

**AVIAN CONSERVATION IN MAN-MADE WETLAND: A CASE STUDY OF ASEJIRE AND ELEYELE DAMS,  
OYO STATE, NIGERIA**

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**ABSTRACT**

Survey of avian species diversity and abundance in Asejire and Eleyele dams was carried out to examine the impacts of dam construction on bird species composition in these wetlands. Line transect method was used during the survey. Avian diversity indices were analyzed with PAST software version 16. T- test was used to test for significance in avian abundance between the two wetlands. A total of 858 individual birds were recorded in the two dams consisting of 52 species from 26 families and 11 orders. Asejire dam had a total of 489 birds (56.99%) from 44 species, 26 families and 11 orders. Eleyele dam had a total of 369 birds (43.01%) comprising of 30 species from 20 families and 11 orders. Twenty-two species were exclusive to Asejire dam with Eight species exclusive to Eleyele dam. The order Passeriformes had the highest number of species at both sites (Asejire=23; Eleyele= 15). Diversity indices were higher in Asejire dam than Eleyele dam (Shannon-2.58, 1.94; evenness- 0.3006, 0.2315; equitability- 0.6823, 0.5698 respectively). Bird density was higher at Asejire dam (53.3birds/hectare) than Eleyele dam (40.22birds/hectare). Four (7.69%) migrant birds were recorded. The birds were grouped into eight feeding guilds with insectivores having the highest percentage of 36.54%. The study has shown that Asejire and Eleyele dams can be sites for bird conservation if the habitat condition is improved upon and avian conservation is equally given attention in the area. Therefore for a sustainable avian conservation in the two dams, the management of the dams should be educated on the needs to provide short-term and long-term measures to reduce habitat degradation in the two dams.

**Keywords:** Avian species, diversity and abundance, Asejire and Eleyele dams, conservation, migrant birds.

## INTRODUCTION

There is a growing concern all over the world for the environmental problems that are brought about by the many years of misuse of resources. These has resulted in disasters such as soil erosion, desertification, and loss of cropland, pollution, deforestation, ecosystem degradation and the extinction of many species (Anoliefo *et al.*, 2003). The concern is more apt in the developing economics like Nigeria, where environmental protection and sustainable use of natural resources are not made an integral part of the developmental programs and planning (Anoliefo, 2010).

The conservation objectives for birds aimed at maintaining bird populations, or the diversity of species within defined assemblages, both through the protection of the habitats supporting them and management against the negative impacts of disturbance (Joint nature conservation committee, 2004). Birds diversity are indicators of how biologically rich an habitat could be (Bibby, 1999). There are bird species that are peculiar to particular habitats, environments, vegetation, biotypes and ecosystems. Such species have restricted habitat requirements and are more sensitive to habitat changes and easily disturbed as a result of habitat degradation (Bird life International, 2000). Many species require a mixed type of habitat (Abdar, 2013), while many species are highly seasonal. This occurs majorly in the case of many wetland birds (Sutherland *et al.*, 2004).

The study of bird species diversity, distribution and abundance become important not only for knowledge but also for conservation purposes as birds has been used as ecological indicators (Rittiboon and Karntanut, 2011). The patterns of bird species diversity and distributions along the landscape are strongly related to environmental factors: habitat types and features (Buckley and Freckleton, 2010; Pennington and Blair, 2011), climate and altitude (Humphrey, 2004; Jankowski *et al.*, 2009), and human interventions/ anthropogenic activities (Cordeiro, 2005; Rodríguez-Estrella, 2007; Jankowski, 2009).

Tropical region wetlands are important ecologically, and serve as a major link between agricultural practices and natural resource management. It is a hot-spot for the conservation of important species consumed by rural inhabitants as source of protein and also serves deep protection interest of the conservationists (Ramsar Convention Bureau, 2000). Therefore, wetland or riparian ecosystem is a servicing point for diverse species of animals (fishes, birds, antelopes, primates and carnivores) that need water either for drinking, wallowing and abode (Ramsar Convention Bureau, 2000). Adaptation to utilize wetlands and other aquatic systems are diverse among many diverse bird taxa of the world and include: anatomical, morphological, and behavioural changes (Ezealor, 2002; Ezealor, 2001). As a result of these adaptations, birds are better equipped as a group to exploit wetland resources and are often used as indicators of conditions within a wetland ecosystem (Niemi, 1985).

