head the bill reaches (Hammick, 2002).Color: Overall body colors and special patches of Color are one of the easiest clues to a bird's identity. Check the abdomen, head, back, chest, outer tail, feathers, legs, eyes and feathers around the eyes for different colors.

Markings: Special marking can distinguish two closely related bird species. Looking for stripes, dots and bands on the birds wings, head tail and body. Note how clear or blurred they are. Behavior: Observing how birds behave can be challenging but can also be critical for proper will bird identification. Note sounds, flight patterns, where the bird lands, what it eats and how it interacts with other birds. With so much to observe, even experienced birders can easily miss vital clues to a bird's identity. A digital camera is very useful for capturing a bird's appearance for later identification. This is depending on Bird guides.

The aims of this study were to investigate the abundances of wetland Bird species in the study area (Lake Hora Arsedi). Field work was started by recorded down the weather conditions and other affecting factors, such as the presence of grass cutters, fisherman, and boats passing. During field work, I tried to detect, locate and identify most of the individual birds in a certain range. The name of the bird Species was recorded based on bird guides and their locations clearly recorded on data sheets (Hostetler and Main, 2011). The behaviors of birds were also recorded, such as nesting, flying-through, swimming and feeding.

Birds in the study area were observed using naked eyes and binoculars for better identification as well as hand tally during counting. Moreover, photographs were taken for further identification of birds and to capture corresponding habitat types. Field identification of birds was aided by binoculars and digital camera as well as field guide books (Sinclair and Ryan, 2003). The fundamental parameters of biological communities, that is the number of species (species diversity) and the number of individuals within each of those species (species richness) were assessed in the study area. The species richness and diversity were measured for broader understanding of bird species richness and diversity as well as bird abundances around Lake Hora Arsedi.

3. Materials and Methods

3.1 Description of the Study Area

Like all the other volcanic crater lakes in the area, Lake Hora is a closed system, surrounded by very steep and rocky hills and cliffs. Mohr (1961), estimated the age of Lake Hora along with other Bishoftu crater lakes as early Holocene (≈ 7000 years). The catchment of the lake is formed from volcanic rocks of basalt, rhyolite and tuff. So, Lake Hora-Arsedi is a crater lake formed by volcanic activity ~7000 years ago (Mohr, 1961). It is located in Bishoftu town and is only 2 km from the center of the town and about 47 km southeast of Addis Ababa at 1850 m altitude and located at 8.7645 degree latitude and 38.9924 degree longitude. The lake has a surface area of 1.03 km^2, maximum depth 38 m and mean depth 17.5 m (Mohr, 1961). This lake is also the biggest in town. This lake is the oldest developed resort in Bishoftu. The average temperature of the surface water is about 22^oC with a maximum of 24.5^oC and minimum of 19.2^oC, while the bottom temperature is almost constant (19.2^oC-19.4^oC) (Wood *et al.*, 1976). Lake Hora Arsedi is one of the structural features in wetland environments.

The lake has both indigenous and exotic flora, terrestrial and aquatic fauna including a variety of birds (Betre Alemu, 2000).The surrounding hillsides were covered with forest dominated by *Junipers procera*, and the lower slopes supported groves of *Acacia s*pp and covered with plantations of *Eucalyptus*. The region around the lake is characterized by moderate rainfall, varying around 850 mm per annul, high incidence of solar radiation and low relative humidity (Rippey and Wood, 1985).The region has two rainy seasons, the short rainy season from February to April and the long rainy season from June to September. The soil type is characterized as Andosol (Fisseha Itanna, 1992). Its wealth of fish species and aquatic bird life give opportunities for fishing and bird watching (Fig 2), Map of the study area.

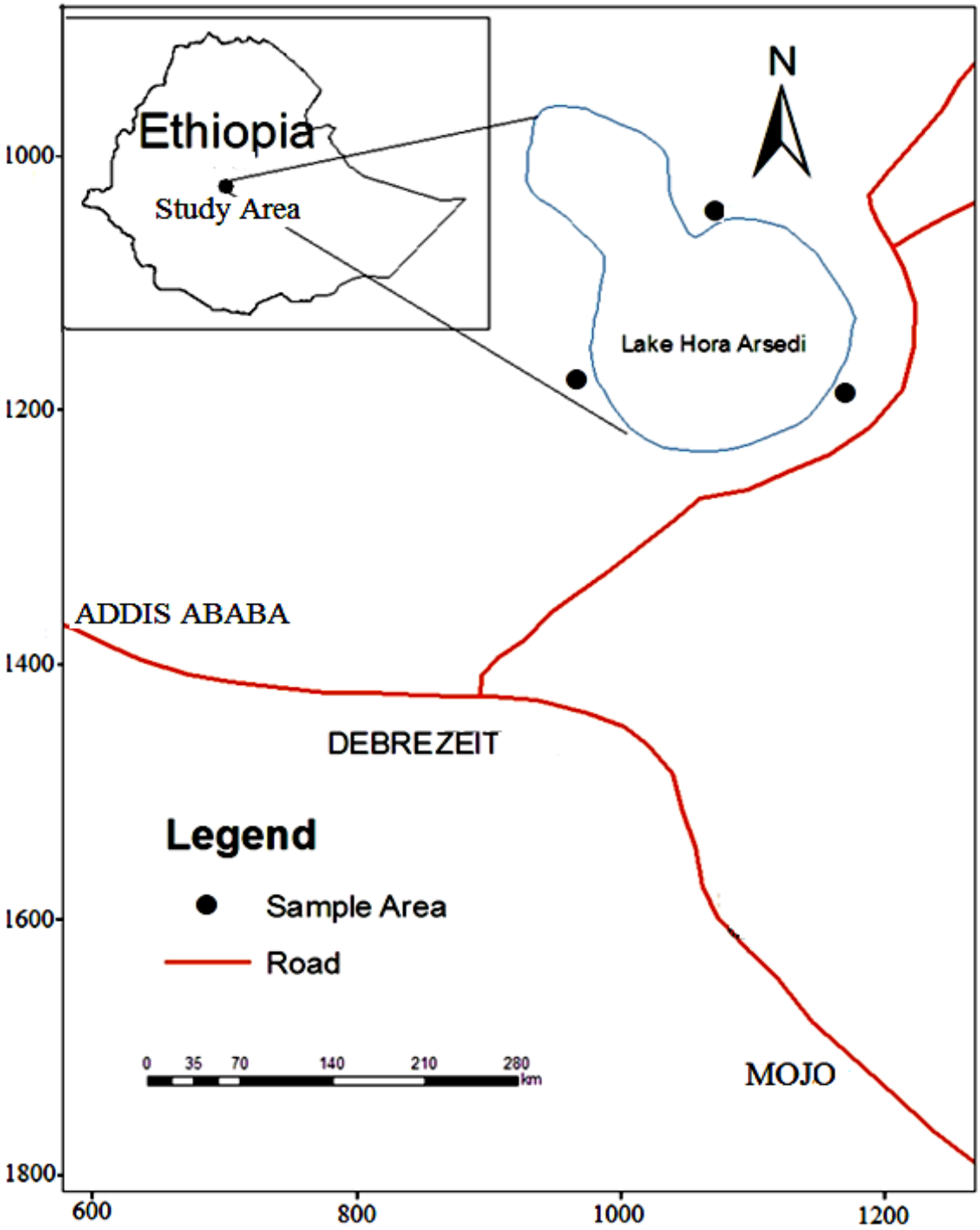

Figure 2 Map of the study area (Hora Arsedi)

Source: Bishoftu Manulipality.

Climate

Temperature and rainfall are major climatic elements that affect the distribution of vegetation used for birds. The topography of the study area is generally characterized mainly by different lakes, very steep and rocky hills. The climatic condition of this woreda is generally semi-arid, Bishoftu is rapidly expanding. It is the site of the air force base and the veterinary institute. At an altitude of 1,900 meters it enjoys a warmer climate than the capital city. The average monthly maximum and minimum temperature around Bishoftu area were recorded in Januarys max.(26.9^{o}c)and min.(8.38) and December max.(26.26^{o}c) and min. (7.64^{o}c) respectively, from the year2012 up to 2016 (Bishoftu Agri Research Center, 2017) (Fig.3).

