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# Application of Gisfor Biodiversity Conservation of Indigenous Chickens in Ile-Ife, Nigeria

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***Abstract:*** *Reports of various authors indicate that there is a decline in the number of the Yoruba ecotype indigenous chicken, found in southwestern Nigeria. The geographical distribution of these strains of chicken is poorly documented thereby hampering the implementation of any effective management and sustainable conservation program. Hence this study conducted an open survey among breeders of local fowls in Ile-Ife, a traditional town in southwestern Nigeria to identify some of the attractive characteristics of these chickens that can be included in breeding programs designed for biodiversity conservation of indigenous chickens.*
*Ile-Ife, located on latitudes 7.52°N – 7.57°N and longitudes 4.50°E – 4.57°E, was classified into three zones of core, transition and sub-urban using high resolution satellite imagery. Snowball sampling technique was used to administer questionnaire to breeders of indigenous chickens in all the three zones of Ile-Ife. The GPS coordinates of all the sampled locations were also recorded. The data from the questionnaires were analyzed, within a geographic information system (GIS), for trait preferences, selection and the risk status of the strains that exists among the population of indigenous chicken in Ile-Ife.*
*The study observed that the size of cock and the egg production performance of the hen were the most preferred traits. The comb type of the cock and the plumage colour of the hen were also preferred. The ratings for these traits in the three zones showed heterogeneity. The study also analyzed the selection practice by the chicken breeders to regulate the size of the flocks. The result of this analysis revealed that selection was made to increase the normal feather chickens. However, selection practice did not favor the naked neck, frizzle feather and the short-flight chickens. This was attributable to the cultural significance attached to these strains of chickens. This ignorant action of the breeders of indigenous chickens had facilitated the decline in the number of these strains.A survey on the availability of the different strains revealed that the normal feather chicken constituted 91.7% of the indigenous chickens in the study area. Other strains were available in minute quantities. The frizzle feather and the short-flight feather chickens each represented2.9% while the naked neck chickens were 2.3% of the available stock.*
*The results of this study highlighted the need to breed local fowls, not just to eat as meat, but for the sustainable conservation of the different strains that exist within the Yoruba ecotype chicken. This is to prevent the extinction of these strains.*

***Keywords:*** *Indigenous Chickens, Diversity, GIS*

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## I. Introduction

**Background of the Study**

Convention on Biological Diversity (CBD, 1992) defined biodiversity as the variability that exists among living organisms from all sources including terrestrial, marine and other aquatic systems. The ecological complexes including diversity within species and between species of the ecosystem are also part of biodiversity. Africa is recognized as hotspot for biodiversity (Mittermeier *et al.,* 2000) and there are presently different breeds of chickens with some similarities across countries. Diversity within indigenous chickens has been reported by several authors (Okumu*et al.,* 2017; Rudresh*et al.*, 2015; Ajayi, 2010; Ige*et al.,* 2014). The rich variation within the indigenous chickens in Africa may be attributed to the fact that most of the breeds have not been developed for specialized functions. The origin of each strain or ecotype of the indigenous chickens of Nigeria is the product of mutation, genetic drift, adaptation and evolution. The different selection pressures imposed on these chickens include the diet, variation in climate, endemic parasites and diseases (Barker, 1994).The diversity (strains) within Yoruba indigenous chickens of Nigeria were reported by Odubote (1994) based on the body size, the characteristics of the feather, the colour of the plumage and the position of the feather.

The dwindling decrease in the numbers of Animal Genetic Resources (AnGRs) was reported by FAO (2007a).This observation paved way for the Convention on Biological Diversity (CBD), Sustainable Development Goals (SDGs) and Food and Agricultural Organization of the United Nations (FAO). This agenda is to conserve and sustain the diversities that exist among indigenous breeds. By 2020, CBD and SDGs aim to maintain the genetic diversity of farmed and domesticated animals and their related wild species as well as the genetic varieties of wild seeds and cultivated plants.

Spatial analysis of availability of diversities that exist among indigenous chickens is necessary to understand the dynamics and interventions required for conservation. However, most studies on indigenous chickens are not spatially based. Krigas *et al*. (2012) noted that Geographical Information System (GIS) has a central role in analyzing the geographic distribution of endangeredspecies, measuring and monitoring biodiversity, and identifying priorities for conservation management.

The Geographical Information System (GIS) is computer software that links spatial information with descriptive information. GIS is a versatile tool applicable in any discipline because of the capability to harnessnon-spatial data with geographical locations. This tool is essential to monitor change in habitat, track wildlife demographics and to foretell land and resources used in achieving conservation goals, sustaining biodiversity, preventing fragmentation, extinction and natural depletion of resources.

Several authors like Salem (2003); Botkin*et al.* (2007); Engler*et al*. (2004); Boyd *et al.* (2006) and Araujo *et al.* (2005) have demonstrated the application of GIS for biodiversity conservation.However, the author is not aware of any documentation on the applications of GIS for biodiversity conservation of indigenous chickens.

## II. Statement of Research Problem

FAO (2007b) stated that the geographical distribution of most breeds of livestock is poorly documented, thus hampering the effective management and sustainable conservation of Animal Genetic Resources (AnGRs). Previous studies on indigenous chickens were focused on genetic improvement through crossbreeding with exotic breeds (Kitalyi, 1998). The result obtained from such studies was poor; partly because very little was known about their genetic makeup (Msoffe*et al*., 2004). Other studies on the diversity of chickens wereconcentrated on the molecular characterization and variation that exist with molecular markers (Kenya: Okumu*et al.* (2017); Sweden: Abebe (2013); China: Wei *et al.* (2013); Nigeria: Ige*et al.* (2014).

This project differs from other studies on indigenous chickens because it underscoredthe need to observethe diversities that exist among indigenous chickens (figure 1) within the heterogeneous population of chicken keepers in Ile-Ife. For effective management and sustainable conservation of these local chicken breeds there is a need to identify the trait preferences, selection procedure and analyze the risk status of the different strains.

**Aim and Objectives of the Study**

The aim of this study was to apply Geographic Information System for biodiversity conservation of indigenous chickens in Ile-Ife, Nigeria.

The specific objectives were**:**

- To identify and assess the traits preference for indigenous chickensin Ile-Ife;
- To examine for selection practices among the people that raise indigenous chickens in the study area;
- To identify stock diversity and availability in order to determine the risk status of different strains within the indigenous chicken population in Ile-Ife.

**Justification for the Study**

Understanding the diversity, distribution and the current status of each country's animal genetic resources is essential for any efficient program on development and conservation.Without such information, some breed populations may decline significantly, or be lost, before their value is recognized (FAO, 2007b).

Cultural values are already attached to the strains that exist within indigenous chickens in Ile-Ife (figure 1) but the effort to conserve the relatively threatened and rare strains is marginal. Study of the genetic variation within these chickens (Ige*et al.*, 2014) indicated high heterozygosity (differences). If these differences are lost, what will be the fate of the gene pool they represent? This study is therefore a prototype resourceful survey to promote the effective monitoring and management of the diversities that exist within these local breeds of chickens.

**Scope and Limitation of the Study**

A major limitation of the study is the spatial coverage. Although the data collected spanned across all the three zones of Ile-Ife(i.e. the core zone, the transition zone and the sub-urban zone), this information was not obtained from all the people that breed indigenous chickens in Ile-Ife. The study utilized snowball sampling

technique to administer questionnaires to people that breed indigenous chickens in all the three zones. Due to the time constraints, data were collected from only eighty participants from all the three zones.Hence, this study serves as representative samples of all locations in Ile-Ife.


**Figure 1:** Strains of Indigenous Chickens in Ile-Ife

### 1.6 Significance of the Study

The project is designed to document the risk status of the different strains within indigenous chicken population in Ile-Ife, as defined by FAO. This study is important as the heterogeneous population of breeds constitute biodiversity. The loss of one breed among other breeds is a great loss which can never be replenished.

The sustainable use of these animal resources within the environment is important to meet food security issues in years to come. With the projected escalation in human population, it is expected there will be an increase in the consumption of animal protein. Furthermore, the meat of chicken has a low level of cholesterol that has additional health benefits, hence, the need to ensure that these local fowls do not go into extinction.

