WINTERING RUFFS *PHILOMACHUS PUGNAX* ARE NOT PESTS OF RICE *ORYZA SPP.* IN NIGERIA'S SAHELIAN WETLANDS

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The food and feeding habits of Ruffs wintering in a Nigerian Sahelian wetland were investigated by analyzing their gut contents and observing their foraging habits in the field. Although rice, constituted a large proportion (30.5-37.8%) of Ruff diet during most of the wintering period, the species could not be considered an important vertebrate pest of rice in the area, because most of the consumed grain was waste and residue grain from harvesting and threshing operations. In addition, the depth of water in rice fields and the availability of invertebrates made unlikely Ruff depredation of rice during the early wintering period.

Keywords: Ruffs, Wetlands, Sahel, Crop Damage, Rice, Food Habits

The West African Sahel and adjoining semi-arid areas have one of the world's most persistent bird-caused crop damage problems. There, the Red-billed Quelea *Quelea quelea* and other granivorous weavers and finches consume large quantities of grains in the mostly subsistence farms of the local people. Berryman (1966) reported that, in 1958, grains worth about 2.8 million dollars (US) were lost to bird depredation in north-eastern Nigeria. Crop depredation by Queleas and other granivorous birds is a continuing problem in the area (Elliot 1979; Ward 1979; GTZ 1987; Anon. 1991). Due to the experiences with these granivorous bird pests, many farmers in some parts of Sahelian West Africa fear and dislike large flocks of birds of any kind, and wish the destruction of these perceived threats. Palaearctic waterbirds, including Ruffs *Philomachus pugnax*, that winter in large numbers in Sahelian wetlands, have thus come to be regarded by these farmers as pests.

Treca (1975, 1977, 1981) found Ruffs and waterfowl to cause considerable damage to rice in the Senegal delta, and Wilson (1988) reported rice damage by waterbirds, including Ruffs in the inland delta of the Niger in Mali. Such reports and perhaps the foraging preference shown for rice fields by Ruffs have prompted speculation (eg Adams *et al.* 1993) that Ruffs, may also be pests in the agriculturally important Sahelian wetlands of north-eastern Nigeria. In this paper, we report a pilot study of the feeding ecology of Ruffs in one such wetland during the 1992-93 and 1993-94 winter seasons.

The Study Area

The study was carried out in the seasonally flooded Hadejia-Nguru wetland in north-eastern Nigeria (**Figure 1**). The climate in the area is characterized by distinct wet (usually May-September) and dry (October-April) seasons. Peak flooding of the wetland occurs in August and September. Floods receed during the dry season creating a mosaic of habitats comprising shallow ponds, lakes, and meadow-like flood-retreat areas (locally called *fadama*), interspersed in degraded xeric savanna scrubs and woodlands. The *fadama* are important

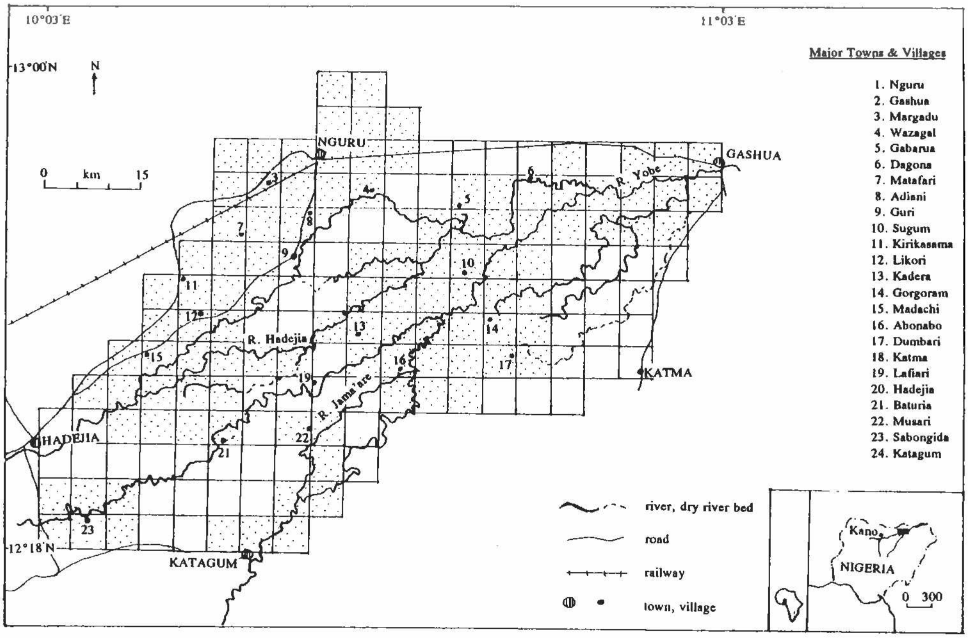

Figure 1. The study area within northern Nigeria, west central Africa.

haunts of both resident Afrotropical waterbirds and their migrant Palaearctic counterparts. Most of the dry upland (the unflooded portions of the landscape) are usually farmed during the wet season. Millet *Pennisetum glaucum* and Sorghum *Sorghum bicolor* intercropped with Cowpea *Vigna unguiculata* are the common upland crops.