Dams represent one of the most significant human interventions in the hydrological cycle. According to Role of Dams, (2014) many of the benefits afforded by dams are economic in nature, allowing regions to produce goods and services they may otherwise have to import. Irrigation water from dams allows previously unusable land to be farmed. Through provision of water for drinking, irrigation and electricity, they have supported human socio-economic development, but simultaneously they have had a considerable impact on freshwater ecosystems (McCartney and Sally, 2007). Dams and reservoirs affect ecological environment through: habitat area decrease and alteration of habitats' spatial configuration (Wu, *et. al.*, 2003;

McCartney and Sally, 2007; Zhou, et. al., 2008), hydrological intervention (David, 2000), water quality change (Yao, et al., 2005; 2006), prevention of the natural highs and lows of rivers as well as reducing the breeding ground of migratory fish, a key food source for water birds and cloud the waters, making it harder for birds to spot their prey and an accumulation of toxic materials and chemicals (Jean-Luc et al., 2010) .

Human Development depends on nature and ecosystem services: growing populations, with their associated demand for food, water, fibre and energy, have caused unprecedented changes to ecosystems. While nature has contributed to improving billions of lives, development has simultaneously damaged the ecosystems on which it depends, and this degradation is increasing (MA, 2005). Tobias et al., (2013) conclude that sustainable conservation of tropical birds and the ecosystem services they provide will be achieved only if attention is focused not merely on current snapshots of species distributions and protected areas but on biotic processes and interactions operating at larger spatial and temporal scales. The water demand in Oyo State, Nigeria increased tremendously over the years rendering the facility to become grossly under-dimensioned for the intended towns and villages, a development that called for a much larger supply scheme. Consequently, the Oyo State Government in 1976, commissioned Asejire and Eleyele Dams with the objective of supplying water from the resulting reservoir for the existing water scheme.

## **METHODOLOGY**

### **Study Area**

This study was carried out in Asejire and Eleyele Dams in Ibadan the capital city of Oyo state, south-west Nigeria. Asejire Dam is located 30km east of Ibadan, in Egbeda Local Government area of Oyo state. The dam is located between Latitude 07° 21'N and Longitude 04° 07'E and has elevation of 137m above sea level. The annual mean Temperature is 27.3°C, annual rainfall is 1500mm- 2500mm, and annual mean humidity is 79% (Tijani et al., 2011).

Eleyele Wetland is located in north-eastern part of Ibadan, within longitude N07°25'00" and N07°27'00" and Latitude E03°50'00" and E03°53'00". The study site is surrounded by Eleyele neighbourhood in the south, Apete in the east and Awotan in the north. Eleyele wetland is a modified natural riverine wetland type with area of about 100 km<sup>2</sup> including the catchment area. The elevation is relatively low ranging between 100- 150m above sea level and surrounded by quartz-ridge hills toward the downstream section where the Eleyele dam barrage is located. A number of stream channels serve as feeding / recharge streams to the Eleyele wetland basin (Akinyemi et al., 2014).