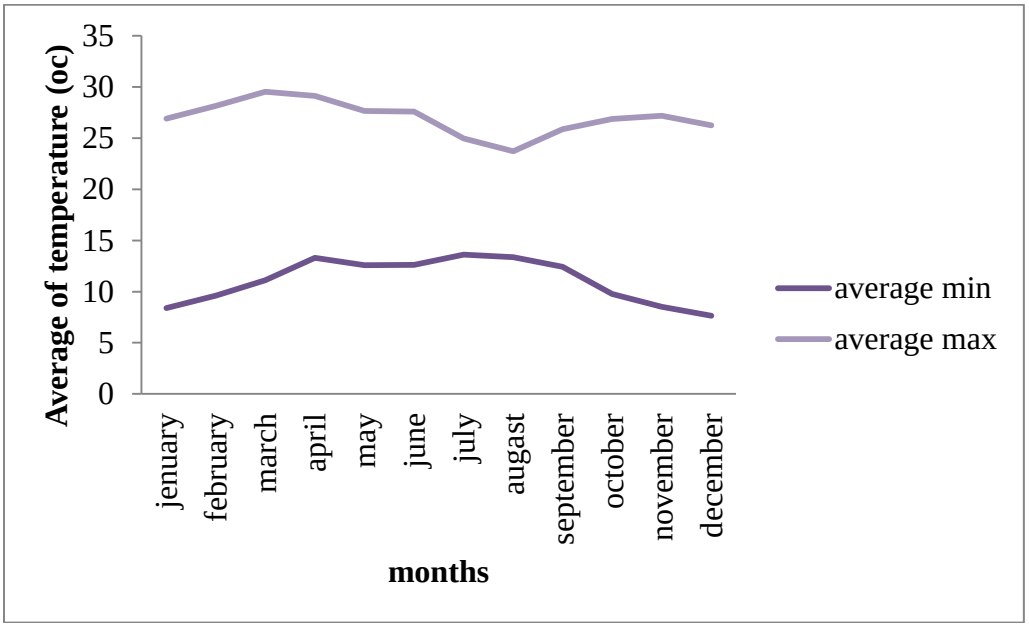

Figure 3. Monthly average monthly maximum and minimum temperature (^{o}c) of Bishoftu area from year 2012-2016.

Source; (Bishoftu Agri Research Center, 2017).

The highest average rainfall intensities occur in July and August 183.5 mm and 183.28 mm) and the lowest occur in December (0.0 mm), respectively. (Bishoftu Agri Research Center 2017) (Fig. 4).

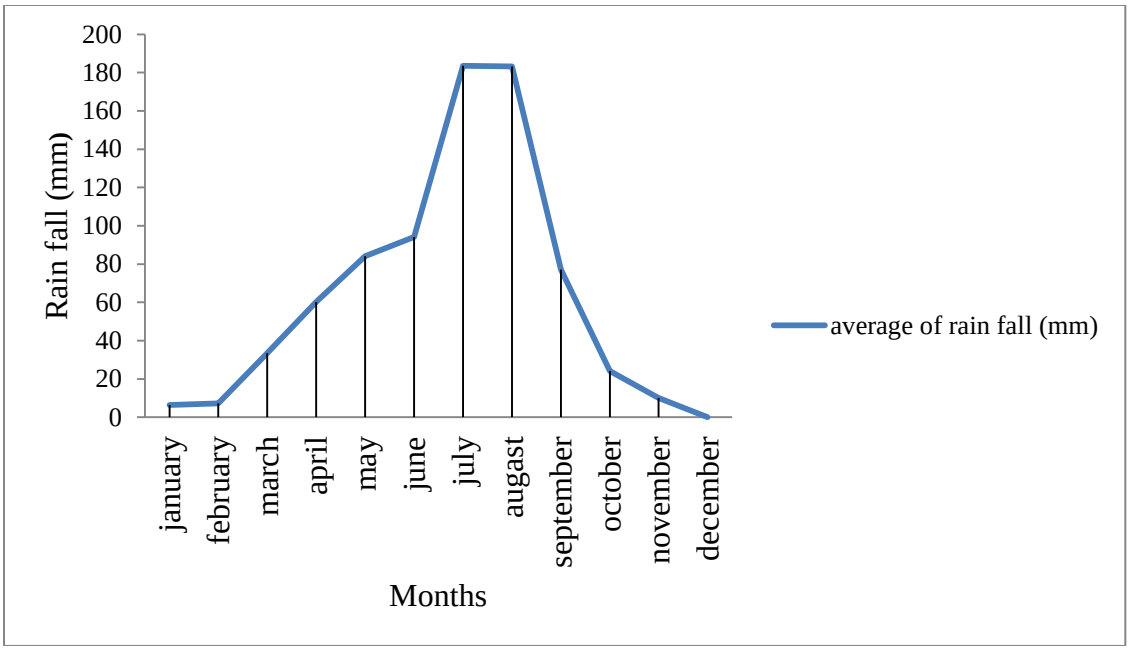

Figure 4. Average monthly rainfall (mm) of Bishoftu area from year 2012-2016.

Source:Bishoftu Agri Research Center, 2017.

The area is known with strong wind,in certain month of the year. The wind intensity is usually high during early morning and late afternoon hours, especially during the rainy season.

3.1 Sampling design

Point count method was used to study the abundance of birds in the Lake of Hora Arsedi Activities, numbers, types and locations (Blake, 1992). Birds were recorded during a fixed amount of time at each point. Station for the point count method was select depending on the abundance and activity of birds. This method was used for species that are small flocking and difficult to identify in most occasions. this count was used at different stations with boat ways (open water bodies) and vegetation and reeds surround lakes.

3.3 Data Collection

Data were collected from February to June in 2017. Observations were carried out for 136 hrs during the rainy season and small rainy season. Before the actual study, a pilot survey was conducted to gather information about the distribution, abundances and richness as well as the evenness of wetland bird species on selected sample areas.

Information about the distribution of wetland birds in the study area was gathered from fishermen and individuals who spent most of their time around the study area. Sample areas were randomly selected. To collect data on their abundance, repeated observations were made. Data were collected in the morning from 6:30 a.m. to 8:30 a.m. and in the afternoon from 4:00 p.m. to 6:00 p.m., when most of the avian species are active (mateos 2004). Activities were recorded using spotting scope sampling method throughout the study period and the scan method. During the observation period, a group or an individual bird was followed at a distance of 5-10 m. To conduct the study; Observation was the most critical step for identifying birds and it is used to collect the required data (Blake, 1992).

3.4 Data Analysis

Data analyses were carried out using qualitative and quantitative descriptions. The data were collected mostly through observation by comparing method of Bird identification from Bird guides with the Birds in the lakes and also different instruments, information from secondary data, from different references and also analysis of the data was made possible using different diversity indices and encounter rates to estimate relative abundances. The species diversity in different duration give interims of Shannon wiener diversity index. Shannon wiener diversity index is calculated as:

$H=-\sum (Pilnpi)$ where: H'=Shannon-wiener index

Pi=proportion of the ith species

Ln=natural logarithm

Species evenness, which measures the pattern of distribution of the bird populations

Present in the study area, will evaluate using Shannon-Wiener evenness Index (E) as

Follows:$E = H'/ H_{max}$ where:

E = Shannon-Wiener Evenness Index

H' = Shannon-Wiener diversity Index

H max = ln S= natural logarithm of the total number of species(S) in each duration

Encounter rate method was used to explain a species list with an index of relativeAbundance based on the number of encounters with individuals per period of time. It was calculated as:

Encounter rate = Total Number of Individual Birds Observed

Period of Observation in Hours

Encounter rate was used to give a crude ordinal scale of abundance (Bibby*et al*,1998) as given in (Table 1).

