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Impact of Damage on Rice crop by the Red-billed Quelea (Quelea *quelea*) on the livelihood of Farmers in Hadejia- Nguru wetlands of Northern Nigeria.

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Abstract

The Hadejia-Nguru wetlands supports a population of over 1.5 million people who relies on the basin for their livelihoods through farming, fishing and cattle rearing. One of the challenges facing farmers in the basin is the incidence of Red-billed quelea which destroy rice fields and other grains such as millet and corn. Quelea is a type of African weaver bird which is granivous and migratory and moves in large flocks and cause a lot of destruction to rice farmers. A single flock can number up to a million birds and a single bird can consume an average of 18 grams of grain per day. A flock of two million birds can eat up to 50 tons of grain per day. This causes rural hardship and difficulty to rural farmers culminating in hunger and famine in some cases. This paper highlights the impact of rice damage by Red-billed Quelea on the livelihood of farmers in the study area. Using Multi stage sampling 11 villages were selected from the study area and using stratified and random sampling 411 farmers and fishermen were selected from the villages based on their populations. Questions asked includes demographic information, information on Red-billed Quelea, *Typha latifolia*, Rice farming and damage on rice crop by birds. Result of the interview showed that majority of the

inhabitants of the wetland are farmers occupying 90.51 % and 9.49% are fishermen. About 90.51% of the population are married with only 9.49% as singles. 74.21% responded that pests are the major problem of the farmers and 25.79% responded that drought and flooding are the major problem. Result also showed that birds are the major pest with 86.86% response and 10.70% responded that insects are the major pest,2.44% responded that rodents are the major pest. 94.89% responded that Red billed Quelea is the most damaging pest and 5.11% responded that other bird species account for the damage. The damaging stage of Quelea is the milking stage as responded by 91.97% and8.03% responded that the damage occurs during panicle initiation stage

Introduction

water is a vital element for the existence and sustainability of all living forms on earth, making it a significant environmental component (Jeffery, 2024).The recognition of the Hadejia-Nguru Wetlands (hereafter HNWs) as a crucial site for bird conservation dates back to the International Centre for Bird of Prey (ICBP, now Bird- Life International) sponsored ornithological expedition to Nigeria. Hadejia-Nguru Wetlands (HNWs) are a UNESCO-declared Ramsar wetland of international importance as a waterfowl habitat (Ibrahim, 2025). The Hadejia-Nguru wetlands supports a population of over 1.5 million people who relies on the basin for their livelihoods through farming, fishing and cattle rearing. It is a Ramsar site and an Important Bird Area (IBA) being recognized nationally and internationally as an ecological area for resident, inter-African and Palearctic migrant bird species in the sub- Sahara region, Nigeria (Mohammed, 2022).

Ramsar sites are wetlands of international importance recognized as critical habitats for bird conservation, especially waterfowls (Muhammad, 2022).Wetlands have an enormous significance for both human and animal life; such as for scientific operations, water management, resource-rich, nitrogen depletion and others. Anthropogenic behavior and effects on climate change have gradually disrupted the natural cycle (Gambo, 2020).Wetlands are an interaction between aquatic and terrestrial ecosystems, they are the most valuable life-sustaining water resources, they play critical roles as ecosystem service in providing food and habitats for a variety of species (Syakir, 2023).

The Hadejia-Nguru Wetlands are extensive floodplains created by the Hadejia and Jama 'are rivers to form the Komodugu-Yobe River which drains into Lake Chad. The wetlands like other wetlands across the globe are invaded by invasive plant species cattail *(Typha latifolia*) which have become a menace to the water bodies (Edegbene, 2018). In Yobe and Jigawa states, increase in populations and damage by Red-billed Quelea appear to be linked to the spread of this introduced aquatic cat-tail (*Typha latifolia*). As a non-native invasive species, the cat-tail already causes significant problems by blocking waterways and impeding fishing activities (Lawal, 2025). However, it appears that the cattail also promotes Red-billed Quelea populations

by providing an excellent breeding ground and roosts for the birds which then move into crops to feed. The pattern of Red-billed Quelea occurrence, however, is very variable from year to year, depending on regional variations in rainfall and grass seed production (Abadi, 2024). This fact has been proven by Dallimer (2002) that the migration patterns and the timing of the annual cycle of Red-billed Quelea are determined by seasonal changes in food availability (annual grass seeds and insects) and ultimately by the movement of local rain fronts. Red-billed Quelea is capable of destroying entire crops, over areas up to 10km2 because of their large numbers and generalist granivores feeding habit (Sabastian & Z.M., 2023); Cheke et al., 2012). An individual Red-billed Quelea consumes an average of 18 grams of grain per day (Abadi, 2024). It is not unusual for flocks to number into millions, so a flock of two million birds can eat up to 50 tons of grain in a day, or 1500 tons within 30 days, which is worth approximately US$600,000 ((Mathew, 2025). The East African countries of Somalia, Kenya, Tanzania, Ethiopia and Sudan suffer an annual total loss of grain worth US$15million due to Red-billed Quelea damage (Nguru, 2025); (Mohammed, 2022).; (Nguru M. I., 2025). In addition to the economic impact, they also caused rural hardship resulting into hunger and famine to some extent (MOHD I. N., 2024).

Materials and method.