It is envisaged that the results of this pilot study will serve as a lead for other communities within Osun State and the whole of southwest Nigeria. By identifying the traits preferred by local breeders of indigenous chickens, this study will provide viable information for future conservation programmes so that these programmes will be designed to promote acceptability among the natives, for sustainable conservation of the indigenous chickens.

## III. Materials And Methods

### 3.1 Description of the Study Area

Ile- Ifeis located within the tropical savanna climate zone of West Africa. This ancient townlies between latitude 7° 31'N and 7° 34'N, and between longitude 4° 30'E and 4° 34'E(Olajuyigbe*et al.,* 2012). Ile-Ife covers the whole of Ife Central and Ife East local government areas (Adefioye and Ujoh, 2012). There has been an incremental population growth in Ile-Ife. Population censure figure reported 92,865 in 1963; 178,409 in 1991 and 480,000 in 2006 (NPC, 2007). Thetotal population of the study area is presently estimated at about 509,035.

### 3.2 Division of Ile-Ife into Three Zones

Years of development has made Ile-Ife to follow the pattern of classification as observed in Ibadan (Onokerhoraye, 1977) and Ogbomosho (Afon, 2005). A high resolution satelliteimagery (Geo Eye) downloaded from goggle earth was used to classify Ile-Ife into three zones, based on the features. The core zone was recognized as the most ancient part of the town. The classification features for this zone include the palace, the shrines, early settlements and local markets. The transition zone featured development outside the core zone. Features observed in this zone includethe banks, schools and private establishments. The sub-urban zones featured development outside the transition zone. Major features include site development, private homes mostly owned by the elites. Each zoneis internally homogenous in terms of the physical layout, socio-economic status andthe environmental amenities available. These zones are also associated with low, medium and high quality residential areas respectively. In this study, the zones were referred to as:the core zone(the traditional town centre); the transition zone (areas with layout development and middle income residential area); and the sub-urban zone (high income area). The map of Ile-Ife, with the three distinctive zones, is shown in figure 2.

### 3.3 Data Types and Sources

Two types of datasets were used for this study: primary and secondary data

#### 3.3.1 Primary Dataset

The primary dataset were obtained from fieldwork. These included structured questionnaires and the geographic coordinates of selected sites. The structured questionnaires were administered to selected participants comprising people that breed indigenous chickens within Ile-Ife. The author visited the participants and used a handheld Garmin Global Positioning System (GPS) device to obtain the geographic coordinates of the location of each participant. The administration of questionnaires and collection of GPS data is depicted in figure 3

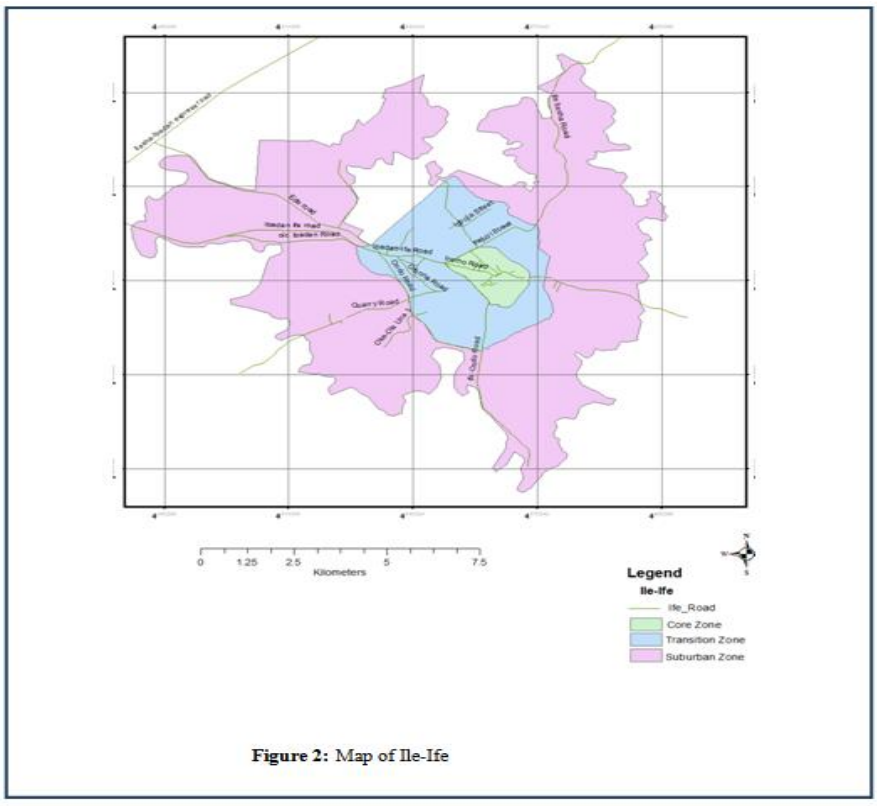



**Figure 2:** Map of Ile-Ife

**Figure 3:** Administration of Questionnaires and Collection of GPS Data

**Sampling Procedure**

Purposive sampling technique was used to select the areas visited for the study. This was identified from the development pattern of Ile-Ife. Snowball sampling technique was however employed in the administration of the questionnaire to the people that breed indigenous chickens.

**Questionnaire- Based Survey**

The questionnaire (appendix 1) administered for this research was designed to capture the personal information of the participants and also to address the three objectives of the study. The personal information recordedincluded the social profile of the respondents, the reasons for raising indigenous chickens and the challenges faced in breeding the chickens.

**Sampling Frame and Sample Size**

The questionnaires were administered within a period ofone week. During this period, the three zones (core, transition and sub-urban) were visited. Using the snowball sampling technique, ten respondents were identified in the core zone, thirty-three respondents in the transition zone and thirty-seven respondents in the sub-urban zone as shown in table 1.

**Secondary Data**

The secondary data included high resolution satellite imagery fromGeo Eye. Thisimagery was used for the classification of Ile-Ife into the three developmental zones of core, transition and sub-urban. The identified features of these zones included: the palace, shrine and local market for the core zone; medium income houses for the transition zone and high income settlers for the sub-urban zone.

**Data Analysis**

The data were analyzed, based on the objectives of the study, with the Microsoft Excel spreadsheet. The ArcMap application on ArcGIS 10.3 was used to produce the maps of the results obtained for the study.

**Identification and Assessment of Trait Preference for Indigenous Chickens in Ile-Ife**

The types of traits preferred in indigenous chicken were extracted from the questionnaire. Cross tabulations were used to examine the variations that existed for preferences by zones. The ratings for the

preferences were presented and each zone was presented on maps based on the preference. Tables, charts and maps were used to display the outputs of these analyses.

**Examination forSelection Practices among Breeders of Indigenous Chickens**

The ratio of people that practice selection to those that did not practice selection was determined. The reasons for raising indigenous chickens and the factors that determine selection of particular genotype were discussed in relation to the selection practices. Tables, charts and maps were used to display the results of these analyses.

**Identification of Stock Diversity and Availability**

The numbers of normal feather chicken; frizzle feather, short-flight and naked-neck chickens were recorded. The maximum numbers of chickens ever raised, the minimum and the average size of flock ever raised were also recorded.

The risk status for each strain of chicken in Ile-Ife was determined from the recorded numbers available and FAO (2007) was used to obtain the descriptors for the determination of the risk status.The results of these analyses were displayed in tables, charts and maps.

**Table 1:** Number of Respondents

| Zone | Respondents |
|---|---|
| Core | 10 |
| Transition | 33 |
| Sub-urban | 37 |

## IV. Results And Discussion

**General Profile of Respondents**

The study examined the profile of respondents in different zones of Ile-Ife. The profiles generated, shown in table 2, included the distribution of gender, the distribution of age, the educational background, house ownership, years of experience in breeding indigenous chickens and the major occupations of the respondents. The data obtained were compared to studies conducted in Ethiopia, Kenya and other African countries.

Table 2 showed that a high percentage of people who breed indigenous chickens in Ile-Ife were female with 90%in the core zone, 80% in the transition zoneand 70% in the sub-urban zone.

The age distribution of the respondents is between 19years and 50years. It can be observed that the highestpercentage of the respondents in the core and sub-urban zones were between 41 to 50 years old while 35% of respondents in the sub-urban zone were older than 50years.