Methods

Using binoculars and telescope, the activities of Ruffs at various locations in the wetland were observed from October 1992 to April 1993, and again from October 1993 to April 1994. The following records were kept whenever Ruffs were encountered in an agricultural setting: 1) size of the flock, 2) type of crop field being utilized, 3) the feeding behaviour of the flock (*ie* whether birds were feeding on farm crops or were probing the benthos for food, and 4) characteristics of the location where the birds were found (*ie* flooding status and condition of the vegetation). When a flock was observed to land in a rice field, the location of landing was noted. After observing the activities of the birds, the area where the birds landed was examined. The depth of water was measured (if the area was flooded) and the density of the vegetation there was assessed visually. The vegetative condition was recorded as 'bare' if it had less than half the normal stocking density of rice in the area, and 'dense' if it had more than half the normal stocking.

To investigate whether there were any relationships between the phenology of the rice crop and the way Ruffs utilized the rice fields, a large *fadama* rice field near Margadu was monitored. The field was visited thrice monthly and flocks of Ruffs present were counted and their activities noted. The largest flock size recorded for each of the months was noted, then compared graphically. The predominant phenological stage of rice during each month was also recorded for comparison.

Between October 1993 and March 1994, six dead Ruffs caught in hooklines set by the local people were collected. Their gut contents, oesophagus to the gizzard, were removed and preserved in 10% formalin.

Between October 1993 and April 1994, 41 Ruffs were also captured live with a leg-hold snare locally known as *tarko da safe*. Earlier attempts to catch them with mist nests had been unsuccessful because the fields were very open, and provided no bushy background against which to set the nets. Furthermore, harmattan winds deposited dust on the nets, making them visible to the birds. The snares were set at the edges of shallow ponds frequented by the birds. Birds were removed from the snares as soon as they were caught, and samples of regurgitated food were obtained from them by administering an emetic, 'ipecac', in a manner similar to the method of Tomback (1975). Male birds (usually large) were each given 1.5 ml of the emetic while Reeves (the females) were given 1.0 ml. The emetic was administered orally through a 1.5 mm flexible tube with a disposable dropper. The beaks were spread and the tube was placed on top of the bird's tongue and gently pushed down the oesophagus until it stopped. The emetic was then squeezed into the bird's gut, and the bird was placed in a cardboard box lined with absorbent paper. Regurgitation occurred in 5-10 minutes, then the bird was transferred to another box to recover, and was released after 15 minutes in the recovery box. The regurgitated food sample was preserved in 10% formalin.

No fatalities occurred, but two birds escaped and flew away during the transfer to the recovery box. This was an indication that the handling and the emetic may not have had any adverse effects on the birds. All the other birds flew away on release, showing no signs of the drowsiness they seemed to display when the emetic was administered. Activities pertaining to snaring and treating the birds were carried out between mid-morning and mid-afternoon (about 10:00-14:30 h), to ensure that released birds had enough time to regain food before dusk.

Using a dissecting microscope, the components of the regurgitated food samples were identified and sorted into four groups: rice, other plant materials, animal matter, and unidentifiable materials. The sorted components of the regurgitates were pooled into larger monthly samples and dried with absorbent paper. The volume of each monthly pooled component was determined by water displacement in a measuring cylinder. The percentage composition of each component was calculated in the manner of Swanson (1940), using the equation:

$$PC_xT = 100(V_x/V_T)$$

Where PC_{xT} is the percentage composition of component x in month T, V_x = volume of monthly pooled sample of component x, and V_T = volume of monthly pool of all components.

Results and Discussion

The activities of Ruffs and changes in their flock sizes in relation to the conditions of the *fadama* are shown in **Table 1** and **Figure 2**. Flock sizes appeared to change with changing phenology of the rice fields. Flocks were largest during the period when residual and waste rice grains from harvesting and threshing activities were most abundant. Of 119 recorded observations of Ruffs in rice fields, there were only three instances of their taking rice grains from unharvested tillers. The observations of depredation on unharvested tillers were made at a dry field edge where rice plants were stunted, probably due to inadequate flooding. At the field edge the small panicles developed within the reach of Ruffs. There were two instances of visits by separate flocks of three and 11 Ruffs to harvested and stacked rice. Ruffs in flocks of four, nine, and 51 birds were observed feeding on swathed rice at a *fadama* near Gorgoram. In all other field observations of foraging Ruffs, the birds were probing benthic sources for food or picking things (probably grains) off the ground.