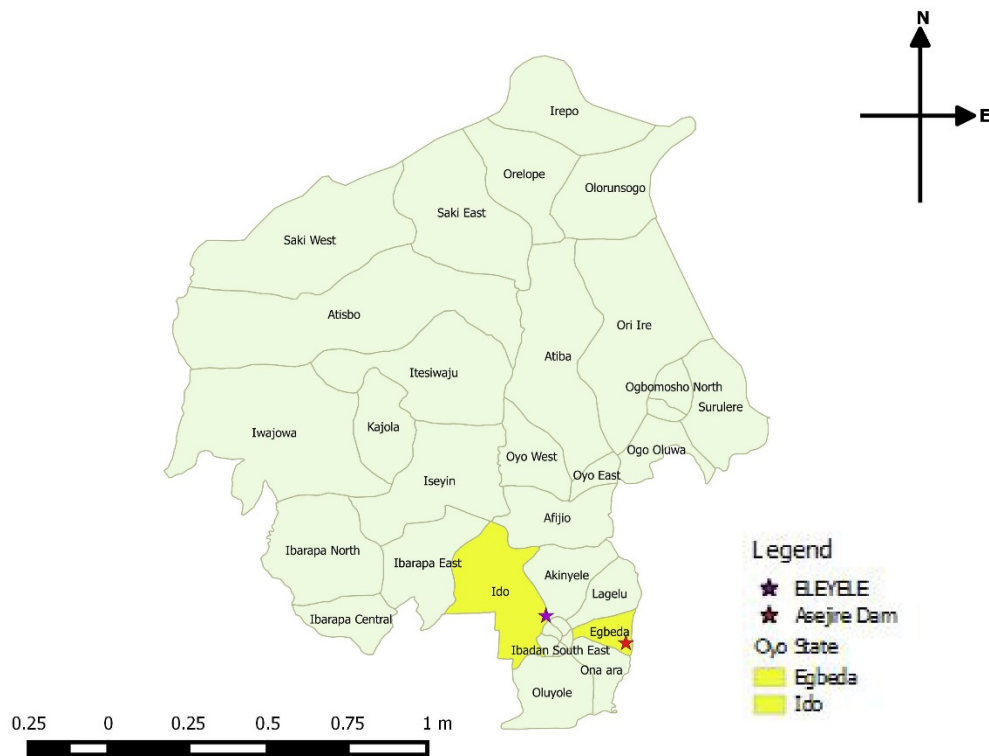


Figure 1: Map of Oyo State indicating the location of the two dams

### Method of Data Collection

Line Transect method of estimating bird populations and diversity as described by Bibby et al., (2000) was used. A total of eight transects; four transects at each study site, were selected (including the open waters). As the observer moved along each transect, the observer stopped at 50m interval (to avoid counting the same bird species at different points on each transect) for 10 minutes. The transect length ranges from 350m-850m depending on the accessibility of the area. Each transect was traversed four times and a day was dedicated to each sites. The survey was done early in the morning between 0700hrs and 1100hrs and evening, between 1600hrs and 1800hrs. The survey was carried out between January and July 2016. A pair of digital binoculars was used to aid identification of birds. Photographs of the bird species were taken where necessary. The field guide to Birds of West Africa by Borrow and Demey (2008) was used for identification of the birds. For every bird species identified, the following parameters were recorded: the species name, family, order, and number sighted. Birds were counted as bird seen and heard and birds in flight were also recorded. Birds sighted were categorized based on their migratory nature as: Resident (R), and Migrant (M) according to Teneson and Ravichandran (2015). The feeding guilds of the birds was categorized into Insectivores (I), Nectarivores (N), Omnivores (O), Scavengers (S), Frugivores (F), Carnivores (C), Piscivores (P), and Granivore (G) according to Odewumi *et al.*, (2015) and Nikunj *et al.*, (2013).

.Relative abundance of bird species was expressed as  $RA = n/N \times 100$

Where n= Number of individuals recorded per bird species

N= Total number of birds observed (Zakaria et al., 2009).

Density was calculated as number of birds per hectare

Shannon-Weiner diversity index was calculated as

$$H' = - \sum_{i=1}^s (Pi \ln Pi)$$

Where;

$P_i$  = proportion of individual species

$S$  = Total number of species of the site. (I.e. number of species seen and heard.)

$i$  = no of individual species.

Menhinick richness index = the ratio of the number of taxa to the square root of sample size.

Buzas and Gibson's evenness/Equitability:  $H/S$

## Statistical Analysis

Avian Species Diversity indices were determined using the PAST ((Paleontological statistics software package for education and data analysis) statistical software [version 16] program. T-test was used to determine whether bird species diversity indices and density were normally distributed at 0.05 level of significance between the two sites.

## RESULTS

### Bird Species Composition, Abundance and Diversity

A total of Eight hundred and fifty-eight (858) individual birds comprising of fifty two (52) species from 26 families and 11 orders were recorded in the two Dams (Eleyele and Asejire) (Table1).