The Hadejia-Nguru wetlands (HNWs) is located between lat. 11° . 00" E, 11° 55" N and covers an area of about 3500km² in size and drain a catchment of 84,000km² (Ibrahim, 2025). The wetlands are located in the Sahel zone of north-eastern Nigeria ((Muhammad J. chiroma, Yahaya D. kazaure, Yahaya B. karaye, 2013), (MOHD I. N., 2024) The area is a floodplain wetland made up of permanent water bodies and seasonally flooded areas. It is located in the Sudano-Sahelian zone of north –eastern Nigeria (Umar, 2019). About 40% of the wetlands remain flooded throughout the year, this resulted in stands of *Echinochloa crasipise, Nymphaea, Limnophyton,* and *Typha latifolia* which is now extensive over 200km², compared to 5.5km2 in 1999 (Lawal, 2025). A wetland as defined by the Ramsar convention in 1971 is an area that marshy, fen, terrestrial or aquatic, whether natural or artificial, permanent or temporary, with water that is stagnant or flowing, fresh or brackish or salt, including areas of oceanic water in which the depth at low tide does not exceed six meters (Bukar, 2021). For the fact that water is essential for life , Over 1.5 million people live in the Hadejia-Nguru wetlands (HNWs) area whose life is supported by the water and its resources (Abdulrahman Shuaibu, 2022); Umar, *et al.*, 2019). The wetland is very rich in biodiversity consisting of at least 250 species of flowering plants, over 136 types of aquatic flora (both flowering and non-flowering). More than 103 species of fish and 378 species of birds (N., Idris, & Mubarak, 2025), (Sabo, 2022) , ; (Buba, Ussa, & Sabastian, 2022)). By providing corridors for wildlife and migratory birds, the areas are of ornithological significance to the international community (Aliyu, 2024). This prompted in an international initiative that led to the establishment of the Hadejia-Nguru wetlands conservation project in 1987 (MOHD I, 2024), Zakari, 2015). There are so many reports of estimated losses related to birds on major cereal crops in the wetland, because of the painful and horrific experience farmers are undergoing as a result of the activities of avian pests, many of the farmers rejected the idea of wildlife conservation (Odewumi, 2024).

It is clearly evident that the loss in biodiversity is partly attributing to the expansion and destructive impact of two major invasive species, the Red-billed Quelea (Black-faced Dioch, *Quelea quelea*) and the invasive cattail (*Typha latifolia*). The presence of the two species was cited by many researchers as the two most important issues for Agriculture with respect to declining flood levels and there is no satisfactory solution to either of these species which are regarded as pests (FAO, 2023).

Methodology

A multistage sampling technique was used to select 11 communities from the study area. The first stage involved the selection of sites based on their strategic location in the wetlands. Four (4) local government areas were selected Nguru and Karasuwa in Yobe state and Kirikasamma and Guri local government areas in jigawa state. In the second stage villages were selected based on their strategic positioning in the wetlands.