Figure 3 shows the monthly significance of the various types of food in the diet of Ruffs. All of the birds that were given ipecac regurgitated samples of the foods they had eaten. Except in October, when rice was absent from the sample obtained, all the other samples contained representatives of the four different groups of food (into which the regurgitates were sorted) in varying proportions during the wintering period.

Rice was an important component (30.5-

Table 1. Temporal variations in flock size and feeding haunts of Ruff in relationship to *fadama* conditions and the phenology of rice in the Hadejia-Nguru wetland.

Month	Rice field/*fadama* conditions	Flock Size	Feeding haunts
Sept - Oct	Rice in flowering, milky, or dough stage. Water depth greater than 6 cm	10-15	Mudflats at the edge of lakes, ponds, and rice fields
Nov - Dec	Ripening rice; early harvesting of some fields	50-200	As above, but also includes parts of the harvested fields where water is 6 cm deep or less
Jan	Most of the rice harvested and piled into doughnut-shaped stacks; portions of the fields have dried out, and water depth in most areas are shallow as a result of the dry season weather; recession cultivation of the fields with cowpea and threshing of harvested rice commence	500-2,000	Post-harvest rice fields and rice threshing sites
Feb - Mar	Threshing of rice and cultivation of the fields intensify; most of the standing water in the fields have dried up, leaving few sticky mudflats	200-1,500	Rice threshing sites and newly tilled fields; gathering of flocks for early Spring migration may start here
Apr	Flowering and fruiting cowpea fields; standing water is restricted to only perennial ponds and lakes	5-15; occasional and only at wet sites	Larger flocks of several 100s forage at the shallow edges of lakes and perennial ponds where flocks gather for Spring migration

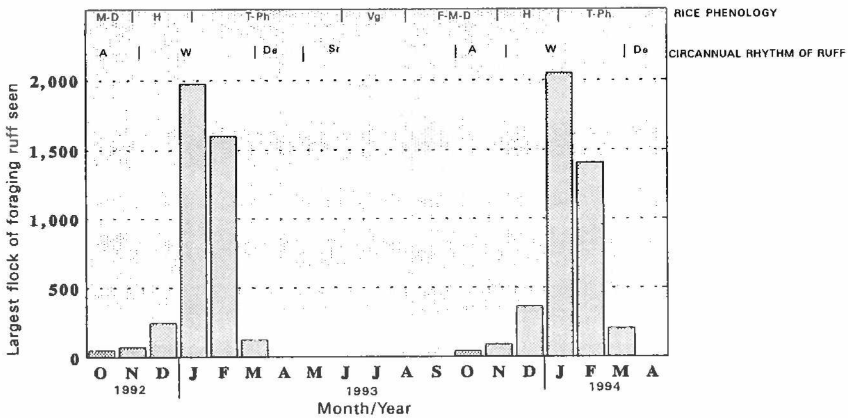

Figure 2. Use of the Margadu rice fields by Ruffs in relation to the phenology of the fields. Vg=Vegetative growth; F=Flowering; M=Milky stage; D=Dough stage; H=Harvesting ripe grains; T=Threshing; Ph=Post-harvest; A=Arrival from summer breeding range; W=Wintering; De=Depart summer breeding range; Sr=At summer breeding range.

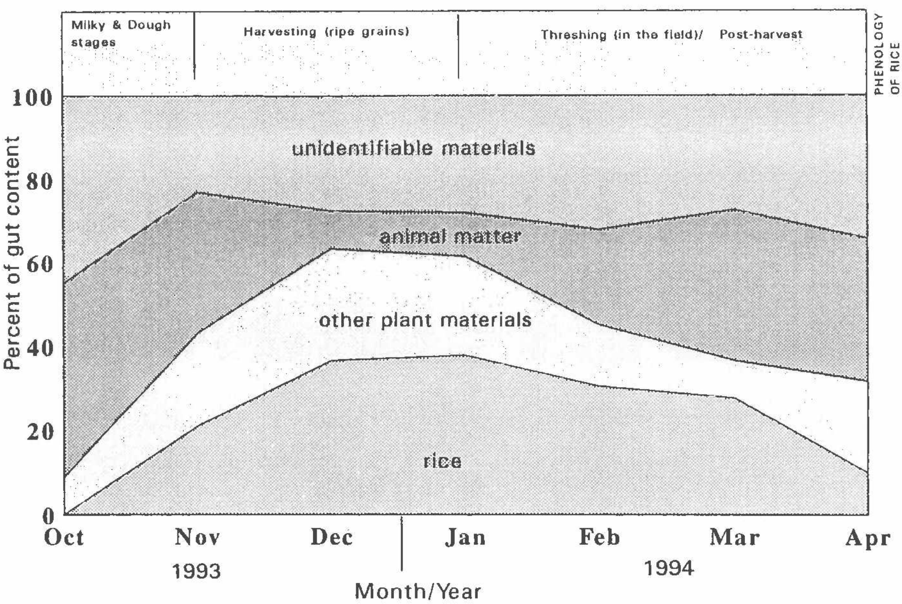

Figure 3. Percentage (by volume) of Ruff diet in relation to the phenology of rice.