Table 1. Encounter rate used to give a crude ordinal scale of abundance

Abundance Category	Abundance score	Ordinal scale
<0.1	1	Rare
0.1–2.0	2	Uncommon
2.1–10.0	3	Frequent
10.1–40.0	4	Common
40.0+	5	Abundant

Data collected during the study period was analyzed using SPSS (version 16.0) statistics. Chi square was used to investigate the effect of season on abundance of birds. Correlation was used to evaluate significant of difference between total species count and mean species count of each month of the study period. Graphs were used to explain results of the data analyzed after being employed using Microsoft Excel.

4. Results

The checklist is prepared based primarily on the field work conducted during February 2017 to June 2017 across Lake Hora Arsadi by boat, that is along ashore line by marked three main area; (sample area A; at south eastern direction which measures 0.0009km^2,sample area B;at North western direction which measures 0.000625km^2,sample area C;at south western direction which measures 0.001225km^2,and the other which is not marked is sample area D on the open water which measures 1.03km^2.Birds in the area was counted and identified using a spotting scop technique or marked area and scan sampling method where does the birds found in large number.A systematic random sampling technique was used and observations were made from the shore of the lake side along the marked place at every 625m^2-1.03km^2.The sighting distance varied on either side of the marked place depending on the species and habitat types. In the open area of a lake ,take sampled to count birds using boat along the lake,boat was sloly (0.5km^2/hour) driven to allow counting of birds.From the number of birds counted at sampled area 1.03275km^{2}then estimated the total number of birds from 1.75km^2.Birds in the study area were observed using naked eyes and binoculars for better identification as well as handtally during counting.More over photographs were taken for further identification of birds and to capture corresponding habitat types.Field identification of birds was aided by binocular and digital camera as well as field guide books (sinclair and Ryan,2003).

The data collected during rainy season and small rainy season at observation time; which showes the types of birds the area of sampled birds represented by A,B,C and D the sample taken from 1.0327 km^2,types and number of birds recorded in each date of observation time,the types of birds and their number in each month and the number of individual species in the total study area 1.75km^{2}showed in (Table 2-5) respectively.

Table 2; The raw data collected during rainy season and small rainy season at observation time.Types of Birds and the area of sampled birds represented by A, B, C and D;the sample taken from 1.03275km^2.

Dateof observation	Abdim's stork				Grey Heron				Hammer Kops				Long Tailed Cormorant				Egyptian Goose				White necked Cormorant			
Date	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
18/06/09	1	3	2	2	-	-	-	-	10	11	5	-	1	2	4	2	-	-	-	4	2	5	1	5
19/06/09	1	3	6	-	-	-	-	-	11	10	5	-	1	3	2	2	-	-	1	2	2	4	2	4
25/06/09	2	3	6	-	-	-	-	-	6	10	5	5	-	1	2	1	-	-	-	4	1	6	1	4
26/06/09	-	4	6	-	-	-	-	-	5	9	7	-	2	5	4	1	-	-	4	-	2	8	3	2
02/07/09	2	4	1	2	-	-	2	-	9	9	6	2	1	3	3	2	-	-	-	4	2	6	2	2
03/07/09	2	4	1	-	1	-	2	1	9	9	8	-	-	3	2	2	-	-	-	3	2	6	2	2
09/07/09	-	4	3	1	1	-	-	1	7	8	9	-	1	2	2	2	-	-	3	-	2	5	2	4
10/07/09	2	3	2	2	1	-	1	2	7	8	6	2	1	2	2	1	-	-	2	2	1	5	1	3
16/07/09	1	3	2	-	-	-	1	1	9	9	8	-	-	3	2	2	-	-	-	3	2	4	2	2
17/07/09	2	2	2	3	-	-	1	-	7	9	7	2	1	1	3	1	-	-	3	-	1	6	1	2
23/07/09	-	2	2	3	1	-	1	-	9	9	6	1	1	2	3	2	-	2	-	-	-	6	-	4
24/07/09	-	4	3	-	1	-	1	2	14	8	5	2	-	3	3	2	-	-	2	-	-	5	2	3
30/07/09	1	4	1	3	1	-	1	1	11	8	9	-	-	2	2	2	-	-	2	-	-	8	2	2
01/08/09	3	2	5	-	2	-	1	2	8	9	8	2	-	1	2	3	-	-	2	-	-	7	2	3
14/08/09	3	5	6	-	-	-	2	-	8	8	6	4	-	1	2	1	-	-	2	2	1	7	1	-
15/08/09	-	4	6	2	-	-	1	-	13	9	6	-	-	-	2	2	-	-	2	2	1	5	1	-
21/08/09	4	4	7	2	2	-	-	-	9	9	9	-	1	1	2	2	-	-	-	3	2	6	1	3
22/08/09	-	3	5	3	-	-	-	2	6	9	8	-	-	-	1	1	-	3	-	-	1	6	1	3
28/08/09	2	5	5	1	1	-	1	1	8	9	8	-	-	1	1	2	-	-	-	2	-	5	1	3
29/08/09	-	2	6	2	1	-	-	-	9	6	7	-	-	1	2	2	-	-	-	2	1	6	-	3
05/09/09	2	2	4	-	1	-	-	-	7	4	5	-	-	1	3	2	-	-	2	2	1	4	1	2
06/09/09	1	2	4	1	-	-	-	1	6	3	5	-	-	-	3	3	-	-	-	2	2	5	-	3
12/09/09	-	2	5	2	-	-	-	-	5	3	2	-	-	1	1	2	-	-	-	4	1	4	1	2
13/09/09	-	2	5	-	-	-	-	-	3	3	2	-	-	1	1	1	-	-	2	2	1	2	1	3
19/09/09	2	2	4	-	-	-	-	-	3	2	1	-	2	1	1	2	-	2	-	2	1	3	1	3
20/09/09	-	2	5	-	-	-	-	-	1	2	1	-	-	1	-	2	-	-	-	3	-	2	1	2
26/09/09	-	1	5	-	-	-	-	-	2	1	1	-	-	1	1	2	-	-	3	-	-	2	1	2
27/09/09	-	2	4	2	-	-	-	-	2	-	2	-	-	1	2	-	-	-	-	4	1	-	1	3
03/10/09	2	2	4	-	-	-	-	-	4	4	3	1	1	1	2	1	-		1	1	1	2	1	2
04/10/09	2	2	3	1	1	-	1	-	3	3	2	1	1	2	2	2	-	1	1	1	2	2	1	4
10/10/09	2	3	2	1	1	-	1	-	3	2	3	-	1	1	1	1	-	1	1	1	1	2	1	3
18/10/09	1	2	2	1	-	-	-	-	3	3	2	-	-	1	1	1	-	-	1	1	1	2	1	2
24/10/09	1	2	2	-	-	-	-	-	2	2	2	-	-	2	1	1	-	-	1	-	1	2	1	2
25/10/09	-	2	2	-	-	-	-	-	3	2	2	-	-	-	-	-	-	-	1	-	-	2	-	2

Cont..