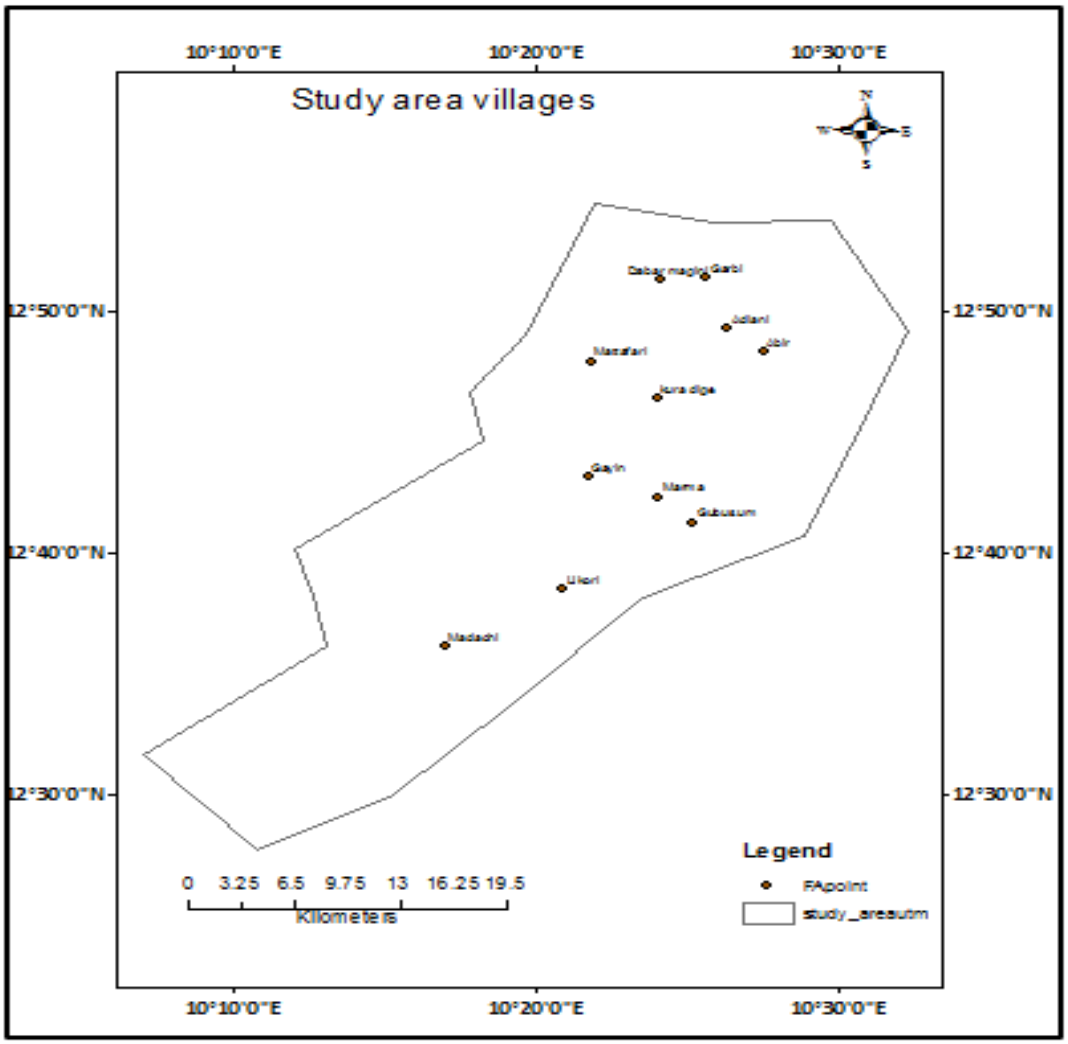


Figure 1 Study area map showing sampled villages

In this case seven villages were selected in Kirikasamma (Mattafari, Gayin, Madachi, Likori, Marma, Gubusum and Kuradige) which are situated in the heart of the wetland and Typha infestation area. Two villages were selected from Guri local government area (Adiani and Abir), two villages from Nguru local government area (Garbi and Dabar Alhaji Giwa). Stratified sampling was used to select occupational groups from the communities. Farmers and fishermen are the target population in this case. Interview method was used to administer the questionnaires to the respondents with the help of research assistants (trained enumerators) and writing materials. The third step involves random sampling of respondents. The number of respondents was shared across the villages based on the population of each village. The population of the villages was shown in Table 1

Table 1 population of villages and number of respondents

Village	Population	Number of respondents
Mattafari	2205	25
Gayin	5040	54
Madachi	6015	61
Likori	4050	42
Marma	6703	60
Gubusum	1620	15
Kuradige	4018	40
Abir	2200	22
Adiani	3208	30
Garbi	4011	41
Dabar Alhaji Giwa	2090	21
Total	39070	411

The data collected during the field survey include socio-economic characteristics of the respondents such as name, age, sex, marital status, house hold size, farm size, income, educational level, type of farming, variety grown, problems (pest and diseases), damage by birds, species that does damage, time of coming of birds, Typha infestation, time of Typha infestation, habitat of birds, control method of birds, effect of Typha on livelihood.

Demographic information.

Result of the demographic data showed that 11.68% of the respondents were between the age of 10 -20, 29.68% were between the age of 21-30, 26.52% were between the age of 31-40, 19.95% were between the age of 41-50, 8.28% were between the age of 51-60, 3.89% were above 60 years of age. The result showed that 90.51% were married and 9.49% were single. 10.70% of the respondents attended primary education, 19.46% attended secondary education, 13.39% attended tertiary education and 56.41% attended Arabic education. The result showed that 77.37% of the respondents are farmers while 22.63% were fisher men.

Table 2. Age class of respondants

Age class of respondents	
10-20 years	11.68%
21-30 years	29.68%
31-40 years	26.52%
41-50years	19.95%
51-60 years	8.28%
Above 60 years	3.89%
Educational status of respondents	
Primary education	10.70%
Secondary Education	19.46%
Tertiary education	13.39%
Arabic education	56.41%

Table 3 marital status of respondants

Marital status of respondants	
Married	90.51 %
Single	9.49%

Type of occupation	
Farmers	77.37%
Fishermen	22.63%

Farming information.

Result showed that 59.61% of the respondents owned land for 5-10 years ago, 24.34% owned land 10-15 years ago, while 10.95% owned land for more than 30 years and 5.10% owned land by inheritance. Result showed that 38.68% of the respondents grow food crop, while 4.38% grow cash crops and 56.94% grow food and cash crop. Result of the interview showed that 16.78% practice rain fed farming while 83.22% practice both rain fed and irrigated farming.

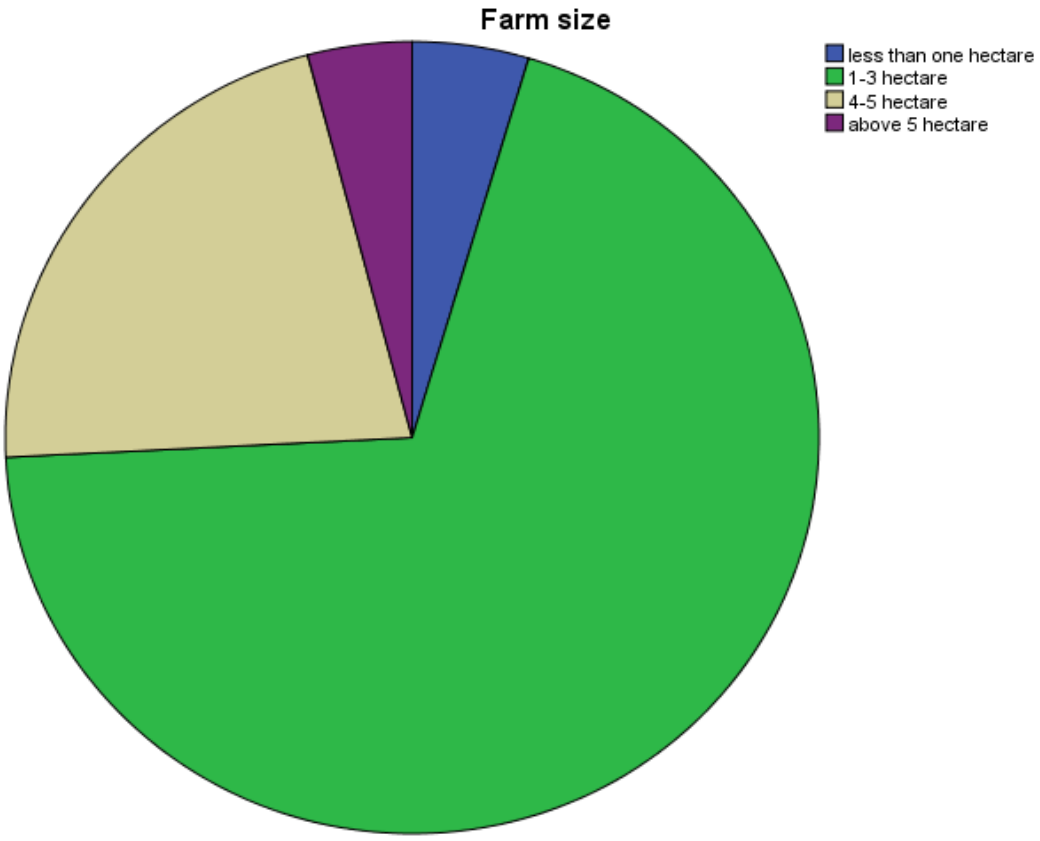
Land ownership	
5-10 years	59.61%
10 -15 years	24.34%
More than 30 years	10.95
Ownership by inheritance	5.10%