37.8%) of Ruff diet during the harvest and post-harvest period (December-February), and combined with other plant materials appears to be the dominant food of wintering Ruffs in the Hadejia-Nguru Wetland. Animal matter was important when the birds arrived on the wetland in October (45.0%), and prior to their departure in March (34.2%).

The preponderance of rice in the diet of Ruffs wintering in the Hadejia-Nguru Wetland and their preferential use of rice-related sites may prompt a cursory observer to deduce that they are serious pests of rice in the area. However, the period of highest consumption of rice and its source should be considered in making any inferences. The largest amounts of rice were consumed during the harvest and post-harvest periods when waste rice is abundant as a result of poor harvesting, storing, and threshing methods employed by local farmers. Large flocks of Ruff were encountered in newly harvested rice fields and at threshing sites during these periods. Furthermore, unidentifiable materials (made up largely of mud-like material) constituted a large proportion (27.5-45%) of the regurgitates obtained from the birds, suggesting that Ruffs may be obtaining most of what they eat (including grains) from the benthos of flooded areas, or from the ground.

When food resources are scarce and patchily distributed, birds tend to be territorial; they tend to flock to exploit a temporarily abundant resource (Faaborg 1988). The large flocks of Ruff formed during the harvesting and post-harvest periods for rice (**Figure 3** and **Table 1**) may be viewed as such a response. Optimal foraging theory (Krebs 1978, Krebs *et al.* 1983) predicts that birds will forage where the energy intake per unit time of foraging is maximized. Voracious feeding by flocks of Ruffs before spring migration may be part of their energy-storing (fattening) activities.

The flooding condition of many rice fields at the time of arrival of Ruffs in the wetland provides latent protection of rice grains from the birds by precluding any potential harm which the birds might do to the crop during its dough and ripening stages. Measurements of water depth at sites where Ruffs were sighted showed that they tend to use areas where water is shallower than 6 cm deep. Because most parts of flooded rice fields are deeper than 6 cm during the early wintering period of the birds, their activities are restricted to field edges only. Besides, the time of arrival of Ruffs and other Palaearctic migrants to the wetland corresponds to the end of the wet season when, according to Lovei (1989), insects are abundant in the Sahelian region. It is, therefore, not surprising that animal matter was a large part of their diet during this period. Ruffs may be contributing to the control of noxious arthropods in the rice fields. Fragments of the chitinous exoskeleton of arthropods were among the animal matter identified in the regurgitates from Ruffs, an indication that they might be feeding on insects in the rice fields they frequented. Bock *et al.* (1992) demonstrated experimentally that birds can reduce significantly the density of grasshoppers in a grassland ecosystem.

Many of the farmers interviewed attest to Ruffs not usually going for rice in unharvested tillers. They claimed that losses occurred when the birds dislodged grains during take-off or landing in rice fields, hence the birds' local name *share fage* (meaning 'one who cuts off grain heads with its wings'). Our field observations failed to confirm this perception of the species. Of 53 records of Ruffs alighting on or taking-off from rice fields, 35 were in sparsely-vegetated portions of rice fields, 16 in bare portions, and two in fairly dense portions from which they were frightened by overflying Marsh Harriers *Circus aeruginosus*. The apparent preference for bare or sparsely vegetated patches in rice fields may be because birds are unlikely to reduce their fitness for flight in such patches. Although other unknown factors may be affecting the birds' choice of where to land in rice fields, bare or sparsely vegetated areas may be rewarding in that they save time and energy that would have been spent on preening to restore feather condition after landing in well vegetated areas. Furthermore, sparsely vegetated areas may offer the birds a view of the horizon that enables early detection of predators.

Conclusion

The problem of Ruff depredation on rice in the Hadejia-Nguru Wetland is more perceived than real. It may be possible to minimize the conditions in the wetlands that predispose rice to Ruff predation by 1) discouraging the swathing of crops over several days as a harvesting procedure, 2) devising a means of protecting harvested stacks of rice, and 3) ensuring optimal flooding of rice fields and alternative feeding areas of water-birds until harvesting begins. Whereas the first two of these conditions may be achieved through awareness campaigns by extension agents, the last can only be achieved by proper management of the water resources of Nigeria's Sahelian wetlands, which presently appears to be poorly coordinated (Ezealor & Giles, in press).

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