Dateof observation	Black crake				African darter				Great white Egrete				Pied kingfisher				African fish Eagle				Pink back Pelican				Glossy Ibis				White Breasted Cormorant			
Date	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
18/06/09	-	-	-	3	1	2	2	1	-	2	2	2	-	-	-	-	-	-	1	-	-	-	2	7	-	-	-	-	-	2	2	2
19/06/09	-	-	-	4	-	-	-	-	-	2	2	-	-	-	-	-	-	-	1	1	-	-	2	6	-	-	-	-	1	-	2	3
25/06/09	-	-	-	4	1	3	2	2	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	2	1
26/06/09				2	2	3	3	2	-	2	2	2	-	-	4	-	-	-	-	-	-	-	-	8	-	-	-	-	-	1	2	2
02/07/09	-	-	-	3	-	-	-	-	-	4	2	2	-	-	4	-	-	-	-		-	-	-	6	2	-	2	2	1	1	2	1
03/07/09	-	-	-	3	1	1	2	1	-	-	-	-	-	-	-	-	1	-	1	1	-	-	-	6	1	-	1	-	2	1	2	1
09/07/09	-	-	-	3	-	1	2	1	-	2	-	2	-	-	-	-	1	-	1	2	-	-	-	6	-	-	2	1	-	-	1	2
10/07/09	-	-	-	3	-	2	3	1	-	-	4	-	2	1	2	1	1	-	2	1	-	-	-	8	-	-	3	2	1	1	-	2
16/07/09	-	-	-	2	2	1	3	2	-	-	-	-	-	1	4	1	1	-	1	-	-	-	-	8	-	-	-	2	1	-	-	2
17/07/09				4	2	-	-	-	-	-	2	-	1	-	3	2	1	-	-	1	-	-	-	7	-	-	2	1	1	-	2	1
23/07/09	-	-	-	2	2	1	3	4	-	2	2	-	-	-	3	-	-	-	-	-	-	-	-	7	-	-	1	2	-	1	-	2
24/07/09	-	-	-	4	2	2	4	2	-	2	-	-	-	1	3	-	-	-	-	-	-	-	2	4	-	-	-	-	-	1	1	1
30/07/09	-	-	-	3	1	-	2	4	-	2	2	-	-	-	3	-	1	-	1	1	-	-	-	6	-	-	2	2	-	1	-	1
01/08/09	-	-	-	1	2	1	3	4	-	-	2	2	-	-	3	-	1	-	1	2	-	-	-	6	2	-	-	2	-	1	1	
14/08/09	-	-	-	2	-	1	2	2	-	-	2	-	-	3	3	4	-	-	-	-	-	-	2	6	-	-	1	2	1	1	1	1
15/08/09	-	-	-	4	-	2	2	2	-	-	1	2	-	2	2	4	-	-	-	-	-	-	2	6	-	-	-	2	-	2	2	2
21/08/09	-	-	-	4	1	2	-	3	-	-	2	-	-	-	3	-	1	-	1	2	-	-	-	5	-	-	1	2	1	1	1	1
22/08/09	-	-	-	3	-	2	2	-	-	-	1	2	-	2	4	-	3	-	1	1	-	-	-	5	-	-	2	-	1	1	1	1
28/08/09	-	-	-	5	1	2	2	1	-	-	2	-	1	3	2	-	3	-	1	1	-	-	-	6	-	-	2	2	-	2	-	-
29/08/09	-	-	-	4	-	2	2	-	-	-	1	2	-	2	2	-	-	-	1	1	-	-	-	6	-	-	1	2	2	3	-	-
05/09/09	-	-	-	4	1	1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	2	-	1	2	1	1
06/09/09	-	-	-	4	-	1	-	1	-	-	-	-	-	1	4	-	3	-	-	-	-	-	-	2	-	-	1	2	2	2	-	-
12/09/09	-	-	-	3	1	1	1	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	3	1	-	-	-	1	1	-	2
13/09/09	-	-	-	4	-	1	1	1	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	2	-	-	-	-	1	1	1	-
19/09/09	-	-	-	5	1	1	2	1	-	-	-	-	-	1	-	-	2	-	-	-	-	-	-	2	-	-	2	-	-	2	1	2
20/09/09	-	-	-	3	1	1	1	1	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	2	-	-	-	3	1	2	1	-
26/09/09	-	-	-	2	-	1	2	1	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	2	-	-	2	-	2	-	1	2
27/09/09	-	-	-	4	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-		-	2	-	-	2	2	2	1	-	2
03/10/09	-	-	-	2	1	1	-	1	-	-	-	-	-	2	1	1	2	-	1	1	-	-	1	4	1	-	1	1	1	2	1	2
04/10/09	-	-	-	2	1	2	2	1	-	-	-	-	-	1	1	-	1	-	1	1	-	-	1	4	-	-	1	1	-	1	-	1
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24/10/09	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
25/10/09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-

Table 3; The raw data collected during observation time in rainy season and small rainy season from four sampled area which covered 1.03275km^{2}on the:
Types and number of birds recorded in each date of observation time**.**

Dateof observation	Abdim,s Stork	Grey Heron	Hammer Kops	Long TailedCormoran	Egyptian Goose	Whitenecked cormorant	Blackcrake	African Darter	Great white Egret	Piedking fisher	African fishEagl	Pink Back	Glossy Ibis	White Breasted Cormor
18/06/09	10	-	25	10	4	13	3	6	6	-	1	9	-	6
19/06/09	12	-	26	10	3	12	3	-	4	-	2	8	-	6
25/06/09	9	-	25	5	4	12	4	9	4	-	-	8	-	3
26/06/09	8	-	23	8	4	15	3	9	6	4	-	7	-	5
02/07/09	9	2	27	9	3	14	3	-	8	4	-	6	6	5
03/07/09	9	3	25	9	2	14	4	7	-	-	4	6	4	4
09/07/09	7	2	23	7	3	14	2	6	4	-	3	7	3	3
10/07/09	8	3	24	8	3	10	3	6	4	5	3	7	5	4
16/07/09	6	2	26	8	4	10	2	6	-	5	2	8	3	3
17/07/09	9	1	25	6	4	10	4	2	2	5	2	7	3	4
23/07/09	6	2	26	5	2	9	2	9	4	4	-	7	-	4
24/07/09	8	4	28	6	3	10	4	9	2	6	-	6	2	4
30/07/09	7	5	28	6	2	11	3	7	4	3	4	6	4	3
01/08/09	10	4	27	5	4	12	1	9	4	3	4	6	4	3
14/08/09	15	2	24	4	2	10	2	8	2	5	4	7	3	4
15/08/09	12	1	26	4	4	9	4	6	3	5	4	7	2	4
21/08/09	15	2	27	5	4	10	4	5	2	4	2	6	2	4
22/08/09	13	2	25	4	2	10	3	4	3	6	3	6	3	6
28/08/09	11	4	25	4	2	9	5	5	2	5	3	6	3	2
29/08/09	10	1	24	5	2	9	4	4	3	4	-	6	2	5
05/09/09	8	1	18	5	4	8	4	6	-	-	-	4	4	5
06/09/09	9	1	15	5	2	8	4	3	-	4	3	3	1	4
12/09/09	9	-	9	4	3	7	3	4	-	3	-	2	2	4
13/09/09	7	-	7	4	3	9	4	3	-	3	2	2	2	4
19/09/09	7	-	5	5	4	8	5	3	-	1	2	2	2	4
20/09/09	8	-	4	4	4	6	3	4	-	2	-	2	2	4
26/09/09	6	-	4	4	4	5	2	4	-	-	2	2	2	5
27/09/09	8	-	4	4	4	4	4	1	-	1	-	2	4	5
03/10/09	8	-	12	5	2	6	2	3	-	4	4	5	3	6
04/10/09	8	2	10	7	3	7	2	6	-	2	3	5	2	2
10/10/09	8	2	8	4	3	5	1	3	-	2	1	4	1	2
18/10/09	6	-	8	3	2	5	1	3	-	2	-	3	-	-
24/10/09	5	-	6	4	1	5	1	1	-	-	-	2	-	-
25/10/09	4	-	7	-	1	2	-	-	-	-	-	2	-	-
Total	295	46	625	186	101	305	99	161	67	92	58	176	72	127

Table 4; The raw data collected during observation time, during rainy season and small rainy season on the:

Types of birds and their number in each month.