Type of food grown	
Food crop	38.68%
Cash crop	4.38%
Food and cash crop	56.94%

Type of farming	
Rain fed farming	16.78%
Both rainfed and irrigated farming	83.22 %

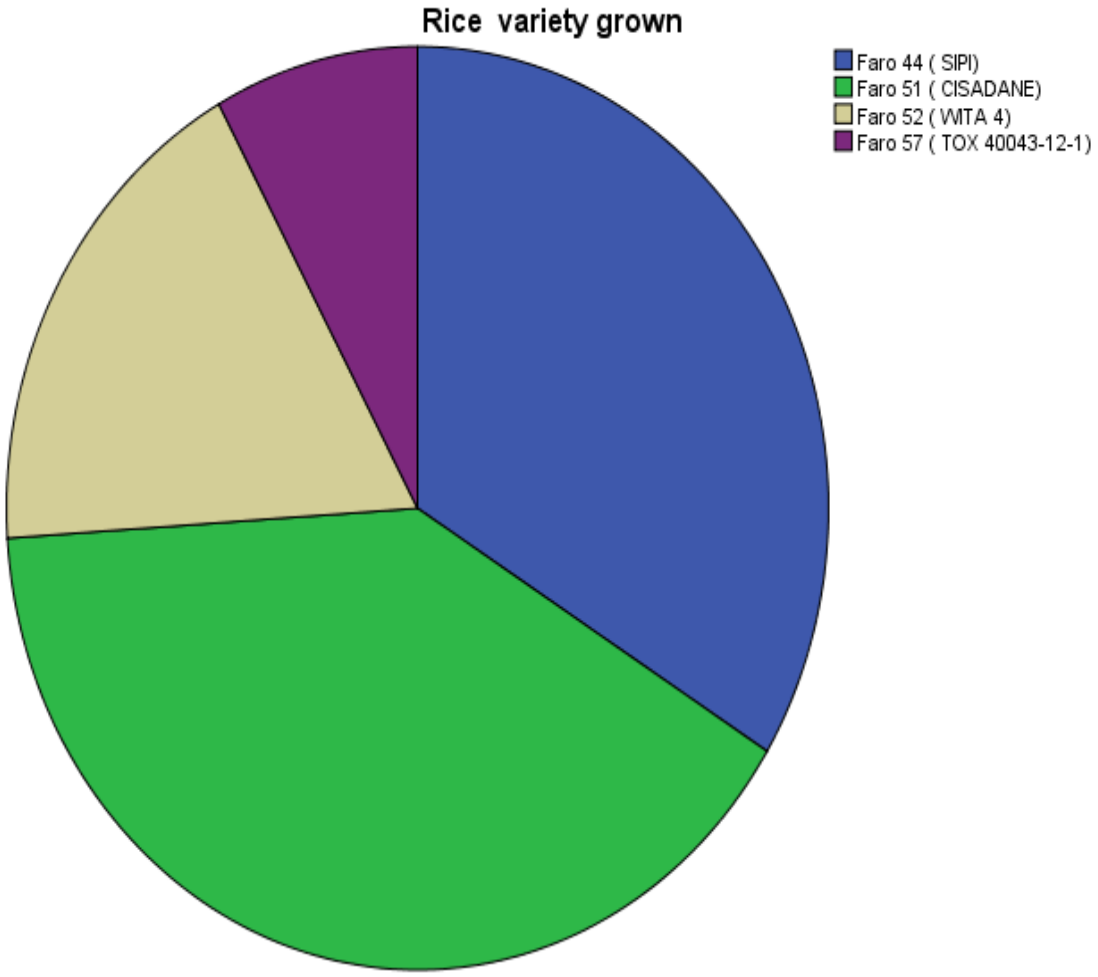
Result showed that 30.42% of the respondents have less than 1-hectare farmland, 55.72% have 1-3-hectare farmland while 13.86% have 5-10-hectare farmland.

	Farm size
Less than 1 hectare	30.42%
1-3-hectare farmland	55.72%
5-10-hectare farmland	13.86%



Result of the interview showed that 24.57% of the respondents grow Farrow 44, 32.37% of the farmers grow sifi variety, 12.89% grow Tos and 2.92% grow Jana variety.

