On the Ruff *Pholomachus pugnax* wintering in the Senegal Delta

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Counts of wintering Ruff in Djoudj National Park, Senegal were made between 30 January and 17 February 1991. Ruffs flew from roosts to feed in nearby rice fields where they took spilt rice grain. Apparently at least some Ruffs satisfied their total daily food requirements in two foraging periods totalling approximately two hours 30 minutes. Taking account of possible sources of count error, total numbers of wintering Ruff using the area were estimated at between 170,000 and 200,000 birds.

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INTRODUCTION

The Senegal delta has long been identified as one of the main wintering areas of the Ruff *Philomachus pugnax.* Up to one million birds used a roost in Djoudj National Park for Birds in February 1972 (Jarry *pers. comm*). More recently, Hötker (1985) gave an estimate of 80,000 individuals in 1985. This however should be regarded with some reservation due to a lack of description of methodology used and because the census period chosen might have been too late, after the departure of the first birds on prebreeding migration. Hötker's estimate, however, may indicate an important decline in wintering numbers since 1972. Therefore, numbers should be re-evaluated and an attempt should be made to determine whether or not abundance is limited by local factors. This is what we began to do in 1990.

STUDY AREA AND METHOD

The study has been described by Roux (1973), Schricke & Triplet (1990), and Voisin (1983).

Djoudj National Park was investigated between 30 January and 17 February 1990. Roosting areas were located and, whenever possible, Ruffs were counted with binoculars and telescopes from the ground, from watchtowers or from a ship. We also counted birds flying to and from their roosts in the northern part of the Park and also east of the Big Lake. In the latter case we positioned ourselves back to back, more or less in the middle of the front of flying birds, a location determined according to experiences on previous days and, sometimes, from first flights observations. We chose an area which would give us the clearest view at ground level, perpendicular to the flightpath. In practice, the points at which counts of overflying Ruffs were carried out were situated some 3 km east of the eastern shore of the Big Lake and 100 - 900 m north of the Flamant post.

Sectors of the rice fields east and north of the National Park, the most likely feeding places for Ruffs, were partially investigated.

RESULTS

Habitat use and activity patterns

Almost all Ruffs that frequented the study area in February were feeding in rice fields. Rice is harvested in December and early January after gravity-draining of the submerged fields, followed by intense evaporation. The soil is clayey and is

completely dry and hard by February. After harvesting of the crop by hand or with farm machinery, the fields are left with some paddy rice strewn over the ground in quantities estimated at 150 kg/ha (Treca *pers. comm.*). This is rice that has fallen from the panicles at harvest, if it has not fallen before due to the wind or other factors. The rest is gathered and sometimes heaped up close to sheaf storage and threshing sites. Rice straw still standing after the harvest is at rather low density allowing Ruffs to walk all over the rice fields. Birds thus may easily concentrate their food finding efforts in places where rice grain densities are highest. This food resource may be considered superabundant.

Ruffs feed in these rice fields in compact flocks numbering several tens and sometimes thousands of birds.

South of the Senegal river, rice lands extend in semi-circle north-north-west to south-east of the National Park. They cover a total area of approximately 15,000 ha. However, some of these rice lands (the easternmost sector towards Rosso) are too far from the Park to be used by the Ruffs which roost there.

The great majority of birds feed in the rice fields east of the National Park, 8 - 25 km from the Big Lake, mostly in the area surrounding Boundoum. They use the National Park for drinking, resting and roosting only. They roost mostly on the eastern and southern edges of the Big Lake in dense and often large flocks, on muddy shores or on the fringes of standing pools bordered with grassy vegetation. Frequently, they are disturbed by raptors, mainly Marsh Harriers *Circus aeruginosus*, less often by Montagu's Harriers *Circus pygargus*, Black-Shouldered Kites *Elanus caeruleus* or Peregrine Falcons *Falco peregrinus*.