Time of observation	1. Abdim's stork					Grey Heron				
	Sample area A	Sample area B	Sample area C	Sample area D	Total	Sample area A	Sample area B	Sample area C	Sample area D	Total
February	4	13	20	2	39	-	-	-	-	-
March	10	30	15	14	69	6	-	10	8	24
April	12	24	40	10	86	6	-	5	5	16
May	5	16	36	5	62	1	-	-	1	2
June	8	13	15	3	39	2	-	2	-	4
Total	39	96	126	34	295	15	-	17	14	46

Timeof observation	3.Hammerkops					4.Long Tailed Cormorant				
	Sample area A	Sample area B	Sample area C	Sample area D	Total	Sample area A	Sample area B	Sample area C	Sample area D	Total
February	32	40	22	5	99	4	11	12	6	33
March	82	77	64	9	232	5	21	22	16	64
April	61	59	52	6	178	1	5	12	13	31
May	29	18	19	-	66	2	7	12	14	35
June	18	16	14	2	50	3	7	7	6	23
Total	222	210	171	22	625	15	51	65	55	186

Timeof observation	5.Egyption Goose					6.White necked Cormorant				
	Sample area A	Sample area B	Sample area C	Sample area D	Total	Sample area A	Sample area B	Sample area C	Sample area D	Total
February	-	-	5	10	15	7	23	7	15	52
March	-	2	7	17	26	10	51	14	24	99
April	-	3	2	15	20	6	41	7	15	69
May	-	2	7	19	28	7	22	7	19	55
June	-	2	6	4	12	6	12	5	7	30
Total	-	9	27	65	101	36	149	40	80	305

Timeof observation	7.Black Crake					8.AfricanDarter				
	Sample area A	Sample area B	Sample area C	Sample area D	Total	Sample area A	Sample area B	Sample area C	Sample area D	Total
February	-	-	-	13	13	4	8	7	5	24
March	-	-	-	27	27	10	8	19	15	52
April	-	-	-	23	23	4	12	13	12	41
May	-	-	-	29	29	5	6	9	8	28
June	-	-	-	7	7	2	5	5	4	16
Total	-	-	-	99	99	25	39	53	44	161

Timeof observation	9.Great White Egret					10.Pied king fisher				
	Sample area A	Sample area B	Sample area C	Sample area D	Total	Sample area A	Sample area B	Sample area C	Sample area D	Total
February	-	8	6	6	20	-	-	4	-	4
March	-	12	12	4	28	3	3	22	4	32
April	-	-	11	8	19	1	12	19	-	32
May	-	-	-	-	-	-	3	11	-	14
June	-	-	-	-	-	-	5	4	1	10
Total	-	20	29	18	67	4	23	60	5	92

	11.African fish Eagle					12.Pink Back Pelican				
	Sample area A	Sample area B	Sample area C	Sample area D	Total	Sample area A	Sample area B	Sample area C	Sample area D	Total
February	-	-	2	1	3	-	-	4	28	32
March	6	-	8	7	21	-	-	2	58	60
April	8	-	5	7	20	-	-	4	40	44
May	9	-	-	-	9	-	-	2	17	19
June	4	-	2	2	8	-	-	2	19	21
Total	27	-	17	17	61	-	-	14	162	176

Timeof observation	13.Glossy Ibis					14.White Breasted cormorant				
	Sample area A	Sample area B	Sample area C	Sample area D	Total	Sample area A	Sample area B	Sample area C	Sample area D	Total
February	-	-	-	-	-	1	3	8	8	20
March	3	-	13	12	28	6	6	8	13	33
April	2	-	7	12	21	5	11	6	6	28
May	1	-	10	7	17	10	11	6	9	36
June	1	-	3	2	6	1	4	1	4	10
Total	7	-	32	33	72	23	35	29	40	127

Table.5 The number of individual species in the total study area (1.75km^2).

month	Ab.	Gh.	Hk.	Ltc.	Eg.	Wnc.	Bc.	Ad.	Gwe.	Pkf	Afe.	Pbp.	Gi.	Wbc	Total
February	66.10	-	167.7	55.89	25.4	87.97	22.06	40.7	34.03	6.78	5.08	54.2	-	33.9	599.8
March	116.9	40.69	393	108.39	44.02	167.5	45.8	88.2	47.6	54.3	35.59	101.6	47.4	55.9	1346.8
April	145.8	27.13	301.6	52.5	33.86	116.7	39.03	69.5	32.33	54.3	33.9	74.5	35.6	47.4	1064
May	105.08	3.39	111.8	59.27	47.41	93	49.2	47.5	-	23.7	15.3	32.2	28.8	60.9	677.6
June	66.10	6.78	84.7	38.95	20.32	50.75	11.9	27.13	-	16.96	13.5	35.6	10.2	16.9	399.7
Total	500	78	1059	315	171	516	168	273	114	156	103	298	122	215	4088

Note: -Ab=Abdim's stork, Gh=Grey Heron, Hk=Hammer kop, Ltc=Long tailed cormorant, Eg=Egyptian geese, Wnc=White necked cormorant, Bc=Black crake, Ad=African darter, Gwe=Great white egret, Pkf=Pied kingfisher, Afe=African fish eagle, Pbp=Pink backed pelican Gi=Gloss ibis, Wbc=White breasted cormorant

4.1Species Composition

A total of 14 species of birds grouped under 7 orders and 11 families were recorded. Family *Phalacrocoracidea* (26.8%) had the highest number of species. The lowest number of species was under the *Threkiornithidae* (2.9%) and *Acciipitridae* (2%) with a few species each. Most of the birds in the study area were observed throughout the study period (Table 6).

Table 6**:** Listof bird species recorded from Lake Hora Arsedi in Bishoftu town.

English Name	Common Name	Scientific Name	Family	Order
Stroks,Abdim's	Abdim's Stork	Ciconia abdimii	Ciconiidae	Ciconiiformes
Darter,African	African Darter	Anhinga rufa	Anhingidae	Suliformes
Eagle,African fish	African Fish Eagle	Haliaeetus vocifer	Acciipitridae	Falconiformes
Crake,Black	Black Crake	*Amaurornis flavirostra*	*Rallidae*	Gruiformes
Goose,Egyptian	Egyptian Goose	*Alopochen aegyptiaca*	*Anatidae*	Anseriformes
Ibis,Glossy	Glossy Ibis	Plegadis falcinellus	Threkiornithidae	Ciconiiformes
Egret,great white	Great White Egret	Egretta alba	Ardeidae	Pelicaniformes
Heron,Grey	Grey Heron	Ardea cinerea	Ardeidea	Pelicaniformes
Hamerkop	Hammer Kops	Scopus umbretta	Scopidae	Pelicaniiformes
Cormorant,long tailed	LongTailed Cormorant	Phalacrocorax africanus	Phalacrocoracidea	Pelicaniformes
King fisher,Pied	Pied Kingfisher	Ceryle rudis	Alcediinidea	Coraciiformes
Pelican,pink-backed	Pink Backed Pelican	Pelecanus onocrotalus	Pelicanidea	Pelicaniformes
Cormorant,White breasted	White Breasted Cormorant	Phalacroxi lucidus	Phalacrocoracidea	Suliformes
Cormorant,White necked	WhiteNecked Cormorant	Phalacrocoraxidea	Phalacrocoracidea	Pelicaniformes

Some of the bird species in the study area showed relatively high number of individuals at restricted months of the survey period.These include;Hammer Kops, white neck cormorant, Abdim's stork,Long tail cormorant,pink Back Pelican, (Figs.5-9).