Birds were more abundant at Asejire Dam with a total of 489 individuals recorded representing 44 bird species from 23 families and 11 orders than at Eleyele Dam with a total of 369 individual birds, comprising of 30 species from 20 families and 11 orders (Table 2). The order Passeriformes had the highest number of species (n=29; 55.77%) while the orders Cuculiformes and Suliformes had the least (n=1; 1.92% each). Twenty two bird species were common to both wetlands. Eight bird species were absent in Asejire Dam but present in Eleyele dam. Likewise, Twenty-two species were not sighted in

Eleyele Dam but were sighted in Asejire Dam. There is a significant difference ( $t=0.94345$ ;  $p=0.3567$ ) in bird exclusiveness between the two dams

Bird density was higher at Asejire Dam (53.30 birds/ha) compared to Eleyele Dam (40.22 birds/ha) (Figure 2). At Asejire Dam, cattle egret (*Bubulcus ibis*) was found to be the most abundant ( $n=162$ ; 33%). At Eleyele Dam, village weaver (*Ploceus cucullatus*) was the most abundant ( $n=199$ ; 53.9%). Test of homogeneity showed that there is a significant difference ( $t=0.55418$ ;  $p=0.5856$ ) in bird abundance between the two dams.

Shannon-Weiner diversity index was higher at Asejire Dam (2.58) than Eleyele Dam (1.94). Diversity T-test revealed that there is a significant difference in the bird species diversity of the two locations ( $t=0.532416$ ;  $p=0.3258$ ). The bird species evenness and equitability was also observed to be slightly higher at Asejire Dam (0.30; 0.68) than at Eleyele Dam (0.23; 0.57). In contrast, there was greater species dominance in Eleyele dam (0.31) than Asejire dam (0.16) Table 3.

Majority ( $n=48$ ; 92.31%) of the birds recorded in the two dams are resident while only few ( $n=4$ ; 7.69%) were migrant species (Figure 3). Also, greater proportions (36.54%) of the bird species are insectivores followed by the granivores ( $n=19$ ; 23.08%) while few species ( $n=2$ ; 3.85%) are frugivores (Figure 4).

## DISCUSSION

The creation of reservoirs has both positive and negative effects for aquatic and terrestrial species. Changes in landscapes induced by man are often accompanied by a degradation of the original environment and a successive loss of biological diversity, including birds (Radford et al., 2005).

Asejire dam had higher species composition (46 species) than Eleyele wetland with 23 species. This can be attributed to the fact that Asejire Dam is located outside the urban centres with less disturbance while Eleyele Dam is located in the core of the city and is surrounded by so many residential apartments and industries. This agrees with the claim of Brawn *et al.*, (2001) that bird communities respond significantly to the disturbance and ensuing successional changes. The presence of species like Black kite, Cattle egret, Common bulbul, Laughing dove, Red-eyed dove, Pied-crow and Pearl breasted swallow in Eleyele dam is a further indication of the impact of the ecosystem alteration on the species composition and abundance in the environment. These are birds that live in degraded areas or in urban areas (Odewumi et al., 2015; Oduntan et al., 2012).

Bird species diversity was higher in the site with less human activities. Higher level of abundance, density and diversity index recorded at Asejire Dam can be attributed to a lot of vegetation surrounding it with a relatively undisturbed riparian forest which serves as roosting site as well as provide cover for birds. In contrast, the settlement around Eleyele Dam has encroached the riparian forest and has reduced the size of the vegetation. This claim supports statement by many authors notably Fahrig et al., 2010; Chace and Walsh, (2006); Sandstrom *et al.*, (2005) that higher vegetation covers support higher diversity of birds. Also, Clergeau et al., (1998) opined that a few species thrive by exploiting the unique nesting and foraging opportunities that such environments provide, but many species decline or disappear as settlement intensity increases.

The dams are important sites for the conservation of the majority of the diverse resident birds and the few migrant species (*Saxicola rubetra*, *Gallinula chloropus*, *Merops albicollis* and *Tringa nebularia*) as well as birds with different feeding habits that were recorded in the area indicating the conduciveness/ heterogeneity of the habitat to support these birds in terms of food, shelter and cover. Furthermore, low number of frugivores recorded during the survey is an indication that the dams' plant community structure had been altered through dam construction and continued human activities as well as alteration of flowing regime of the river system which is hindering the plant regeneration within and below the dams. This is in agreement with the statement by Cordova *et al.*, (2014) that destruction of biodiversity as a result of dam construction will ultimately have wide-reaching consequences for the health of ecosystems and bird diversity. Therefore, for sustainable conservation of birds in the two dams there is the need to reduce human activities that may degrade the habitat further and to ensure constant flow of water because the greater the extent and types of habitats available, the greater the area of occupancy will be for more species (Kallimanis *et al.*, 2008; Cordova *et al.*, 2014). This allows the vegetation below the dam to receive sufficient water and nutrients to support the birds that nest or feed in the general area and will also reduce the rate of pollution. Emergent vegetation might provide useful habitat for some species, it may deter others by decreasing visibility and thus ability to maintain predator vigilance (Murray *et al.* 2013), while the sudden death of large swards of macrophytes can increase the risk of a deadly botulism outbreak (Rocke and Samuel 1999).