The study observed that the highestpercentages of respondents in the core and transition zones were secondary school leavers with 60% and 40% respectively. The suburban zone had the highestpercentage of university graduates (30% of respondents). This is a reflection of the caliber of people resident in this zone. The sub-urban zone is mostly populated by the elites, hence the higher percentage of university graduates found therein. The highest percentage of respondents from each of the three zones (i.e. transition: 30%;core: 37%;suburban: 38%) had been raising indigenous chickens for over 20years. This is an indicator that majority of the respondents were experienced breeders of indigenous chickens.

The majority of respondents in the core and sub-urban zones owned the houses where indigenous chickens were raised. However, 55% of respondents in the transition zone rented the house in which the indigenous chickens were raised. This result revealed that the indigenous chickens are widely and equitably distributed among households thus implying that even the poor and marginalized in societies owned them. The largest percentage of respondents in the core zone (60%) and transition zone (68%) were traders while 35% and 22% were artisan and civil servants in the sub-urban zones respectively.

The findings of this project agrees with the studies of Aini (1990), Tadelle and Ogle(1996) and Kitalyi(1998). All these studies observed that in most African and Asian households, women and children are caretakers of traditional poultry kept on free-range extensive system. Mekonnen (2007) observed that in Southern Ethiopia, 86.2% of the male respondents were between 30 to 40years old. Furthermore, Hailu *et al.* (2013) in North Wollo Ethiopia reported that the prevalent age group for breeders of indigenous chickens in the region was 20-30years and 83.7% of these were females. This result, which is in agreement with FAO (2005), indicates that breeding indigenous chicken constitutes an economic enterprise that is conducive to improving rural livelihoods.This study is in consonant with the studies ofMeseret (2010) in Gomma districts of Ethiopia; Mekonnen (2007) in Southern Ethiopia; Halimah (2007) in Northwest Ethiopia and Hailu*et al.* (2013) in North

Wollo, Ethiopia. All these studies observed that in thedifferent zones, the breeders of indigenous chickens representedpeople with different types of occupations.

**Table 2:** General Profile of Respondents

| Profile | Core (%) | Transition (%) | Sub-Urban (%) |
|---|---|---|---|
| **Gender** | | | |
| Female | 90 | 81 | 70 |
| Male | 10 | 19 | 30 |
| **Age of Respondents** | | | |
| 13-19years | 0 | 0 | 3 |
| 21-30years | 20 | 22 | 5 |
| 31-40years | 30 | 28 | 14 |
| 41-50years | 40 | 22 | 43 |
| > 50 years | 10 | 28 | 35 |
| **Years of Experience** | | | |
| <5 years | 18 | 22 | 14 |
| 5-10 years | 18 | 22 | 27 |
| 11-20 years | 27 | 25 | 22 |
| >20 years | 37 | 31 | 37 |
| **House Ownership** | | | |
| Rented | 40 | 56 | 30 |
| Owned | 60 | 44 | 70 |
| **Educational Background** | | | |
| Informal | 20 | 31 | 24 |
| Primary | 10 | 0 | 5 |
| Secondary | 60 | 41 | 22 |
| NCE/Polytechnic | 10 | 19 | 19 |
| University | 0 | 9 | 30 |
| **Profession** | | | |
| Student | 0 | 3 | 0 |
| Unemployed | 0 | 0 | 0 |
| Trader | 60 | 69 | 33 |
| Artisan | 40 | 13 | 35 |
| Civil servant | 0 | 6 | 22 |
| Retired | 0 | 0 | 5 |
| Others | 0 | 9 | 5 |

**Identification of Traits of Preference**

The results presented in this section addressed the first objective of the project:to identify and assess the traits preference for indigenous chickens in Ile-Ife. The traits of preference were identified, ranked and inferences were drawn according to the different zones.

**Identified Preferred Traits**

Table 3 showed the identified traits preferred for the cock and the hen. The respondents preferred the following traits in the cock: the plumage colour, comb type, strain of chicken and the size. The traits preferred for the hen included the plumage colour, egg production performance, broodiness performance and strain of chicken.The attractive traits in the hen are particularly significant for any program to promotethe developmentand conservation of indigenous chickens because the hen is projected to serve as the replacement stock for the next generation of chickens.

**The Most Preferred Traits Identified**

Figures 4 and 5 showed ratings for the different traits of the cock and the hen. The most preferred trait in the cock for all the zones was the size of the cock. 50% of respondents in the core zone, 50% in the transition zone and 45% in the sub-urban zone preferred the size of cock. However, 33% of respondents in the sub-urban zone preferred the comb type while 30% of respondents in the core zone preferred the plumage colour.

The most preferred trait in the indigenous hen is the egg production performance. 80% of respondents in the core zone, 78% in the sub-urban zone and 63% in the transition zone preferred the egg production performance. However, broodiness performance of the hen was also rated high (33%) as apreferred trait in the transition zone.

**Preference Ratings for the Cock by Zones**

Figure 6 showed the ratings for the different traits of the cock. The plumage colour of cock was the most preferred trait by respondents in the core zone. 50% of respondents in the core zone preferred the plumage colour of the cock. The transition and sub-urban zones however preferred the comb type of the cock. The least preferred trait of cock by the three zones was the strain of chicken. The genotype was least rated with 60%, 53% and 70% by respondents in the core, transition and sub-urban zones respectively.

**Preference Ratings for the Hen by Zones**

Figure 7 showed the ratings for the different traits of the hen. The most preferred trait of the hen by the respondents in all the zones was the egg production performance of the hen. 90% of respondents in the core, 84% of respondents in the transition zone and 86% of respondents in the sub-urban zone rated egg production performance of the hen as the most preferred traits. This is followed by broodiness performance, plumage colour and the strain of the hen.

**Table 3:** Identified Preferred Traits forthe Cock and the Hen

| S/N | Traits in the Cock | Traits in the Hen |
|---|---|---|
| 1 | Plumage colour | Plumage colour |
| 2 | Comb type | Egg production performance |
| 3 | Size/posture | Broodiness performance |
| 4 | Size | Strain |