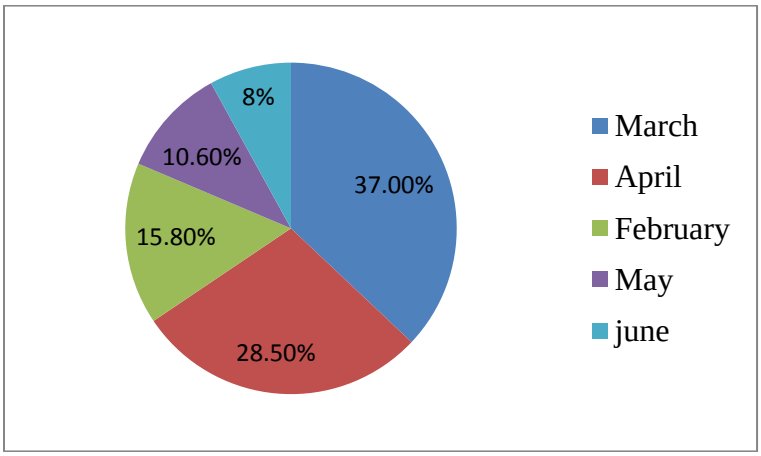

Figure 5 The abundance of Hammer kop

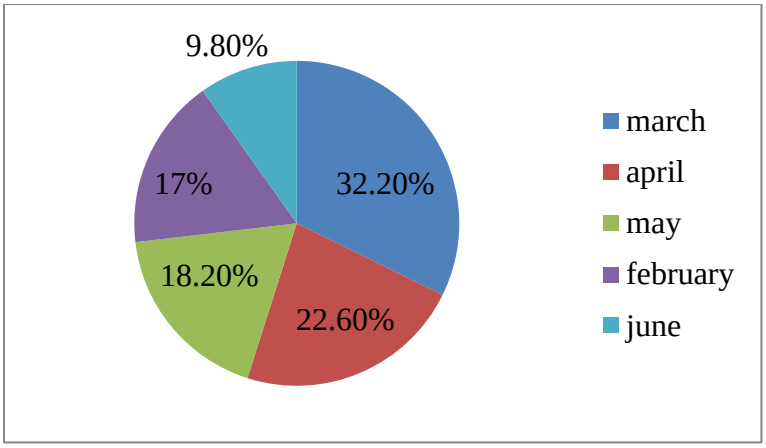

Figure 6 The Abundance of White Necked Cormorant.

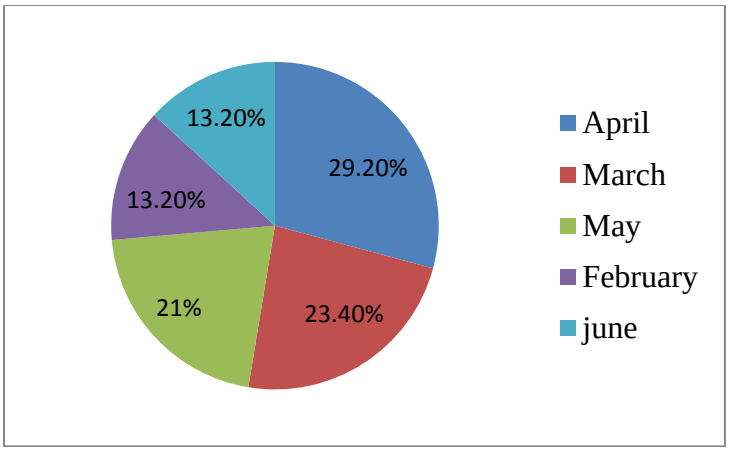

Figure 7 The abundance of Abdim's Stork.

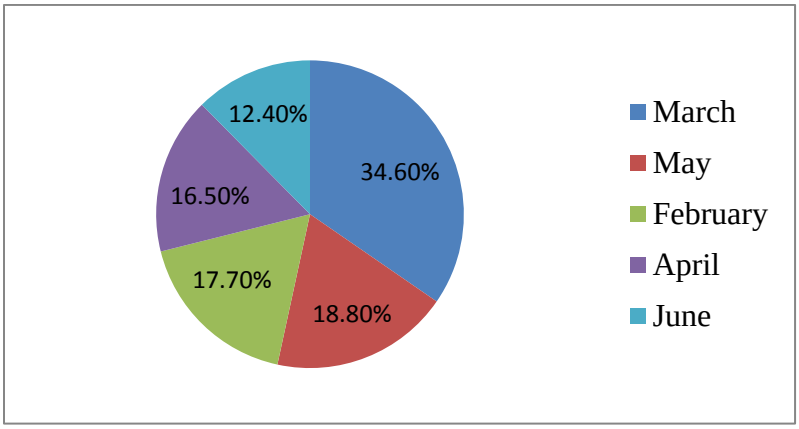

Figure 8 The Abundance of Long Tailed Cormorant

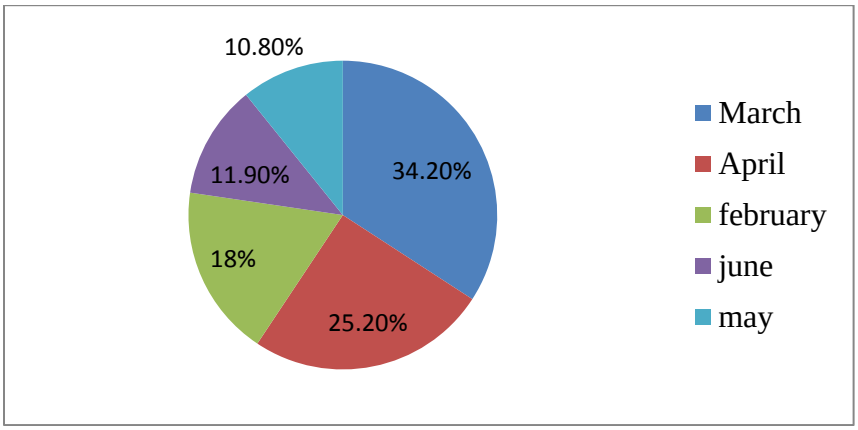

Figure 9 The Abundance of Pink backed Pelican.

Few species of birds were observed only during restricted months of the study period and few of them are observed in very few numbers during restricted month (Table 7).

Table**7** Bird species abundant only during restricted months of the year.

(P= Present, p'=present in a few number, - = absent).

Species Name	Month				
	February	March	April	May	June
Gloss Ibis	-	p	p	P	P'
Great White Egret	p	p	p	-	-
Grey Heron	-	p	p	P'	P'
African fish Eagle	P'	p	p	P'	P'
Black crake	p	p	p	p	P'

Gloss Ibis and Grey Heron does not observed in February month during the study period and Great White Egret does not observed in May and June month and also, Grey Heron and African fish Eagle were observed in very few number in May, June and February month during the study period as well as black crake observed in few number in June month also.

4.2. Species diversity.

The highest diversity of birds were observed during March (H'= 0.35) and April (H'= 0.35) and the lowest diversity of birds were during February (H'=0.33) .The highest even distribution of birds was observed during March and April (E= 0.14), where as the lowest was during February, May and june (E= 0.13) (Table 8).

Table 8. Species diversity of birds in the study area

Month	Species Richness	H'	Hmax	E
February	12	0.33	2.48	0.13
March	14	0.35	2.6	0.14
April	14	0.35	2.6	0.14
May	13	0.34	2.56	0.13
June	13	0.34	2.56	0.13

4.3. Species Richness

The highest number of bird species was recorded during March and April (14) and the Lowest during February (12). The average number of species for the respective number of days for each month gives the mean number of species. The result of the data showed that, the mean number and the total number of bird species of each month correlated positively (R^2=0.89) (Table 9).

Table**.** 9 Species richness: Mean ± SE (Correlation factor, R^2=0.89)

Month	Total Species	Mean ± SE
February	12	9.77 ±4.40
March	14	8.4±2.09
April	14	10±2.66
May	13	11±5.5
June	13	10.5±6.67

4.4. Abundance

Abundance of birds in the study area was correlated with different season of months that is rainy season and small rainy season. Individual of were counted 2408.76 and 862.28 during the small rainyseason (February, March and April) and rainy season (May and June), respectively. Chi square test for the abundance of birds in the study period for each month showed that there was statistically significant difference between observed and expected counts of each species (P<0.05). Abundance of birds at each month is given in (Table10).

Table 10. Variation in abundance of birds between months of the study period.