## CONCLUSION

The study has clearly shown that Asejire and Eleyele dams harbor diverse species of resident and migrant birds with different feeding habit. As such, they can be centres for bird conservation and **avitourism** if the habitat condition is improved upon and avian conservation is equally given attention in the area. Although dams have negative effects on the environment and species diversity, there is a need for them, due to these benefits that they provide to society. As a result, it is important for governments to balance the services provided by dams with the preservation and sustainable conservation of biodiversity especially birds. As a result there should be short-term and long- term ways to alleviate loss of biodiversity caused by dams.

**Table 1: Checklist of Birds recorded during the study at Asejire and Eleyele dams**

ORDER/FAMILY	SCIENTIFIC NAME	COMMON NAME	LOCATION		MS	STATUS IUCN 2016	FEEDING GUILD
			ASEJIRE	ELEYELE			
<b>Accipitriformes</b>							
Accipitridae	<i>Elanus caeruleus</i>	Black-shouldered kite	+	-	R	LC	C
Accipitridae	<i>Milvus migrans</i>	Yellow-billed kite	+	+	R	LC	C
<b>Anseriformes</b>							
Anatidae	<i>Dendrocygna viduata</i>	White-faced whistling duck	-	+	R	LC	P
<b>Bucerotiformes</b>							
Bucerotidae	<i>Bycanistes fistulator</i>	Piping hornbill	+	+	R	LC	F
Bucerotidae	<i>Tockus fasciatus</i>	African pied hornbill	+	+	R	LC	F
<b>Charadriiformes</b>							
Charadriidae	<i>Vanellus albiceps</i>	White-headed lapwing	+	-	R	LC	I
Jacaniidae	<i>Actophilornis africana</i>	African jacana	+	+	R	LC	P
Scolopacidae	<i>Tringa nebularia</i>	Common green shank	+	-	M	LC	G
<b>Columbiformes</b>							
Columbidae	<i>Streptopelia senegalensis</i>	Laughing Dove	+	+	R	LC	G
Columbidae	<i>Turtur afer</i>	Blue spotted wood dove	+	+	R	LC	G
Columbidae	<i>Streptopelia semitorquata</i>	Red-eyed dove	+	+	R	LC	G
<b>Coraciiformes</b>							
Halcyonidae	<i>Halcyon malimbica</i>	Blue-breasted kingfisher	+	-	R	LC	I
Halcyonidae	<i>Halcyon senegalensis</i>	Woodland kingfisher	+	+	R	LC	I
Meropidae	<i>Merops albicollis</i>	White-throated bee-eater	+	+	M	LC	I



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**Cuculiformes**

Cuculidae	<i>Centropus senegalensis</i>	Senegal coucal	+	+	R	LC	I
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**Gruiformes**

Rallidae	<i>Amaurornis flavirostra</i>	Black crane	+	+	R	LC	O
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Rallidae	<i>Gallinula chloropus</i>	Common moorhen	-	+	M	LC	O
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**Passeriformes**