Variety of rice grown	
Farrow 44	24.57%
Sifi Variety	32.37%
Tos variety	12.89%
Jana variety	2.92%



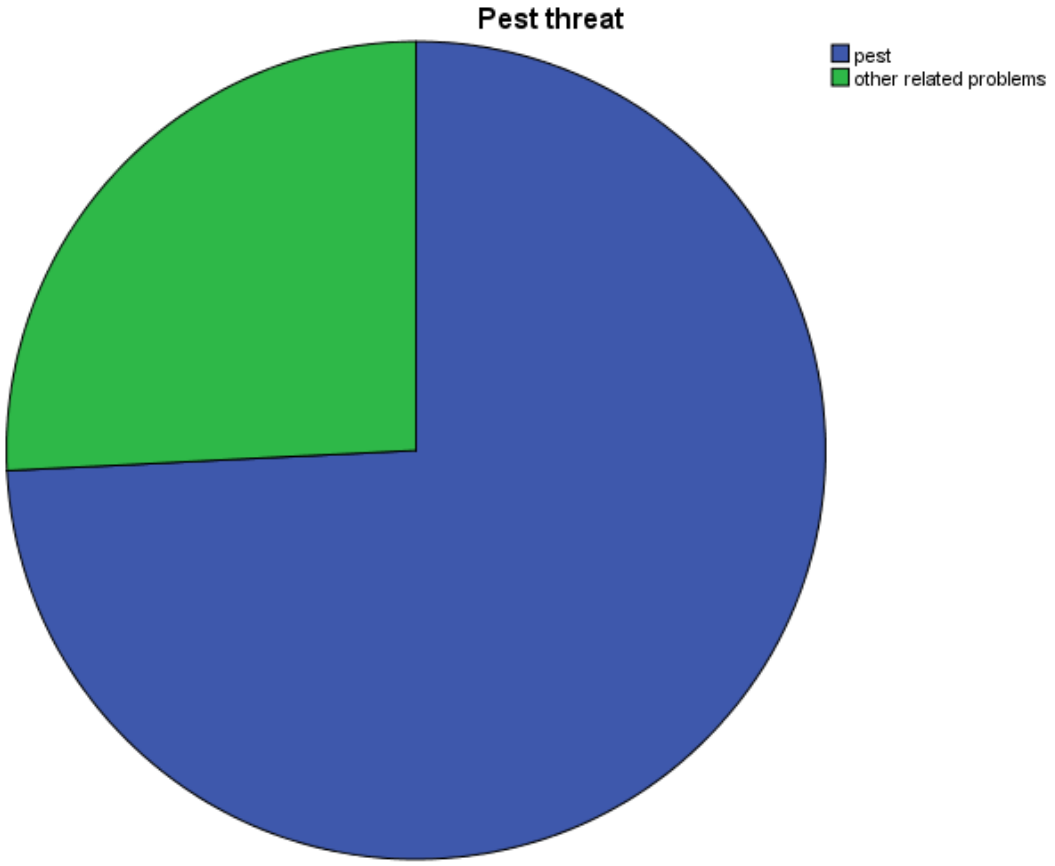
Result showed that 24.57% have Jun-Aug as their planting date, 28.89% have Jul- Oct as their planting date, 21.17 have April- Jul as their planting date, 20.44% have May –Aug as their planting date, while 5.10% have Jun –Oct as their planting date.

	Planting time
Jun- Aug	24.57%
Jul- Oct	28.89%
April-Jul	21.17
May-Aug	20.44%
Jun- Oct	5.10%

Problems encountered by farmers

Result showed that one of the major problems encountered by the farmers is pest 74.21% say that pest is their major problem and 25. 79% responded that drought and flooding are their major problem.

Problems encountered by farmers	
Pest	74.21%
Drought and flooding	25.79%



About incidence of pest 86.86% responded that birds are the major pest affecting their crops, 10.70% say that insects are their major problem, and 2.44% responded that rodents are their major problems. 94.89% of farmers say that Red billed Quelea is the most damaging pest while 5.11% say that weaver birds are the most damaging pest in their farmlands.

Incidence of pest	
Birds are the major pest	86.86%
Insects are the major pests	10.70%
Rodents	2.44%

Incidence of Red billed Quelea	
Red-billed Quelea is the most damaging	94.89%
Weaver birds ae the most damaging	5.11%

91.97% responded that the most damaging stage of growth is the milking stage and 8.03% responded that damage occurs at panicle initiation stage.

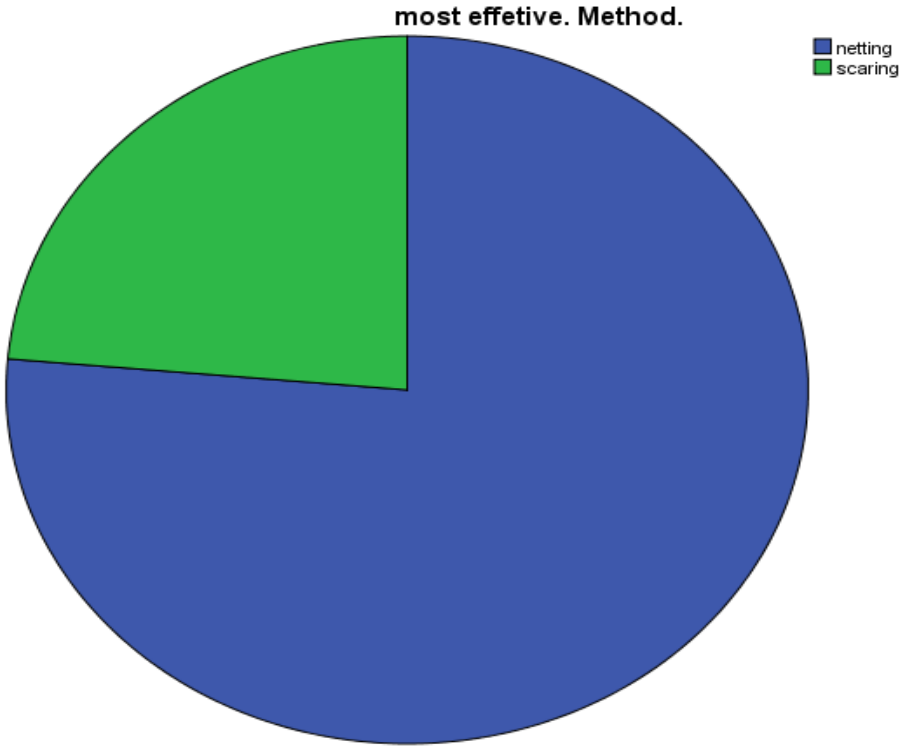
Damaging stage of Quelea	
Milking stage	91.97%
Panicle initiation stage	8.03%