	February	March	April	May	June
Chi-Square	32.228	149.846	121.856	190.797	79.716
Df	11	13	13	12	12
P	.0	.0	.0	.0	.0

Likewise, the Chi-square test for abundance of birds in the study period for the period of times showed that there was statistically significant difference between observed and expected counts of each species (P<0.05) (Table 11).

Table 11. Variation in abundance of birds between different season.

	rainy season	Small rainyseason
Chi-Square	427.586	644.672
Df	25	39
P	.0	.0

4.5. Relative Abundance

Abundance score and ordinal scale of birds in the study area using encounter rate is given in Appendices 1 and 2. Relative abundance of birds in the study area during the rainy season showed that most of the species being frequency (71.42%), uncommon (14.28%), common (7.14%) and rare (7.14%). During the small rainy season, 50% of the bird species were uncommon, 42.85% frequent, 7.14%common, (Fig. 10).

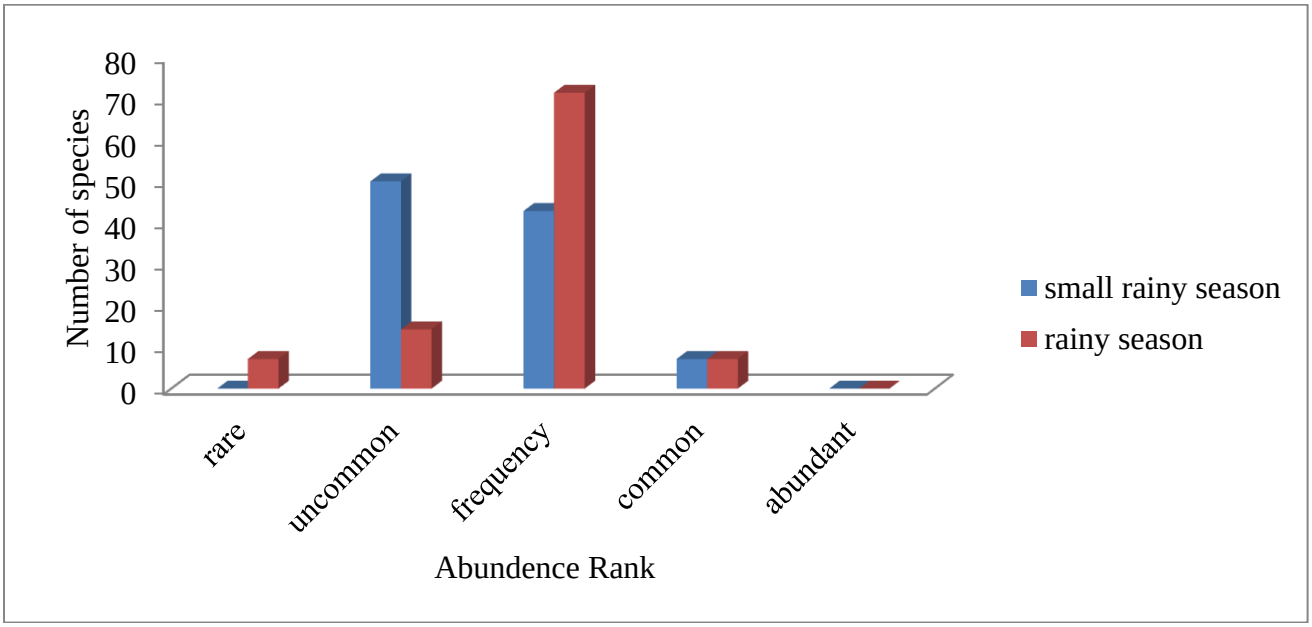

Figure.10 The abundance rank of different Bird species.

4.6. Bird Attractant Features

The most important factor in determining how a bird forages is to identify the distribution of its food. Birds in the study area were seen attracted by food resources available in and around the Lake Hora Arsedi. The forest around lake Hora inhabits invertebrates, rodents and snakes. These features attract birds. The wetlands, grasses around the shore line of the lake areas and the water bodies are found to be attractant as water and food resource site for some of the birds. All birds need un disturbed places to rest and roost all over the time to Avoid predation. The great variety of different types of plants also makes Lake Hora Arsedi an attracting place for birds to nesting and living. Birds in the study area prefer different sites foresting, roosting and nesting. According to the observations method, these include; both manmade and natural habitats. Human induced attractants such as roofs of terminal buildings and trees that planted by human, dry wood that made surround the lake in certain places and related features were found to be attractant for birds to nest, rest and roost. Trees within and around the vicinity of the lake are the natural habitats observed for birds to perform different activities.

5. Discussion

Birds in the study area were observed either throughout the survey period or during specific season of the year only. Some birds were observed exclusively during the rainy season while others only during the small rainy season. There was also bird species with high number of individuals at specific seasons of the study period. These all were due to the availability of resources and favorability of the weather conditions. Food resources are the most important attractant feature for the birds. According to Shannon-Wiener diversity index (H'), bird species diversity and abundance were different among sample Area. Very high bird species diversity was recorded on Sample area C of the south western direction of Alake and sample area B the North western side of Alake. The sample area A on South eastern side had very low to medium bird species diversity. Bird species richness and abundance are influenced by local resource availability and human disturbance boat and fisher man disturbance, vegetation composition, in addition to the size of habitat patches and also Pollution, particularly noise pollution, directly influenced the abundance of bird Population sighted. In general water birds are greatly influenced by complex characteristics including water chemistry, aquatic vegetation, invertebrate fauna and physical features.

Boats will displace birds directly by occupying their foraging areas as well as frightening them away from their preferred habitat. They can also degrade important habitat and food sources of water birds, such as shoreline nesting sites, roosting sites and others. Different species of birds will respond differently to disturbance. The fact that when came across illegal fishing quite often made think about the reduction in the temporality of food supply for different bird species. Species richness of birds in the study area for each month does not show significant difference. The highest species richness was recorded in March and April. This was due to the good favorability of the weather for most birds that observed at this time of the study period. The least species richness was recorded in February, which was due to the less favorability of the weather for most birds. The abundance of birds in the study area showed that there is statistically significant variation between months as well as between different times. This was also determined by the presence and absence of resources on which birds depend at different times of the year and the air condition.

Frequency and uncommon bird species were very abundant in the area because of the favorability of the area to satisfy their requirements during the study period. These birds were observed foraging on food and water resources available with in and around the study area. these include fishes available in the lake, grasses, different fruits in the forest like as shola and kulkal around the lake. Trees and different vegetable provide roosting habitats for species of small, flocking birds. Trees also provide nesting sites for raptors which are commonly struck at hora lake (lyon and caccamise,1981).The birds usually perch and roost on trees in and around Lake Hora as well as, on the standing boats, around the shore line of the lake on the larger stone and others. The birds were usually observed with in habitats on the sides of the north-west of the lake, around the shore line of the lake and in the forest, due to the availability of such resources. Egrets (Ciconiiformes) which forage on insects and worms disturbed by their hooves, while Grazing. African darter often nests with herons, egrets and cormorants. It often foraging fishes and swims with only the neck above water, hence the common name snake bird. The African fish-eagle is a proficient hunter, with live fish accounting for the bulk of its diet. It typically hunts from a high perch on a water side tree, where it can watch for fish moving close to the water's surface. Their nests and roosts may be only a few hundred meters apart from lake. The black crake was forage in the open water or climb reeds to find prey including flying insects. It eats a wide range of invertebrates, small fish, frogs and seeds. Glossy ibises were observed foraging around shore line area as well as flying above the open water. Abdim's storks, on the other hand, forage on worms and other invertebrates between Grasses and reeds surround the lake. Cormorants, geese and pelican swim and forage in the water body found in the study area. All species are fish-eaters, catching the prey by diving from the surface. Cormorants nest in colonies around the shore, on trees, islets or cliffs. After fishing, cormorants go ashore, and are frequently seen holding their wings out in the sun. And its are colonial nesters, using trees, rocky islets, or cliffs. Egyptian geese Perch readily on trees and on different dry wood fall and stand surround the lake. Its typically eat leaves, grasses, and plant stems. Its nest in a large variety of situations, especially in holes in mature trees in parkland. The white egret feeding mainly on fish, frogs, occasionally small reptiles and insects, spearing them with its long, sharp bill most of the time by standing still and allowing the prey to come within its striking distance of its bill which it uses as a spear.