Corvidae	<i>Corvus albus</i>	Pied crow	+	+	R	LC	O
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Dicruridae	<i>Dicrurus adsimilis</i>	Forked tailed drongo	-	+	R	LC	I
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Estrildidae	<i>Lagonosticta rufopicta</i>	Bar-breasted fire finch	+	-	R	LC	G
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Estrildidae	<i>Spermestes cucullatus</i>	Bronze manikin	+	-	R	LC	G
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Estrildidae	<i>Nigrita fusconotus</i>	White-breasted negrofinch	+	-	R	LC	G
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Estrildidae	<i>Estrilda melpoda</i>	Orange-cheeked waxbill	+	-	R	LC	G
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Hirundinidae	<i>Hirundo abyssinica</i>	Lesser striped swallow	+	+	R	LC	I
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Hirundinidae	<i>Hirundo aethiopica</i>	Ethiopian swallow	+	+	R	LC	I
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Hirundinidae	<i>Hirundo smithii</i>	Wire-tailed swallow	+	-	R	LC	I
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Hirundinidae	<i>Psalidoprocne obscura</i>	Fanti saw-wing	-	+	R	LC	I
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Malaconotidae	<i>Tchagra senegalus</i>	Black-crowned tchagra	+	-	R	LC	I
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Motacillidae	<i>Motacilla aguimp</i>	African pied wagtail	+	+	R	LC	I
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Motacillidae	<i>Anthus leucophrys</i>	Plain backed pipit	+	-	R	LC	G
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Nectarinidae	<i>Cinnyris coccinigastrus</i>	Splendid sunbird	+	-	R	LC	N
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Nectarinidae	<i>Chalcomitra senegalensis</i>	Scarlet-chested sunbird	+	-	R	LC	N
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Nectarinidae	<i>Cyanomitra verticalis</i>	Green-headed sunbird	-	+	R	LC	N
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Nectarinidae	<i>Cinnyris venustus</i>	Variable sunbird	+	-	R	LC	N
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Platysteiridae	<i>Terpsiphone viridis</i>	African paradise-flycatcher	+	-	R	LC	I
Ploceidae	<i>Malimbus scutatus</i>	Red vented malimbe	+	+	R	LC	I
Ploceidae	<i>Malimbus nitens</i>	Blue-billed malimbe	-	+	R	LC	I
Ploceidae	<i>Ploceus cucullatus</i>	Village weaver	+	+	R	LC	G
Ploceidae	<i>Ploceus nigerrimus</i>	Vieillot's black weaver	+	-	R	LC	G
Ploceidae	<i>Ploceus nigricollis</i>	Black-necked weaver	+	+	R	LC	G
Ploceidae	<i>Nigritafusconotus</i>	White breasted negrofinch	+	+	R	LC	G
Pycnonotidae	<i>Pycnonotus barbatus</i>	Common bulbul	+	+	R	LC	O
Pycnonotidae	<i>Pyrrhurus scandens</i>	Leaflove	+	-	R	LC	O
Stenostiridae	<i>Fraseria cinerascens</i>	White-browed forest flycatcher	+	-	R	LC	I
Sturnidae	<i>Cinnyricinclus leucogaster</i>	Violet-backed Starling	-	+	R	LC	O
Turdidae	<i>Saxicola rubetra</i>	Whinchat	-	+	M	LC	I
<b>Pelecaniformes</b>							
Ardeidae	<i>Egretta alba</i>	Great egret	+	-	R	LC	C
Ardeidae	<i>Ardea melanocephala</i>	Black-headed heron	+	-	R	LC	C
Ardeidae	<i>Bubulcus ibis</i>	Cattle egret	+	+	R	LC	I
Ardeidae	<i>Ardeola ralloides</i>	Squaco heron	+	-	R	LC	C
<b>Suliformes</b>							
Anhingidae	<i>Anhinga rufa</i>	African darter	+	+	R	LC	P
Phalacrocoracidae	<i>Phalacrocorax africanus</i>	Long-tailed Cormorant	+	-	R	LC	C

Key: Resident (R), Migrant (M), Insectivores (I), Nectarivores (N), Omnivores (O), Scavengers (S), Frugivores (F), Carnivores (C), Piscivores (P), and Granivore (G)

**Table 2: Common and exclusive bird species in Asejire and Eleyele dams**

<b>Order</b>	<b>No of family</b>	<b>No of Species</b>			<b>Common both dams</b>	<b>EA</b>	<b>EE</b>
		<b>Both dams</b>	<b>Asejire</b>	<b>Eleyele</b>			
Accipitriformes	1	2	2	1	1	1	0
Anseriformes	1	1	0	1	0	0	1
Buceriformes	1	2	2	2	2	0	0
Charadriiformes	3	3	3	1	1	2	0
Columbiformes	1	3	3	3	3	0	0
Coraciiformes	2	3	3	2	2	1	0
Cuculiformes	1	1	1	1	1	0	0
Gruiformes	1	2	1	2	1	0	1
Passeriformes	13	29	23	15	9	14	6
Pelecaniformes	1	4	4	1	1	3	0
Suliformes	1	2	2	1	1	1	0
<b>Total</b>	<b>26</b>	<b>52</b>	<b>44*</b>	<b>30*</b>	<b>22</b>	<b>22*</b>	<b>8*</b>