These Ruffs leave the Big Lake early in the morning at 07.30 - 08.30 (local time) to feed in the rice fields. Some of them (varying between an estimated 11% and 72%) may come back between 09.40 a.m. and 10.30. The others stay in the rice fields using these sectors as drinking and roosting sites. Those Ruffs that return to the Big Lake will depart again between 17.15. and 18.35. Between 18.30 and 19.25 all Ruffs return to the Big Lake to spend the night. Actually, on any given day there is a slight delay between the last departures and the first arrivals in the evening (Table 1).

TABLE 1.Times of departures of Ruffs from rice field feeding areas and arrival at roost sites.

Date	Time of departure	Time of arrival
February 4	17:25 - 18:20	18:30 - 19:20
February 7	17:15 - 18:15	18:30 - 19:15
February 15	17:35 - 18:35	18:40 - 19:25

Elsewhere in the Park, Ruffs disperse over the wetlands. On most sites they occur only in small feeding groups and apparently have not adopted the activity pattern described above.

Population estimate

The cumulative total of all small groups dispersed over the Park's wetlands other than the Big Lake, and more especially over the swamp grasslands north-west of this lake, probably amounted to several thousand. A more precise estimate could not be made because the grasslands extended over too large an area to cover. Counts made from the watchtowers situated along the Big Lake's shoreline, either of roosting birds or of birds moving over the lake, totalled no more than 70,000 individuals. This is only a minimum estimate of little interest, since it is based on partial counts; in fact groups are distributed over some a 10 km length of shoreline and are quite mobile due to disturbance by raptors.

Only counts from dawn and dusk flights may provide an estimate close to reality. East of the Big Lake, Ruffs fly over the area in a 5-6 km broad front, at altitudes between 0.5 m and 500 m. The evening front of returning birds shifts about 1 km northwards relative to the morning front of departing birds. For practical reasons and because the evening flights included all birds, we preferentially counted these, yielding the following data:

February 3: 130,000 partial count (started too far north)
February 4: 151,000
February 6: 153,000
February 7: 127,000
February 15: 140,000

Besides errors in estimating group size, there are two other sources of errors:

Firstly, the front of moving birds is somewhat broader than the combined ranges of visibility of two telescopes. The front's two extreme edges are thus not covered. The method chosen was to place the observers in the middle of the flight path, each one covering one side of it minus some 500 m. Hence about 1 km of the front's fringes were not covered. However, as bird densities decrease outwards from the middle of the front, the edges would have the least dense flux of birds. The underestimation of bird numbers may therefore be slight.

Secondly, even in parts of the front visible to observers, some flocks may have escaped observation. Sometimes these were flocks flying low over the ground, for moments concealed from view by the terrain. Otherwise, during an intense passage at different altitudes flocks may be missed by the observer, completely occupied elsewhere.

Taking into account these two causes of underestimation, we think that during the first two weeks of February, the population of Ruffs roosting on the Big Lake and feeding in the rice fields east of the lake amounted to some 170,000 birds. To this should be added their flocks of between 5,000 and 20,000 birds which fed in the rice fields north of the Park and roosted north and north-west of the Big Lake.

Thus total numbers of Ruffs recorded during the first two weeks of February averaged some 180,000 birds. However, taking into account the of different sources of error, actual Ruff numbers are probably between 170,000 and 200,000.

At the end of February, Ruff numbers seemed to have decreased markedly (Fouquet, *pers. comm.*).

DISCUSSION

Apparently, at least some of the Ruffs present in the vicinity of the Djoudj National Park, satisfied their daily feeding requirements during two feeding periods totalling approximately two hours and thirty minutes. In the literature no mention can be found of waders taking such a short time to satisfy their energy requirements over a 24-hour period.

Our evidence indicates that the number of Ruffs present at the end of winter is not limited by local environmental conditions. This is probably not the case in autumn, before the rice harvest. At that time rice fields are very rarely used by Ruffs, since they are feeding on seeds of wild grasses in the naturally flooded wetlands (Treca 1975). These sites are increasingly contracting in area due to the persistent shortage of rain, but also because of water development or farming projects. This may explain the relatively small number estimated in February 1990 compared to that mentioned by Morel and Roux (*op. cit.*) in February 1972.

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