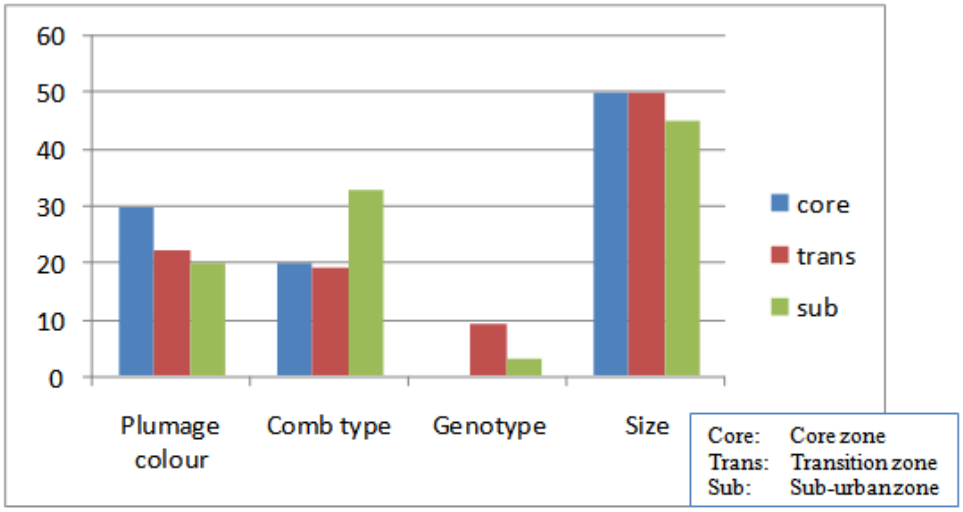



**Figure 4:** Preferred Traits in the Cock

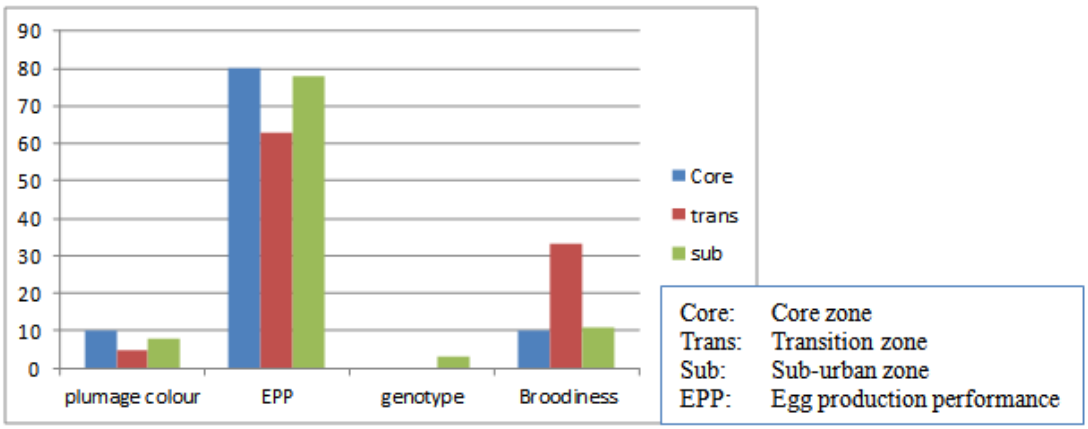



**Figure 5:** Preferred Traits in the Hen

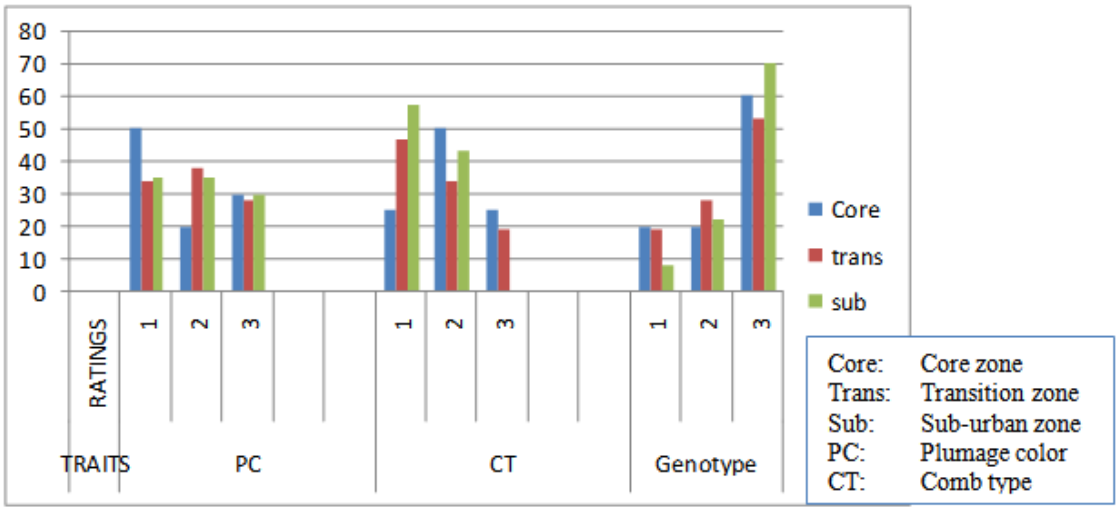



**Figure 6:** Preference Ratings for the Cock

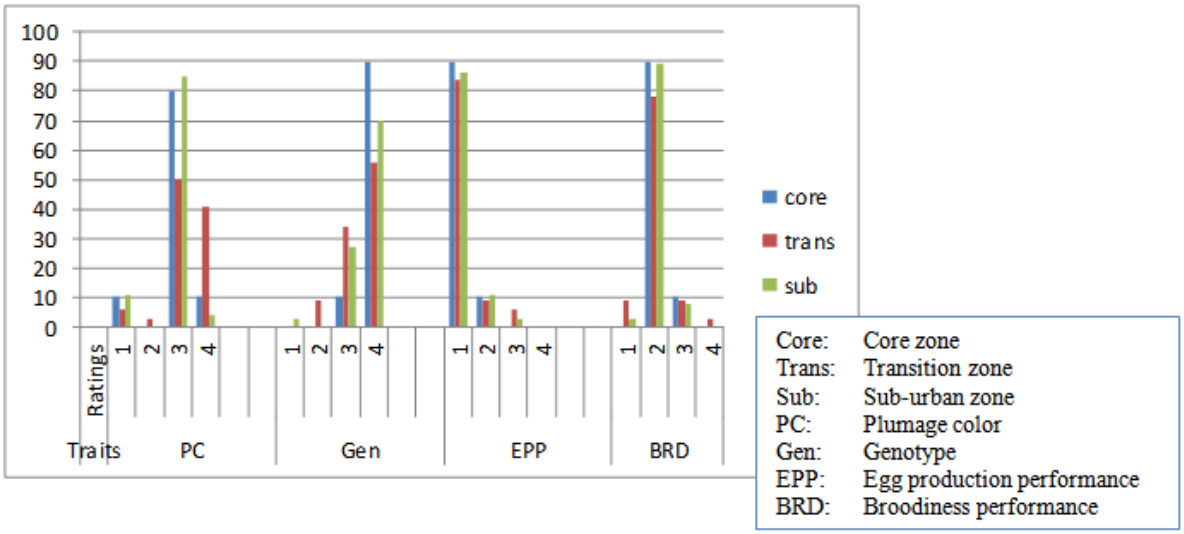



**Figure 7:** Preference Ratings for the Hen

**Assessment of Trait Preference for the Hen**

Consistent and continuous production of chicken for meat, egg and income is dependent on the performance of the hen.This section presentsan assessment of the performance of the hen, based on the most preferred set of traits the respondents would desire to retain for continuous breeding of indigenous chicken.

Different traits of the hen were combined at varying levels in order for the respondents to rank these traits, according to personal preference (refer to appendix 2). A profile is defined as a combination of qualities of the hen (persistency in laying, broodiness, maternal care and hatchability) in varying degrees.The eighteen profiles available within the six sets provided to the respondents are shown in appendix 1.The respondents in all the zones were asked to choose the profile which best described their preferred hen

The result of the assessment of the trait preference for the hen based on choice is shown in figure 8. It was observed that profiles 2 and 3 best described the preferred hen in set 1, 2 and 3. Only profile 1 was preferred in set 4, profile 2 in set 5 and profile 1 in set 6. The characteristic quality common to all these profile is the good maternal care of the hen. No matter the number of eggs laid or how good the hen is at brooding and hatching, the study observed that a hen with bad maternal care was not preferred.

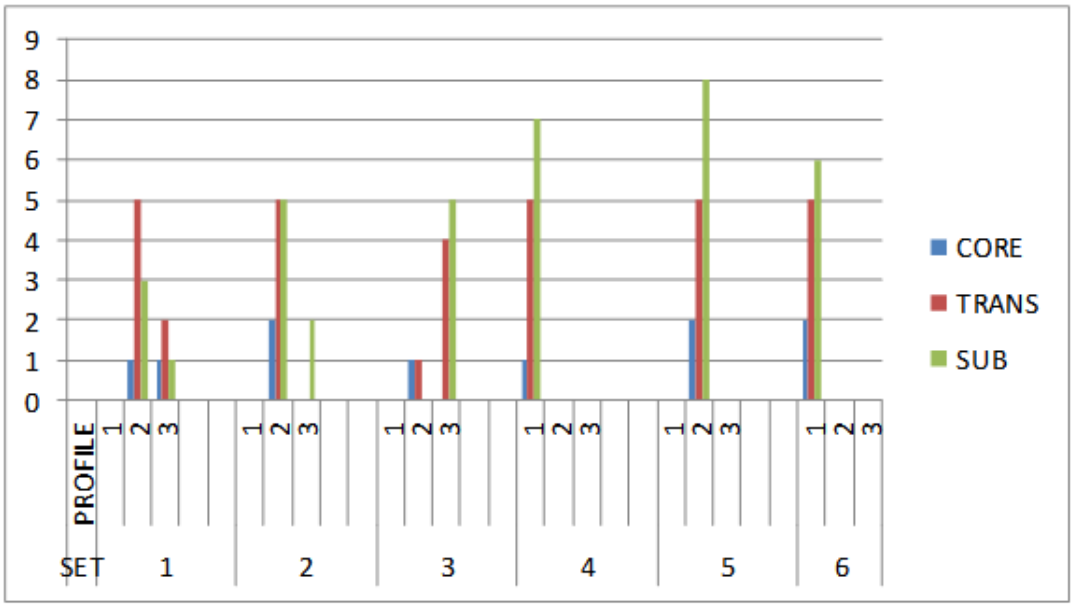


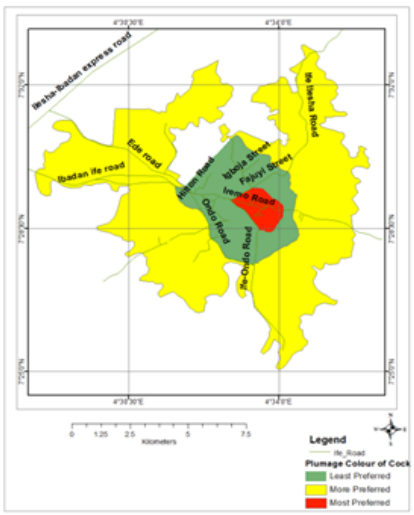

**Figure 8:** Assessment of Trait Preference for the Hen based on Choice

**Map Presentation of Individual Zone Preferences**

The data collected from the survey was translated to the maps shown in figures 9 to 15. Figures 9 and 13 showed that the core zone represented preference for plumage colour of the cock and the egg production performance of the hen. It can also be observed from figures 10 and 12 that the sub-urban zone represented preference for the comb type of cock and plumage colour of the hen. The transition zone representedpreference for the broodiness performance of the hen as depicted in figure 14.