Note: EA: Exclusive to Asejire; EE: Exclusive to Eleyele

\*: Significant at 95% confidence interval

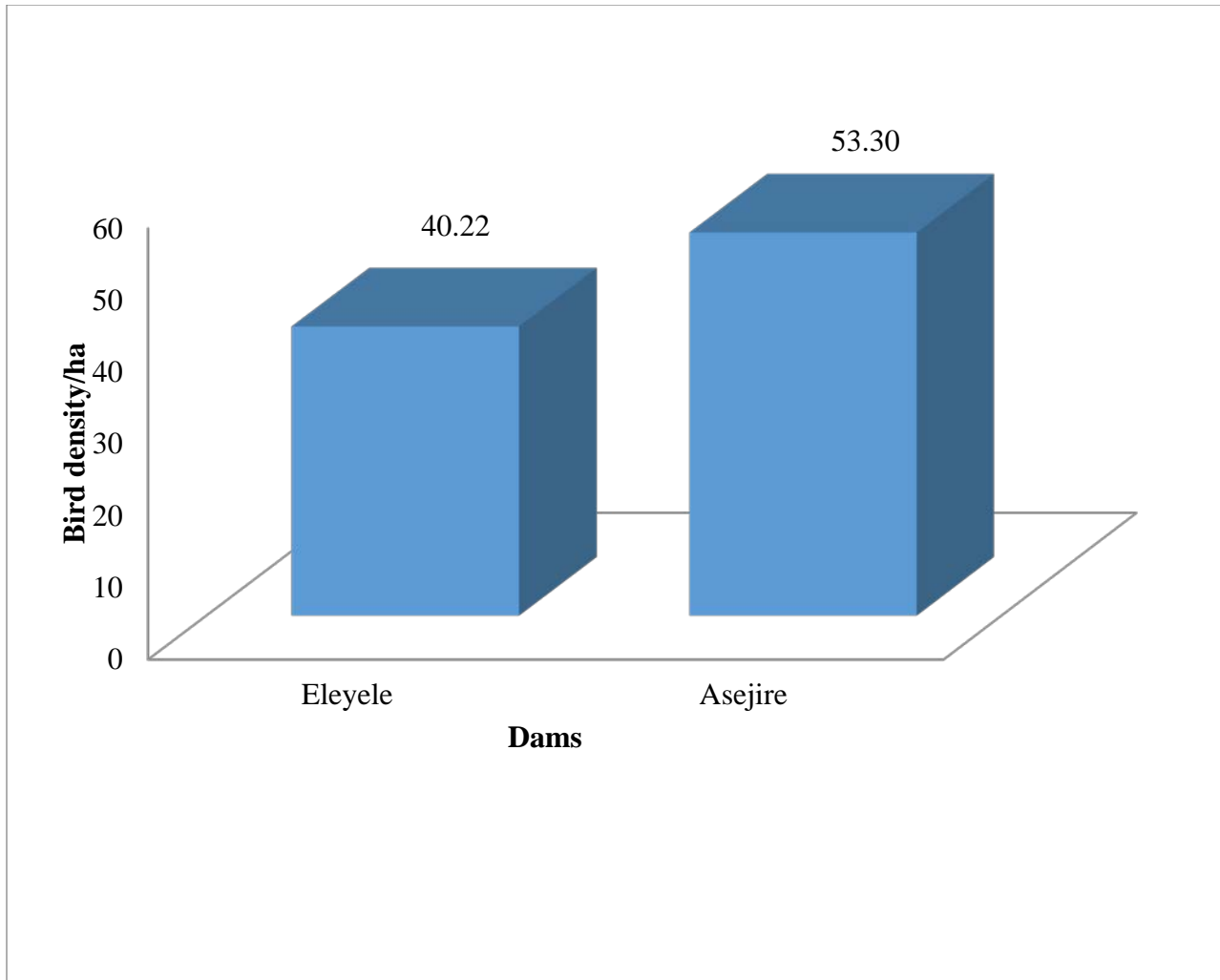


Figure 2: Bird density in Asejire and Eleyele dams

Table 3: Bird species diversity indices in Asejire and Eleyele dams

	Eleyele	Lower	Upper	Asejire	Lower	Upper
Taxa_S	30	16	24	44	19	29
Individuals	178	178	178	104	104	104
Dominance_D	0.31	0.22	0.36	0.16	0.09	0.17
Simpson_1-D	0.69	0.64	0.78	0.84	0.83	0.91
Shannon_H	1.9	1.60	2.04	2.58	1.92	2.41
Evenness_e^H/S	0.23	0.25	0.38	0.30	0.31	0.43
Equitability_J	0.57	0.55	0.67	0.68	0.63	0.73