Control methods of pest

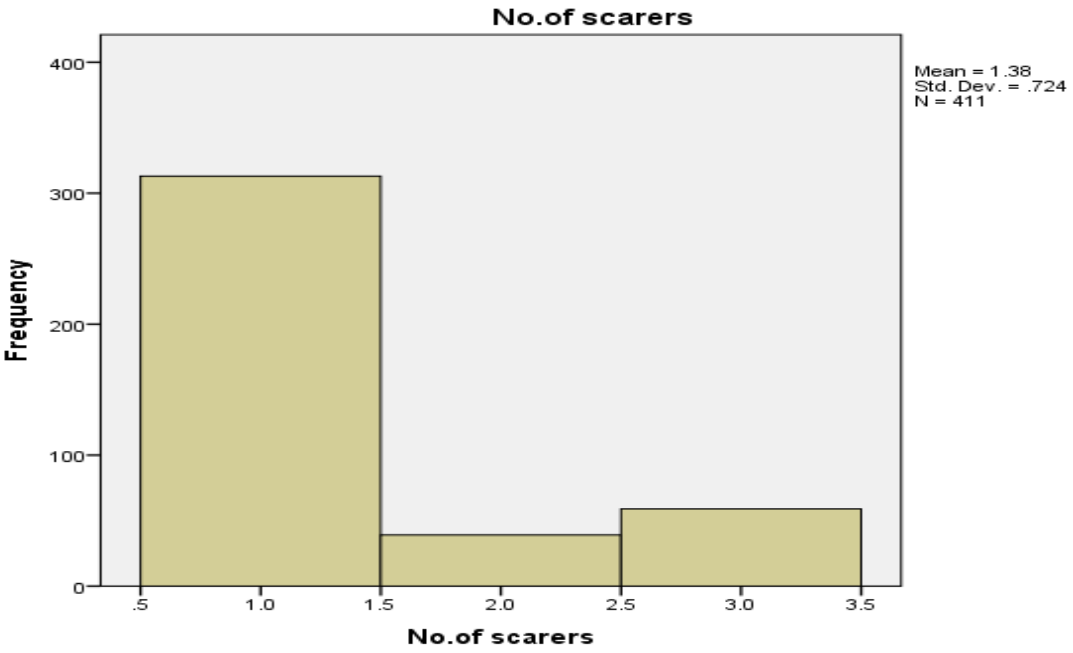
About control methods of Quelea 62.14% say that they used netting, 25.60% say they used scaring in controlling birds, 12.26% say they used scare crow in controlling birds. 75.67% of the respondents say that netting is the most successful method of control and 24.33% responded that scaring is the most successful method.

Control methods of pest	
Netting	62.14%
Bird scaring	25.60%
Scare crow	12.26%

The most successful method	**Netting**	**75.67%**
	Scaring is the most successful method	24.33%
Frequency of control	They control always	94.89%
	Sometimes	5.11%



Number of people employed for scaring	
2-3 people	75.42%
5-10 people	9.83%
Family members	14.75%



	Time engaging people for scaring
Five weeks	92.47%
Three wees	2.68%

	Amount paid to people scaring birds per day
Three hundred Naira (N 300)	85.16%
Five hundred naira (N500)	6.32%
They employ family members	8.52%

When asked about the frequency of control operations 94.89% responded that they control always, 5.11% say they sometimes do the control operations. About the number of scarers employed 75.42% say they employ 2-3 scarers, 9.83% say they employ 5-10 scarers and 14.75% say they engage members of their family to do the scaring. 92.47% of the respondents say they engage the scarers for five weeks, 4.88% of the respondents say they engage the scarers for four weeks and 2.68% say they engage the scorers for three weeks. About the amount paid to scarers per day, 85.16% responded that they pay three hundred naira (300) per day, 6.32% responded that they pay five hundred naira (500) per day and 8.52% say they employ their family members to do the work.