These observations, which are in consonance with the study of Hailu *et al.* (2013), indicate that the plumage colours, comb type of cock, egg production and broodiness performance of hen are traits of economic importance which could be included in breeding programs designed for indigenous chickens. Hailu*et al.* (2013) observed that farmers in diverse altitudes of Ethiopia preferred different traits in chickens. Farmers in the high altitude of Ethiopia preferred the number of eggs as primary traits while for those in the middle and low altitudes, the plumage colourwas a more significant trait. In addition to the traits observed in this study, the reports of Abdelqader*et al.* (2007) and Okeno*et al.* (2011) showed that some farmers in Jordan and Kenya preferredthe growth rate of the chickens, their tolerance to disease, the body size, egg yield and fertility.The egg yield, mothering ability and the body size were most highly ranked in Kenya (Okeno*et al.*, 2011).

Figures 11 and 15 showed least preferences for strains of chickens. This finding is not in line with Okeno *et al*. (2011) who observed that in Kenya, the strains of indigenous chickens were important for their utmost performances.



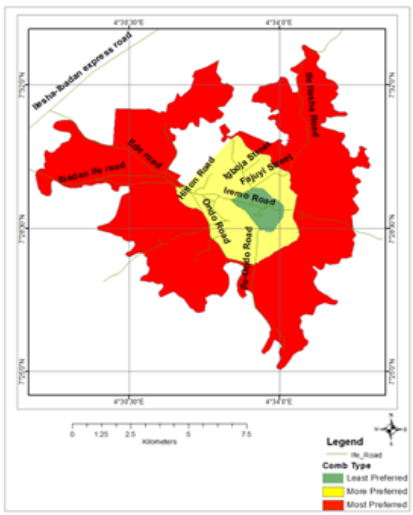
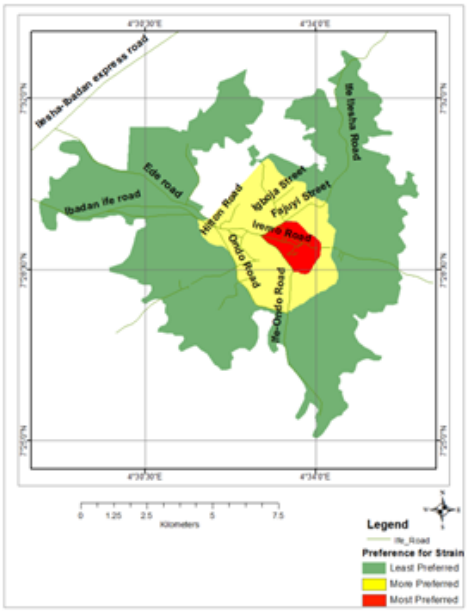




**Figure 9:** Preference for the Plumage Colour of the Cock **Figure 10:** Preference for Comb Type of the Cock



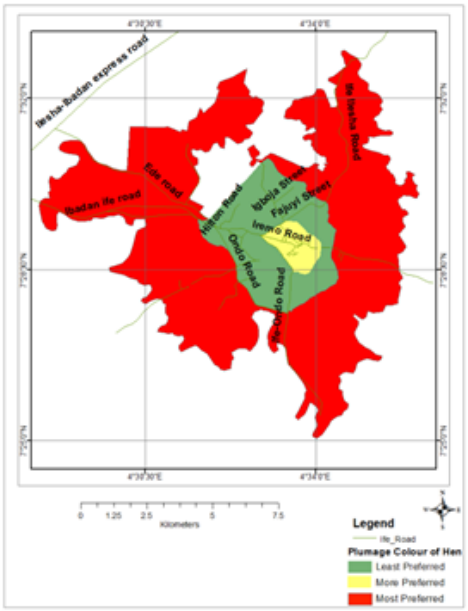
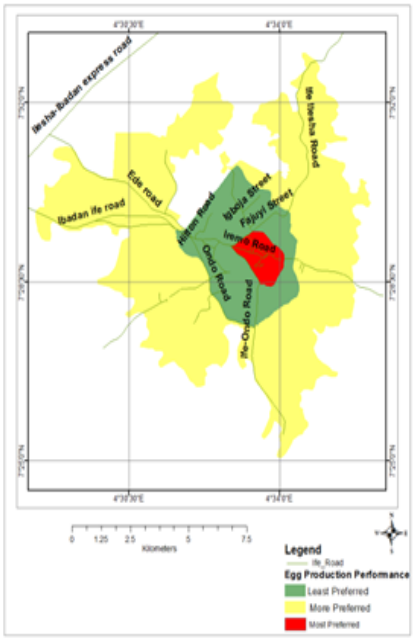




**Figure 11:** Preference for the strain of the Cock **Figure 12:** Preference for the Plumage Colour of the Hen



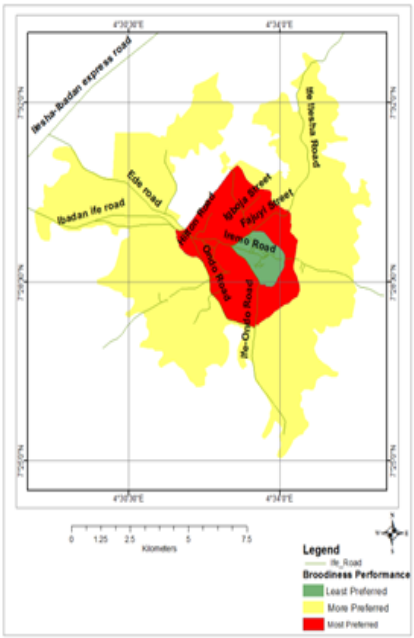




**Figure 13:** Preference for the Egg Production Performance of the Hen **Figure 14**: Preference for the Broodiness Performance of the Hen

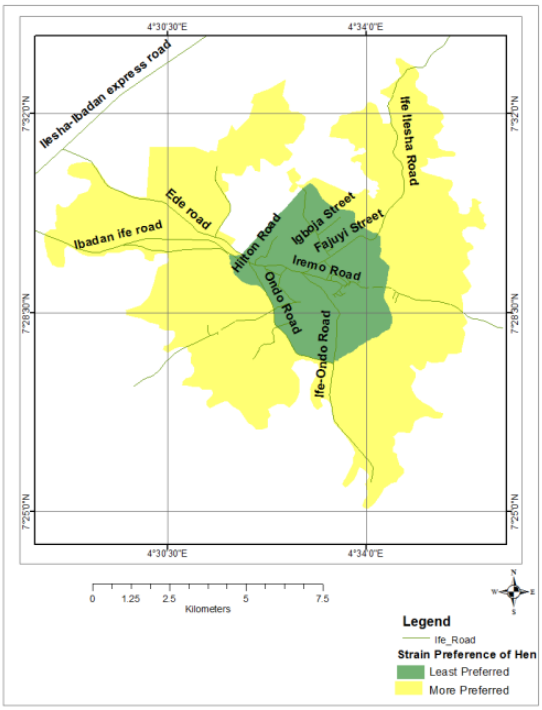



**Figure 15:** Preference for the Strain of the Hen

**Identification of Selection Practices**

The result of the second objective of the study is presented in this section. The second objective was to identify the selection practices that existed among the people that breed indigenous chickens in Ile-Ife.