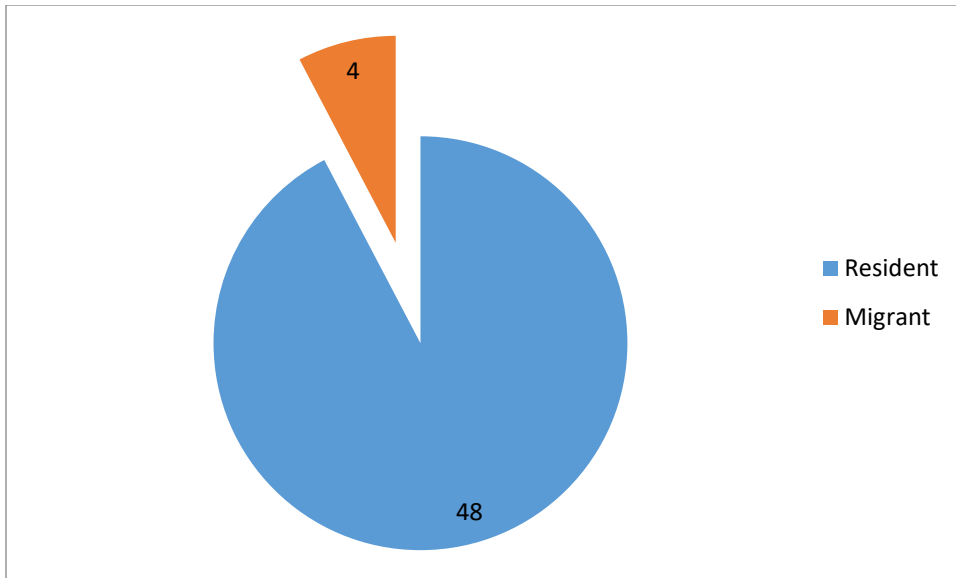


Figure 3: Migratory status of birds recorded in the two dams

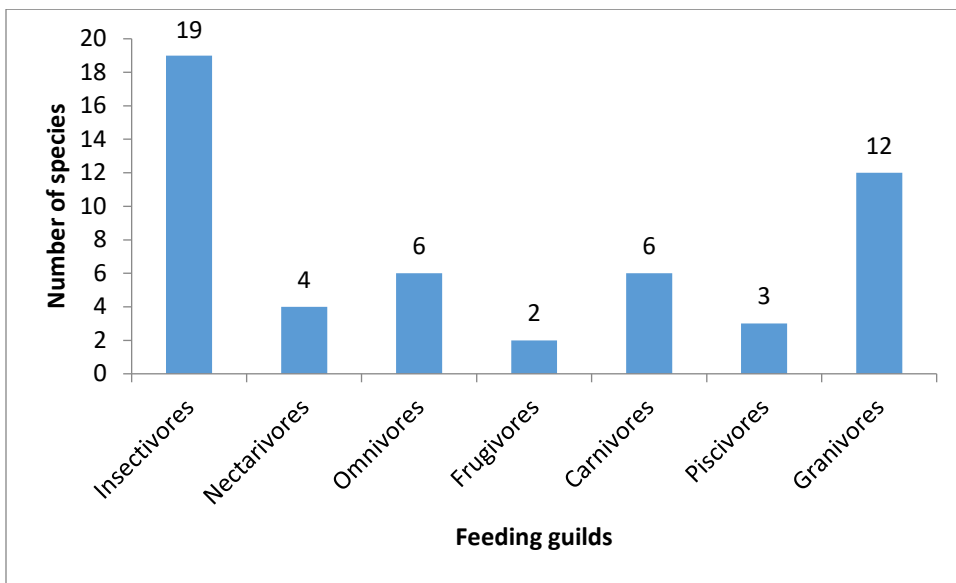


Figure 4: Proportion of bird species in different feeding guilds in the two dams

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