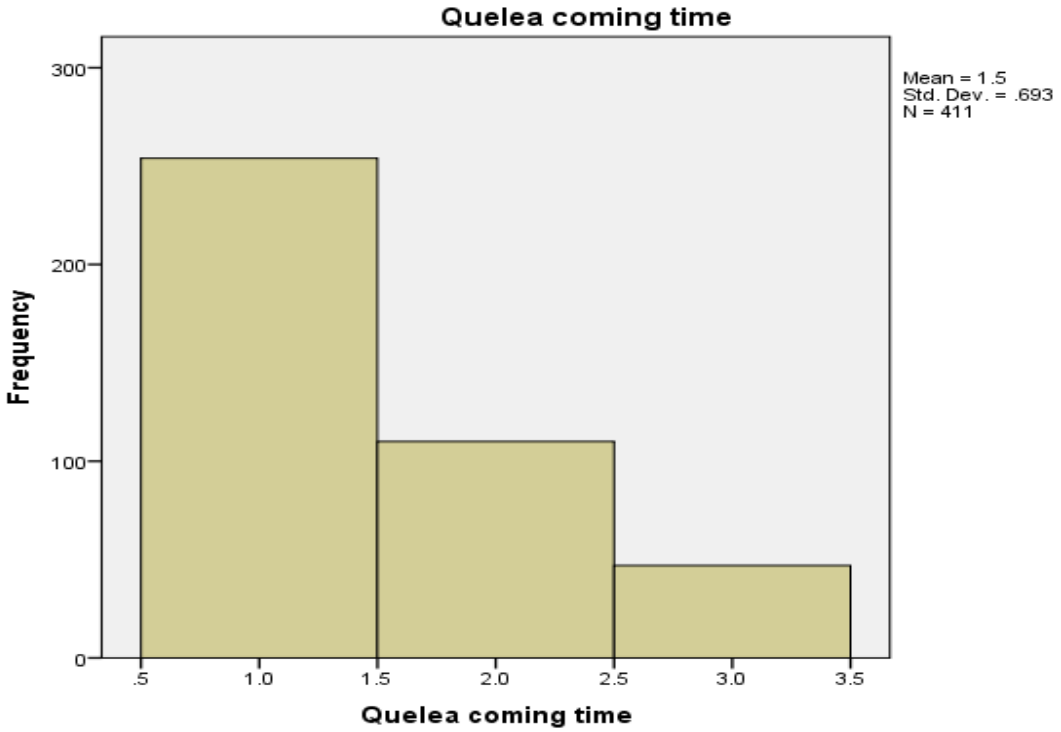
Government support	
No govt support	93.68%
They receive govt support	6.32%

6.32% of the respondents say they receive govt support while 93.68% say they receive no any govt support. When asked about other control methods 60.83% of the respondents mention scare crow, 25.55% mention destruction of pest habitat and 13.62% mention rituals as a control method.

Other control methods information	
Scare crow	60.83%
Destruction of pest habitat	25.55%
Rituals as a means of control	13.62%

When asked about the time of coming of the Quelea 68.62% say they come towards harvesting time, 31.38% say they come at the middle of rainy season. 80.30% say that damage occur at the milking stage of growth and 19.70% say damage occur at panicle initiation stage.

Time of coming of Quelea	
Towards harvesting time	68.62%
Middle of the rainy season	31.38%



Time of damage	
Milking stage	80.30%
Panicle initiation stage	19.70%

Climatic factors that affects the distribution of *Quelea*

All respondents say that the part of the crop damaged is the panicle. When asked about the climatic factors that favours the distribution of quelea 64.47% mentions rainfall, 4.63% mentions temperature and 30.90% mentions harmattan.

Climatic factors that favours distribution of quelea	
Rainfall	64.47%
Temperature	4.63%
Harmattan	30.90%

All respondents agree that damage reduce yield. 4.87% of respondents agree that they noticed *Typha* in the area in 10-15 years' time, 5.84% agrees that they noticed *Typha* in 15-20 years' time, 13.63% agrees that they noticed *Typha* in 20-25 years' time and 75.66% agrees that they noticed *Typha* 25 to 30 years ago in the area.

Appearance of Typha in the area	
10-15 years	4.87%
15-20 years	5.84%
20-25	13.63%
25-30 years	75.66%

95.13% of the respondents agrees that the plant is completely a nuisance, 4.87% agrees that it has some economic use. 92.45% say that Quelea build their nest inside the *Typha* stand and 7.55% say that quelea build their nest on other vegetation. 97.57% of the respondents agrees that Quelea uses *Typha* as habitat and 2.43% agrees that Quelea uses *Typha* as a source of food.

Uses of *Typha* to the farmers	Plant is completely a nuisance	95.13%
	It has some economic use	4.87%
Use of *Typha* by *Quelea*	*Quelea* build their nest in *Typha*	92.45%
	Quelea build their nest on other vegetation	7.55%

When asked about the distances of roosts/nests from farmlands 38.68% agrees that quelea build their roosts 50meters away from farmlands, 23.12% say quelea build their nests 100 meter away from farmlands, 24.82% say quelea build their nests 200 meter away from farmlands, 10.46% say *Quelea* build their nests about 1 kilometer away and 2.92% say quelea build their nests more than 1 kilometer away.

Distance of *Quelea* roosts from farmlands	
They build roosts 50 meters away from farmlands	38.68%
100 meters away from farmlands	23.12%
200metres away from farmlands	24.82%
1 kilo meter away	10.46%
More than 1 km away	2.92%

Discussion.

Livelihood are perceived as the capabilities, assets that include both material and social resources and range of activities required for a means of living(Matthew P. McCartney, 2015). Nigeria is faced with the challenge of providing enough food supply for its fast-growing population. The population of Nigeria is estimated to be over 206.1 million (World Bank, 2020). FAO (2023) has consistently listed the country among those countries that are technically not self-sufficient in food production because of low level input (Nguru, 2025). From the result of the interview of the respondents, it could be seen that more than 90% of the respondents attributed the problem of rice farmers to vertebrate pest (Birds). Quelea is the major pest specie that cause the damage. This has been highlighted by many researchers. A study by (Jeffery, 2024).showed that Weeds and grain feeding birds are the two main biotic causes of yield losses in irrigated rice in Africa. Using two rice cultivars Sahel 202 and Sahel 108. It was found that in two seasons, much lower yield loss was observed in short-cycle cultivar Sahel 108, where as in one season the medium cycle cultivar Sahel 202 was much less damaged. It was concluded that damaged is incurred more in weedy rice as compared with weed free rice. In Africa, quelea have been a pest of cereal grain crops. The population of the birds is dramatically increasing as a result of expansion in the growing of cereal crops. Quelea are ranked the most abundant and most destructive bird in the world, with Agricultural losses estimated at US$70 million per annum (Mathew, 2025).