Reports of several authors (Mekonnen, 2007; Hailu*et al.,* 2013; Halima, 2007; Okeno*et al.,* 2011) indicated that the indigenous chickens bred in most parts of Africa have not been selected for any particular purpose. Rather, these chickens have been exposed to the natural selection phenomena. This has resulted in the adaptive features exhibited by these chickens. The Yoruba ecotype chickens like other indigenous chickens are yet to be selected for particular traits; however the people involved with these chickens carry out their selection based on the performance of the chicken and the cultural significance attached to the chicken.

### 4.3.1 Selection Practice by Respondents

Table 4 showed that a majority of the respondents do not practice any selection for their stock. They were left to mate indiscriminately. However, 60% of respondents in the core zone and 25% in the transition zone carry out selection practices. The selection practice carried out by majority of the respondents in the core zone could be attributed to the reasons for raising these chickens. 43% of respondents in the core zone raised indigenous chickens for profit hence the prevalent selection practice for breeding in this zone is based on the size of the chicken.

The dearth of selection practice observed among chicken breeders in Ile-Ife does not agree with the study of Fisseha (2009) where 92.2% of chicken owners in Bure district, North-west Amhara region in Ethiopiahad the tradition of selecting cocks for breeding stock. Okeno*et al.* (2011) also observed that in Kenya, farmers who confined their flocks do selection of chickens for breeding.

It should be noted however that unconscious selection is practiced by the breeders of the indigenous chicken. Selection is done majorly for consumption, cultural and religious reasons. The cultural believes of most respondents lied in the fact that some strains of indigenous chickens (Frizzle feather and Short-Flight) belong to some people popularly referred to as "elders". This made the respondents to remove these rare strains from their chickens whenever it existed thereby reducing the number in population. Table 4 showed the factors that determine the selection of a particular genotype. This type of unconscious selection practice favors some strains of indigenous chickens thereby making them more available than the other populations.

The indigenous chickensexhibit uncontrolled breeding method because of their characteristics scavenging activities. Tables 4 showed that majority of respondents do not have a special breeding program. There is no mating system in place. The chickens are left to breed uncontrollably.

**Identification of Stock Diversity and Availability**

This section presented and discussed the diversities of indigenous chicken found within the people that raise indigenous chickens and the availability of those diversities. The result will help to determine the present status of the diversities that existed within the indigenous chicken population and probable policies that may be implemented for the continued existence of these chickens.

**Previous Record of Availability of Indigenous Chicken**

In order to know the trend of occurrences or fluctuations with the breeding of indigenous chickens, respondents were required to choose from available options, the sizes of the minimum, average and maximum flock ever raised. Furthermore, the challenges faced in raising indigenous chickens were listed by the respondents.

**The Average Size of Flock Ever Raised**

Table 5 showed the range of sizes of the average size of flock the respondents had at a particular time. A majority of the respondents in the transition and sub-urban zone had on average between six and fifteen chickens at a particular time. However, 40% of the respondents in the core zone had an average size of within the range six to fifteen and sixteen to twenty-five chickens. The other respondents had either less than five chicken on the average or greater than twenty-five chickens.

**The Maximum Number of Chicken Ever Raised**

Table 6 showed the range of the maximum number of chickens ever raised by the respondents. The largest percentage of the respondents: 90% in the core, 87% in the transition and 81% in the sub-urban zones had a maximum of six to fifteen (6-15) and sixteen to twenty-five (16-25) chickens. The other respondents had a maximum of less than five chickens (10% in the core zone, 6% in the transition zone and 5%in the sub-urban zone have raised greater than twenty-five chickens.

**Table 4**: Selection Practices, Mating System and Factors that Determine the Selection of Particular Genotype

**Selection Practice**

| | Core | Transition | Sub-urban |
|---|---|---|---|
| Yes | 60 | 25 | 8 |
| No | 40 | 75 | 92 |

**Factors Determining Selection of Particular Genotype**

| | Core | Transition | Sub-urban |
|---|---|---|---|
| Consumption | 100 | 70 | 92 |
| Cultural | 0 | 12 | 5 |
| Religious | 0 | 0 | 3 |
| None | 0 | 18 | 0 |

**Mating System**

| Core | Transition | Sub-urban |
|---|---|---|
| Yes | 0 | 3 | 8 |
| No | 100 | 97 | 92 |

**The Minimum Number of Chicken Ever Raised**

Table 7 showed the range of the minimum number of chickens ever raised by the respondents in the three zones of Ile-Ife. It was observed that 40% of respondents in the core zone, 59% of respondents in the transition zone and 54% of respondents in the sub-urban zone had at least one chickenat any given time.This implied that the respondents are always involved with the indigenous chickens because of the vast importance they attached to the chickens.Some of these high rating is based on the consumption of the meat, eggs and monetary values.

**Present Record of Availability and Diversity of Indigenous Chickens in Ile-Ife**

The numbers of various diversities of chickens that exist within indigenous chickens in Ile-Ife were recorded for effective monitoring.

**Number of Normal Feather Chickens**

Figure 16 showed the number of normal feather chickens available with the respondents during period of visitation. Over 80% of the respondents in the three zones had normal feathered chickens that ranged between one and fifteen. 16% of the respondents in the transition zone however, do not have any normal feathered chicken at the time of visit. This was attributed to the challenges they faced in raising indigenous chickens. Other respondents, 20% in the core zone and 16% in the sub-urban zone had between sixteen and twenty-five normal feathered chickens.

**Number of Frizzle Feather Chickens**

Figure 17 showed the availability of frizzle feathered chickens. Over 90% of the respondents in all the zones do not have this strain of chicken. The remaining respondents had raised these chickens in the past, but the chickens had to be removed from the flock, due to various cultural reasons. This observation is in agreement with Odubote (1994) who reported this strain of chicken to be threatened. However, there is no documentation of any action to conserve this chicken strain.

**Number of Short-Flight Feather Chickens**

Figure 18 showed the availability of short-flight feathered chicken. This strain of chicken, like the frizzle feather chicken is also gradually been phased out of existence. In 1994, Odubote had reported this type of chicken is rare in Nigeria. However, no program for conservation has been put in place for the conservation this chicken strain.

**Number of Naked Neck Chickens**

Figure 19showed the availability of naked neck chicken. It was observed that the naked neck chickens were not available at all in the core zone. 6% and 5% respondents in the transition and sub-urban zones respectively had this strain of chicken. This particular strain had been subjected to negative selection from people due to its appearance.

Theobservations in this section do not agree withthe study of Okeno*et al.* (2011). This study observed thatin Kenya, indigenous chicken breeders had equitable number of different strains of chickens because they perceived the chickens to be good producers of eggs. The chickens also have big body size, they are resistant to most diseases and parasites, have faster growth rate and possess good mothering ability. Ajayi (2010) reported that the frizzle feather, short-flight and naked neck chickens in Nigeria also possess these characteristics. However, this study observed that in spite of these attractive qualities, the population of these indigenous chickens is on the decline.

**Determination of Risk Status**

The risk status for the different strains of chicken covered in this study was calculated (please refer to Appendix 3) and presented in table 8. The minimum number of a strain wascomputed by using the least number of chickens available and the number of the respondents in the three zones while the maximum number was calculated byusing the maximum number of chickens available and the number of respondents that had it.

The field survey conducted in this study showed that the minimum number of frizzle feather and short-flight chickens was 1, 2 and 2 in the core, transition and sub-urban zones respectively. From table 8, it can be observed that the maximum number of frizzle feather chickens in all the zones was twenty-five (25). Similarly, the maximum number of short-flight chickens in all the zones was also twenty-five (25). The naked neck chicken was not available in the core zone while the maximum number of this strain for the other two zones was twenty (20).The percentage availability of each of the four strains in the study area is shown in table 9. It was observed that the normal feathered chickens constituted the largest percentage (91.7%) of the indigenous chickens available in Ile-Ife, while the remaining strains exist in small percentages.

According to FAO (2007a), a critical breed situation is established in an area when the total number of breeding female chickens is less than one hundred and the total number of breeding males is less than five. Although this study did not record the number of male and female strains available at the time of visit, the determination of the risk status was based on the total number of chickens strainsrecorded during the period of visitation. This result of this study revealedcritical condition for the frizzle feather, short-flight and naked neck chickens in Ile-Ife.