Heron would feed on a variety of live aquatic prey. Their diet includes a wide variety of aquatic animals, including fish, reptiles, amphibians, crustaceans, mollusks, and aquatic insects. Their nests are usually found near or above water. They are typically placed on trees and shrubs although the nests of a few species have been found on the ground. The kingfisher feeds mainly on fish, although it will take crustaceans and large aquatic insects. The main food of pink-backed pelicans is fish; in addition they feed on a variety of small invertebrates and amphibians. Weathers in the months of the years and time of the day determine the significance of activity of birds. Activity of birds is prominent early in the morning and late afternoon hours. During the study period, birds were seen with less significant activities when the weather condition was cold, cloudy and very windy. Factors that may cause fluctuations include variation in weather or food supply, the ability of individuals to disperse to new areas and species interactions such as predation or competition (Toms*et al.,* 2002). Some of the birds in the study area were observed in large numbers during particular time of the survey period.

Hammer kops white necked cormorant and African darter were observed in large numbers during March and April due to the presence of well air condition. Flock foraging was observed in cormorant and Egyptian geese. These birds move around the shoreline of the lake and also forage from the open water of the lake around the study area. Movement pattern was investigated for those birds that usually cross the study area, in particular from the shore line to the forest. This pattern was correlated with the time of the day, months of the year and activities performed by the birds after such movements. Birds that usually perform such activities include pied king fisher, pelican, grey Heron, egrets, geese, and Gloss ibises. Water body, grasses surround the lake are their foraging place and the dry wood surrounding the lake the rocky islets, or cliffs around the shore line of lake was their roosting place Hammer kops were the most abundant bird species throughout the study period, which surviving on the tree on the rocks with the higher flock size of up to 30 individuals. White necked cormorants are mostly roosting in the North West direction of the lake by flocking from 1 to 20 mostly on the dry wood falling around the shore line.Sometimes they roost with the African darter and white breasted cormorant around the south western direction of the lake. Trees and different woods around the lake were used as their roosting sites.

Gloss Ibis, egrets, geese and king fisher are the other bird groups that frequent moving surround shore of lake and swimming in the lake to forage food. Pied kingfishers change their site frequently throughout the day. This mainly depends on the amount of food availability. Pied kingfishers mostly spent their time at the shore of the lake. Gloss Ibises and egrets roosting around the shore line of the lake on the rocks with an average flock size of 2 to 10, during early morning and late afternoon at south west direction of the lake. Pelican was most of the time swimming in the water for foraging by flocking from 2 to 10 and roosting at the shore line of the lake with heron, African darter and cormorant at south direction of the lake. Daily activity patterns of birds are influenced by several factors including weather, season and habitat (bull, 1997),even though, activity patterns are likely to differ among species (Blake,1992)

5.1. Conclusion and Recommendations

Lake Hora Arsedi is found in Bishoftu town at the south east of Addis Ababa is known to the place where the oromo people gather on the shore of the lake where they conduct ritual ceremony(traditional thanks giving ceremony called irecha).Lake Hora Arsedi has a number of natural and human induced bird attractant features. Natural habitats within the study area included grass, reeds, water body, bushes and trees. Human induced attractants are roofs of building around a lake, different trees planted by human, cafeterias and Hailae sillase building or Hailae sillase beta mangiest on the west direction of the lake another area with significant human activities. The area possesses favorable places for birds to nest, rest, roost and a good access to food as well as water resources. These and other factors attract large number and various species of birds to visit the area at different situations and use the lake for many different purposes. The lake which is the dominant feature of the area, forest, are inhabits rodents, reptiles, insects and other invertebrates. The wetlands, reed and shore line of a lake were also found to be attractant as water and food resource for birds.

Man made architectural features attract birds to use the area as their resting and roosting sites. February was the month with the lowest species diversity and richness. March and April on the other hand showed the highest species richness and species diversity, respectively. There was significant difference in bird abundance between different months as well as among the time of days during the study period. The activity pattern of birds showed that, they use the study area as their foraging, resting, roosting and nesting site. The routine movement of birds in the area showed that some birds moves from the shore line to the lake and forest and from the lake to the shore line and to the forest away at different time of the day.

On the basis of the results of the study, the following recommendations were suggested:

- habitat management is necessary to provide Lake Hora environment that discourages birds perching, nesting, roosting or foraging.
- appropriate management of Lake Habitat is necessary to minimize and other forests can effectively discourage birds.
- prevent the establishment of human induced sites that are attractive to birds to rest and roost in the area.

- Prevent the fisher man that disturbed the birds from feeding, roosting and nesting in their habits.
- establish regulations to develop and implement effective bird control plan in and around the lake Hora.
- prevent noise, pollution, that has a very real impact on the number of birds sighted in the park and their survival. Human crowds and noisy human activities will be avoided to creat conducive habitat.
- managing the health of water by avoiding the people who are taking shawor inside the lake, washing their closes and swimming
- avoid any activities that can disturbed the habitats of birds around the lake.
- allocation of designated boating areas (particularly for water-skiing).
- maintenance of bird watching records to monitor the effectiveness of management and to ensure early detection of any impact on bird numbers or behavior.
- developing buffer zones so that, it is possible to minimize human impact on birds habitats.

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Appendex1 Relative abundance of birds during rainy season.

Species	Number of individuals per 52 field hours	Abundance	Rank
Abdim's Stork	9.6	Frequency	3
Grey Heron	1.5	Uncommon	2
Hammer kop	20.36	Common	4
Long Tail Cormorant	6.05	Frequency	3
Egyption goose	3.3	Frequency	3
White Neck Cormorant	9.9	Frequency	3
Black Crake	3.23	Frequency	3
African Darter	5.25	Frequency	3
Great White Egret	-	rare	1
Pied King Fisher	3	Frequency	3
African Fish Eagle	1.88	Uncommon	2
Pink Back Pelican	5.73	Frequency	3
Gloss Ibis	2.3	Frequency	3
White Breast Cormorant	4.15	Frequency	3

Appendex2.Relative abundance of birds during small rainyseason.

Species	Number of individuals per 84 field hours	Abundance	Rank
Abdim'sStork	5.95	Frequency	3
Grey Heron	0.96	Uncommon	2
Hammer kop	12.6	Common	4
Long Tail Cormorant	3.75	Frequency	3
Egyptian goose	2.03	Uncommon	2
White Neck Cormorant	6	Frequency	3
Black Crake	2	Uncommon	2
African Darter	3.25	Frequency	3
Great White Egret	1.35	uncommon	2
Pied King Fisher	1.85	Uncommon	2
African Fish Eagle	1.16	Uncommon	2
Pink Back c Pelican	3.54	Frequency	3
Gloss Ibis	1.45	Uncommon	2
White Breast Cormorant	2.55	Frequency	3

Appendex 3

Habitats in the area with significant attraction for birds are shown in Figure 11 to 18

Figure11.white breast cormorant,grey heron. Figure12.Egyptian geese and black crack in lake.
Source; photo-Askale Girma April (2017) **Source**;photo-AskaleGirma March (2017)

Figure 13.Hammer cop on trees. Figure 14 longtailed cormorantand pied king fisher
Source; photo Askale Girma April(2017). **Source**; photo Askale Girma June(2017)

Figure 15 pink backed pelican in water body. Figure 16 White necked cormorant at shore line of lake.

Source Photo Askale Girma May(2017). **Source** photo Askale Girma February(2017)

Figure 17 Great white egret on tree Figure 18 African fish eagle on tree.

Source photo Askale Girma May (2017). **Source** photo Askale Girma March(2017).