FAO (2023) reported that the damage attributable to Quelea was in excess of $50 million annually. based on the level of damage they cause to the grain farmers, a serious reduction in in farm output is witnessed in the affected community and the whole country at large. This in extreme cases result in hunger and farmine. it encourages object poverty and rural hardship to the affected farmers as result of serious reduction in the yield of grain (Odewumi, 2024).. Red-billed Quelea affected grain production in at least 25 countries. They are regarded as the most destructive bird pest in Africa (Lawal, 2025).. A single Quelea can eat about 3-5 g of grain in a day. That means one million birds in a single roost can destroy up to 7-10 ton of grain per day(Abdel Wahid, 2008). Another important factor is the presence of Typha in the area. This plant species is believed to be invasive and based on the response of the people they start noticing the presence of the plant species about 30 years ago. *Typha* grass create microhabitats reducing critical habitats for feeding, nesting and roosting habitats for birds particularly it harbours a large flock of *Quelea* birds which are cereal crops pests.(Zungum *et al*., 2020)

This species is very invasive and is a very good for providing a habitat and roosting grounds for the *Quelea* species. This has been confirmed by many studies majority of the people interview asserts that *Typha* blocks the passage of canoes used for fishing or access to remote farmlands,

they provides niche for thieves especially cattle rustlers and most of all provide a habitat for *Quelea* birds that destroy cereal crops (Mathew, 2025). Birnin-yauri, et al., (2006) showed that there was reduced fish catch in water bodies that are infested by *Typha*.

A combination of enough rainfall, high seed production by grasses and nearness of ideal roosting and nesting sites gave rise to aggregations of millions of *Quelea* in Etosha National park Namibia (MOHD I. N., 2024). Damage by *Quelea* to crops as serious as it is, is not a recent phenomenon. one of such is the earliest records of a famine in Central Tanzania in 1881 which is attributed to damage by quelea on crops (Ibrahim, 2025). In Africa, quelea have been a pest of cereal grain crops. The population of the birds is dramatically increasing as a result of expansion in the growing of cereal crops (Abadi, 2024).

Since the construction of Tiga and Challawa dam around the 70s the flood extent has dwindled from 2,000 km² to around 413km² subjecting some parts to prolonged flooding and other parts to prolonged drought (Syakir, 2023). The basin supports a population of approximately 18 million people, 1.5 million of whom reside within the wetland. The people are predominantly lives on farming, fishing, rearing livestock and collection of wild resources which is an indication of high dependence on the rich wetland *ecosystem*(Matthew *et al.*, 2015)

. Other problems that emerge as a result of the degradation of the wetlands include proliferation of *Typha* which blocks water ways and imped fishing activities. This aquatic invasive plant also leads to irruption of the population of Red-billed quelea and other wetland birds who used the vegetation for roost and habitat. The Red-billed quelea appears to be a pest by damaging cereal crops in the area particularly rice. Livelihood failures aggravated as the Typha continue to invade farmlands and brings an increase in the population of the quelea which damages the cereal crops around. As a result of the serious reduction in the output of the cereal crop resulting from quelea damage poverty level and hardship of the villagers increase people migrated and began to exploit other wetland resources as a means of livelihood in place of agricultural production. *Typha latifolia* stands provide important food cover for wildlife and birds. They establish habitats for waterfowl and are especially valuable in attracting nesting red-winged blackbird. Muskrats use the foliage to construct their lodges, which in turn provide resting and nesting sites for water birds ((Sabastian & Z.M., 2023); Abdullahi, 2015).

The extensive and largest irrigation scheme in Africa sited in Kano State was almost overtaken by *Typha australis*. The control is extremely difficult and this requires an urgent attention. In addition, the plant harbours pest (Quelea birds) of cereals and this creates a double tragedy for the farmers.

Summary and conclusion

Red-billed quelea is a trans -African migrant pest bird that is endemic to African continent. Damage by birds to rice crop costs millions of dollars. This affects the livelihood of local farmers inflicting poverty and rural hardship. Many other methods of controlling birds are available such as use of chemicals, biological and cultural control methods and each method has its advantages and disadvantages. In Hadejia-Nguru wetlands, In response to the damage by quelea birds, most of the farming families employ their children and women for scaring birds away from rice fields. This period of scaring birds lasts for two to three weeks depending on the time

of infestation which affects the chances of younger children to attend basic education, women as well were denied the chance of doing their domestic jobs.

Recommendations.

This study recommends the use of advance technologies such as drones to mimic the natural enemies of birds instead of using children to scare birds away. Recommends the use of early or late coming varieties that avoid the period of coming of the birds. Harvesting the birds for food. Raptors such as hawks, falcons, barn Owls are some of the natural enemies of the bird, conserving them by rebuilding their population through provision of artificial nesting grounds for the raptor birds can help in controlling them. Using non-lethal chemicals can also help in controlling the birds. Planting resistant varieties of rice. Covering the entire rice crop with nets will also help in controlling damage**.**

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