**Table 5:** Average Size of the Flock

| Size of Flock | Core Zone | Transition Zone | Sub-Urban Zone |
|---|---|---|---|
| <5 Chickens | 10 | 8 | 11 |
| 5-15 Chickens | 40 | 63 | 54 |
| 16-25 Chickens | 40 | 24 | 22 |
| >25 Chickens | 10 | 5 | 14 |

**Table 6:** Maximum Size of the Flock

| Size of Flock | Core Zone | Transition Zone | Sub-Urban Zone |
|---|---|---|---|
| <5 Chickens | 10 | 6 | 5 |
| 5-15 Chickens | 40 | 59 | 46 |
| 16-25 Chickens | 50 | 28 | 35 |
| >25 Chickens | 0 | 6 | 14 |

**Table 7:** Minimum Size of the Flock

| Size of Flock | Core Zone | Transition Zone | Sub-Urban Zone |
|---|---|---|---|
| <5 Chickens | 40 | 59 | 54 |
| 5-15 Chickens | 60 | 41 | 46 |

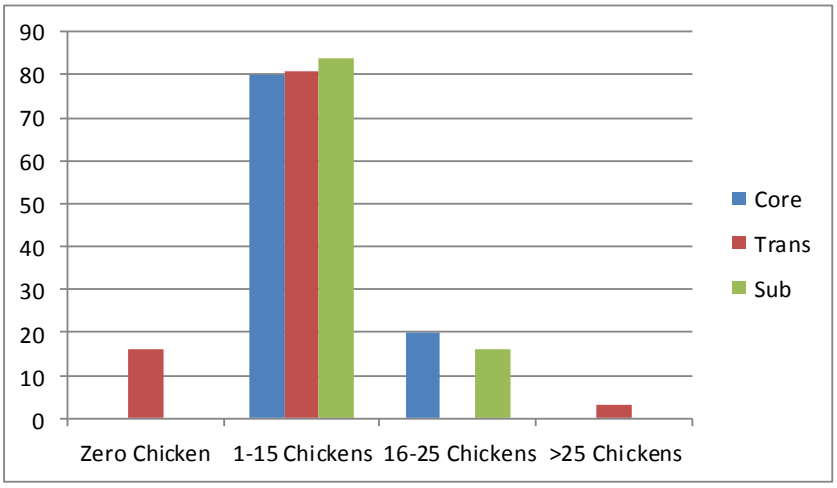



**Figure 16:** Number of Normal Feather Chickens

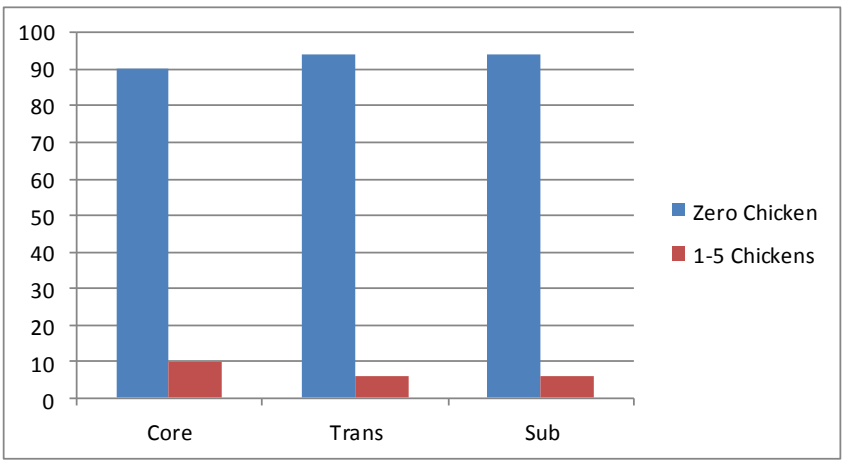



**Figure 17:** Number of Frizzle Feathered Chickens

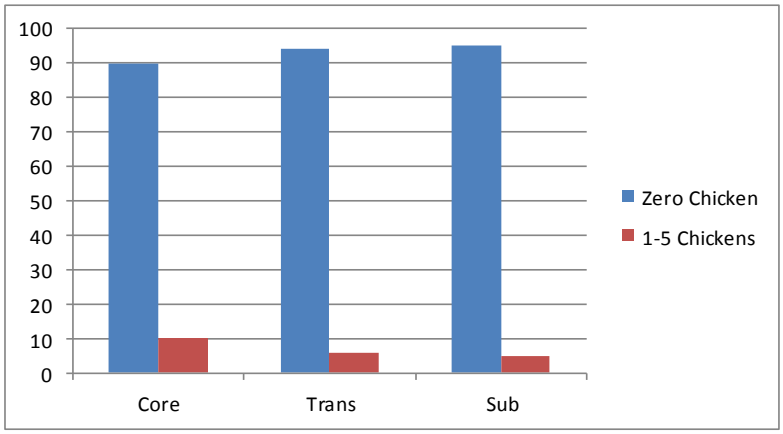



**Figure 18:** Number of Short-flight Feather chickens

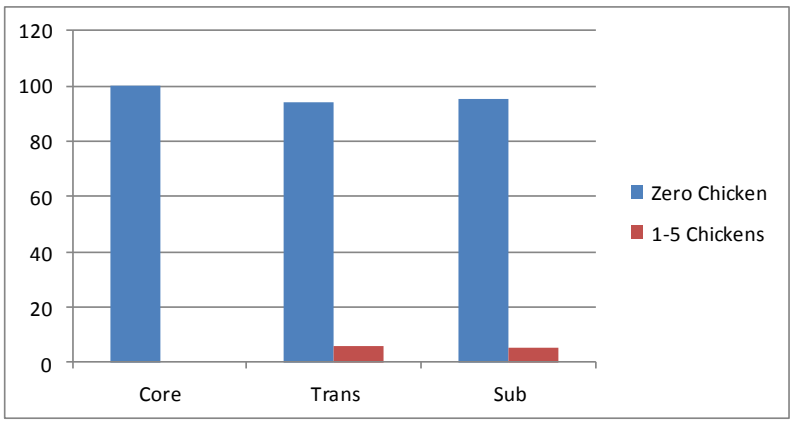



**Figure 19:** Number of Naked Neck Chickens

**Table 8:** Determination of Risk Status

| Strain of Chicken | Core Zone | | Transition Zone | | Sub-Urban Zone | |
|---|---|---|---|---|---|---|
| | Maximum | Minimum | Maximum | Minimum | Maximum | Minimum |
| Normal Feather | 172 | 40 | 415 | 51 | 195 | 127 |
| Frizzle Feather | 5 | 1 | 10 | 2 | 10 | 2 |
| Short-Flight Feather | 5 | 1 | 10 | 2 | 10 | 2 |
| Naked Neck | 0 | 0 | 10 | 2 | 10 | 2 |

**Table 9**: Percentage Availability of the Chicken Strains in Ile-Ife

| Strain of Chicken | Maximum Availability | Percentage (%) |
|---|---|---|
| Normal Feather | 782 | 91.7% |
| Frizzle Feather | 25 | 2.9% |
| Short-Flight Feather | 25 | 2.9% |
| Naked-Neck | 20 | 2.3% |
| Total | 852 | |

## V. Conclusions And Recommendation

**CONCLUSIONS**

The records from previous studies show that some strains of indigenous chickens in Nigeria are threatened, while some are gradually fading into extinction(Ajayi, 2010). Hence this study conducted an open survey among breeders of local fowls in Ile-Ife, to identify some of the attractive characteristics of these chickens that can be included in breeding programs designed for biodiversity conservation of indigenous chickens.

The study observed that for the cock, the favored traits included the plumage colour, comb type, size and the strain of the chicken. The plumage colour, egg production performance, broodiness performance and

strain were listed as favorite traits in the hen. However, the plumage colour was most preferred in cock while the egg production performance received the highest ranking for the hen.

To observe the trait preference on a broader scale, the study divided Ile-Ife into three major zones based on the trend of industrialization. These zones included the core zone, the transition zone and the sub-urban zone. Based on this classification by zones, breeders of local fowls in the core zone displayed a strong penchant forthe plumage colour of the cock and the egg production performance of the hen. In the transition zone, the broodiness performance was most favored while the sub-urban zone preferred the comb type of cock and the plumage colour of the hen.

The study also analyzed the selectionprocedure practiced by the chicken breeders to regulate the size of the flocks. This analysis revealed that active selection was not practiced by the breeders, and where it was practiced, it was based on the performance and cultural significance attached to the chickens.The cultural significance attached to different strains of indigenous chickens is a result of the level of exposure of the people that raised these chickens. Many breeders practiced unconscious selection for a particular strain because of the cultural importance attached. However, this ignorant action of these breeders could facilitate the extinction of these strains.

A survey on the availability of the different strains revealed that the normal feathered chicken was the most abundant. Other strains were available insmall numbers or even absent in some places.The study observed that the number of the frizzle feather, short-flight, and naked neck chickens in Ile-Ife was on the decline and almost becoming extinct. The risk status indicated critical level for these strains of indigenous chickens.

Deductions made from this work revealed that people are actively involved in the breeding of indigenous chickens, though at different levels. The social and economic classes of these breeders varied and the reasons for raising thechickens cut across all the classes. However, the general overview indicated that chickens are raised mainly for the purpose of meat consumption.

The results of this project highlighted the need to breed local fowls, not just to eat as meat, but for the sustainable conservation of the different strains that exist within the Yoruba ecotype chicken. This is to prevent the extinction of these strains. This pilot study therefore serves as a guide, pointer and foundation for further research in conservation process for the Yoruba ecotype chickens.

**RECOMMENDATIONS**

The following recommendations are proposed for the continuation of this project:

- This study focused majorly on particular strains of indigenous chickens i.e. the frizzle feather, short-flight and naked neck. Other strains of crested and feathered shanks should be considered in others studies to obtain a comprehensive account of all the strains that exist within the ecotype of Yoruba chickens.
- Since the risk status of livestock is calculated based on the number of breeding females, it is important therefore to carry out a total head count of the entire hen in Ile-Ife for proper categorization of the chicken strains. The need for conservation of these strains is now. Breeding program should target the traits of preference for continuous existence and production of indigenous chickens.
- Since the FAO risk status is based on country or regional level, the Yoruba ecotype chicken should be categorized using this study as a pilot case.

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## APPENDICES

### Appendix 1

### Sample of Questionnaire Administered

African Regional Center for Space Science and Technology Education in English
(Affiliated with the United Nations)
Obafemi Awolowo University Campus, Ile-Ife, Nigeria

### QUESTIONNAIRE

### Introduction

This questionnaire is designed to collect data on a post graduate diploma research titled: **APPLICATION OF GIS FOR BIODIVERSITY CONSERVATION OF INDIGENOUS CHICKENS IN ILE-IFE, NIGERIA**. The focus of the study is to identify traits preferences, selection practices, stock diversity and availability of indigenous chickens among the people that raise indigenous chickens in Ile-Ife town.

This questionnaire is strictly for academic purpose. Hence, the provision of accurate information from you will greatly contribute to the success of the research.

Please tick or fill as appropriate. Thank you for your kind assistance.

**Section A**

1. Date: _____
2. Location: _____
3. Name of Respondent: _____
4. Gender: ☐ Female ☐ Male
5. Age: ☐ 13-19 ☐ 21-30 31-40 ☐ 41-50 ☐ >50
6. Marital Status: ☐ Married ☐

   ☐ Single (never been married) ☐ Single (Widowed)

   ☐ Single (Divorced)
7. Occupation: ☐ Student ☐ Unemployed ☐ Trader

   Artisan ☐ Civil serva☐ Retired ☐ Others
8. Educational Background: ☐ Inf☐nal Primary

   Secondary ☐ NCE/Polyt☐hic University ☐
9. House Ownership: ☐ Rented ☐ Owned
10. Years of experience in raising Indigenous Chickens (IC):

    <5 years ☐ 5-10 years ☐ 11-20 years ☐ >20 years ☐
11. Reason for raising IC: (you may select more than one option)

    ☐ Consumption ☐ Cultural ☐ Profit

    ☐ Others, please specify _____
12. Is there any selection practices employed? ☐ Yes ☐ No
13. If the answer to question 12 is yes, please specify the selection method employed

    _____
14. Is there a mating system in operation? ☐ Yes ☐ No
15. What factors determine the selection of a particular genotype?

    Co☐mption Cul☐l Rel☐us Others, plea☐specify _____
16. How do you cull (select and kill) your chicken?

17. Are there customers for your stocks? ☐ Yes ☐ No

18. Who are the customers? ☐ Clerics Sellers ☐

☐ Intermediate Sellers ☐ Others, please specify_____

19. What is the average size of your flock?

☐ <5 ☐ 5-15 ☐ 16-25 ☐ >25

20. What is the maximum number of chickens you have ever raised?

☐ <5 ☐ 5-15 16-25 ☐ >25 ☐

21. What is the minimum number of chickens you have ever raised? <5

☐ 5-15 ☐ 16-25 ☐ >25 ☐

22. What is the number of normal feathered in your flock?

☐ 0 ☐ 1-15 ☐ 16-25 ☐ >25

23. What is the number of frizzle feather in your flock?

☐ 0 ☐ 1-5 ☐ 6-10 ☐ >10

24. What is the number of short-flight chickens in your flock?

0☐ 1-5☐ 6-10☐ >10☐

25. What is the number of naked neck in your flock?

☐ 0 ☐ 1-5 ☐ 6-10 ☐ >10

26. What are the challenges you face in raising IC? (You may select more than one option)

☐ Disease Outbreak ☐ Cost of Feeding ☐ Predators

☐ Others please specify: _____

**Section B**

**Traits Preferences**

Please indicate the traits you prefer in IC

Cock: ☐ Plumage Colour ☐ Comb Type ☐ Genotype

Others, please specify_____

Hen: ☐ Plumage Colour ☐ Egg Production Performance

☐ Genotype ☐ Broodiness Performance

☐ Others, please specify_____

Rank these traits according to importance, with 1 representing the most preferred trait.

Cock: ☐ Plumage Colour ☐ Comb Type ☐ Genotype

Hen: ☐ Plumage Colour ☐ Egg Production Performance

☐ Genotype ☐ Broodiness Performance

Please indicate in the table shown below, the most preferred set of traits you would want to retain for continuous breeding of indigenous chickens:

| SET | BROODINESS | PERSISTENCY IN LAYING | MATERNAL CARE | HATCHABILITY | CHOOSE/ RANK |
|---|---|---|---|---|---|
| 1 | GOOD | SHORT | BAD | GOOD | |
| | MODERATE | SHORT | GOOD | GOOD | |
| | BAD | LONG | GOOD | GOOD | |
| 2 | BAD | LONG | BAD | BAD | |
| | MODERATE | SHORT | GOOD | GOOD | |
| | GOOD | SHORT | GOOD | BAD | |
| 3 | BAD | SHORT | BAD | BAD | |
| | MODERATE | LONG | BAD | GOOD | |
| | GOOD | LONG | GOOD | BAD | |
| 4 | BAD | LONG | GOOD | GOOD | |
| | MODERATE | LONG | BAD | BAD | |
| | GOOD | SHORT | BAD | BAD | |
| 5 | MODERATE | LONG | BAD | GOOD | |
| | GOOD | LONG | GOOD | GOOD | |
| | BAD | SHORT | GOOD | GOOD | |
| 6 | MODERATE | SHORT | GOOD | GOOD | |
| | GOOD | LONG | BAD | BAD | |
| | BAD | LONG | BAD | BAD | |

**Appendix 2**
**SAS Codes Used for Traits Preference**

```
%mktruns (3 2 2 2);
%mktex (3 2 2 2, n=1536);
%mktlab (data= design, int=f1-f3);
proc print;  run;
%choiceff(data=final, model = class(x1-x3),
                    nsets=6, maxiter=2,
                    flags=f1-f3, beta=zero);
proc print; id set; by set; varx:;
run;
```

**Appendix 3**
**Calculation to Determine the Risk Status**
∑minimum number of chickens multiplied bythe number of respondents in each zone
∑maximum numberof chickensmultiplied bythe number of respondent in each zone

Agbaje H.A." Application of Gisfor Biodiversity Conservation of Indigenous Chickens in Ile-Ife, Nigeria. "IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) 11.12 (2018): PP- 18-38.