re-entered the reproductively active population and males incubated. The intensity of female-female competition for mates was closely tied to the Operational Sex Ratio. Early nesting females completed their first clutch when sex ratios and the intensity of competition for mates was most favorable for obtaining a second mate. The incidence of polyandry I recorded was low owing to the high mobility of females that had completed their first clutch.

The social organization of wintering Killdeer flocks: There's no place like home.
Katy Heck, Campus Box 7617, Department of Zoology, North Carolina State University, Raleigh, North Carolina 27695-7617.

Resident Killdeer are joined by juveniles and migrants to form winter flocks. Analysis of behavioral and census data indicated resident Killdeer maintained both strong pair-bonds and site fidelity during the winter. Summer neighbors fought strenuously on the few occasions they were in the same flock. Residents dominated nonresidents, and birds which initiated aggressive encounters won overwhelmingly. No banded offspring were observed in any flock.

Between chaos and order: The structure of Sanderling winter populations.
J.P. Myers, Department of Ornithology, Academy of Natural Sciences, Philadelphia, Pennsylvania 19103

What constitutes a nonbreeding population? Without constraints on individual movement imposed by a nest and young, nonbreeding populations might range between two logical extremes: (1) structured, cohesive local populations arrayed discretely over space vs. (2) chaotically mixed, temporary aggregates whose momentary composition varies with the movements of individual birds. I examined the spatial and temporal limits of a Sanderling population in central California during the 1979-80 to 1984-85 winters. Intrayear wandering up to 30 km from the home estuary occurs regularly during some periods of the year but almost no permanent intra- or interyear dispersal takes place. Sanderlings wintering in this region thus lie near the first extreme.

STUDIES OF GREENSHANKS IN SOUTHERN AFRICA

by A.J. Tree

The aim of this article is to announce and describe a small-scale colour ringing study being made on Greenshanks *Tringa nebularia* in the Bathurst district of the eastern Cape Province in South Africa; in addition, further work carried out in the Harare area of Zimbabwe prior to 1984 is reported. Until very recently it seemed most unlikely that west European workers would come into contact with any of the birds from this study but a colour-ring sighting in central France of a bird ringed in Zimbabwe has shown that this population does not migrate only through eastern Europe.

The Greenshank is a widespread and relatively common non-breeding visitor to southern Africa with largest concentrations found in coastal regions (Tree 1979). The first adults appear in late July, indicating very rapid movement from their breeding grounds, but do not normally reach the south coast until about the middle of August. Birds of the year begin to arrive in September but mainly from early October onwards. Return migration of south coast birds takes place mainly in the last ten days of March and the first few days of April leaving only first year birds, many of which remain throughout the southern winter. The very considerable body-mass gains made prior to departure in March suggest that the return movement is very rapid with birds either stopping off in the rift valley lakes or continuing straight through to the Mediterranean; this depends on whose formula one uses! (Tree *loc. cit.*).

RINGING

It is difficult to catch more than a few Greenshanks as they generally congregate in relatively small flocks, move to roost sites after dark and move quickly elsewhere if disturbed. Good netting sites are found only occasionally. Two such sites are at Rainham Dams, outside Harare (operable mainly August till early December), and the Blue Lagoon at Port Alfred. Both these localities are primarily roost sites, with few feeding birds present during the day. Birds are caught at night in single-shelf mist-nets set about 0.6m over water and only very occasionally by the torch and hand-net method. Catches have varied from none (quite usual) to as many as 17 birds (an absolute freak) per night.

Incoloy rings of 5.25mm diameter are placed on the right metatarsus. These rings, although extremely durable, are very difficult to see in the field. DARVIC colour rings are placed on either left, right or both tibiatarsi. In Zimbabwe an individual colour code was used from July 1976 until January 1981 when results indicated that I was wasting both my time and my money. From October 1981 to January 1983 birds were given only a site-specific colour-coding. During a holiday to Port Alfred in December 1977 I started giving birds there their own individual colour-ring combinations, since a local ornithologist was keen to maintain observations for me. More birds were colour-ringed in December 1980 and from September 1983 onwards.

The colours used so far have been red, yellow, black, bright green and blue and it is intended to add orange and white in the forthcoming season. The first four colours have lasted for seven seasons but blue proved too difficult to determine at a distance, and also faded to a greyish colour rather quickly.

RESULTS

The results from Zimbabwean ringing were almost totally negative and only one bird was subsequently resighted in the same area, almost exactly a year later. However, it is from this ringing that a bird was subsequently seen at Port Alfred almost five years later. Even more exciting is the sighting six years later of one of these birds in central France. This was a most surprising sighting, since I had assumed that our southern African birds were of a much more easterly origin.

The results from Port Alfred have been quite different as this site is at the end of a

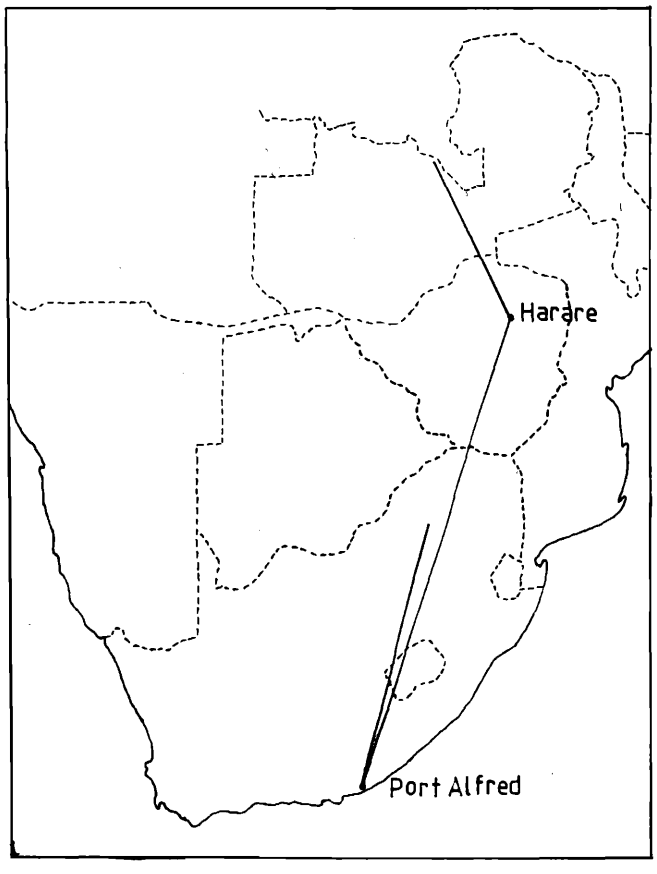

Figure 1. Movements of ringed Greenshanks within southern Africa.

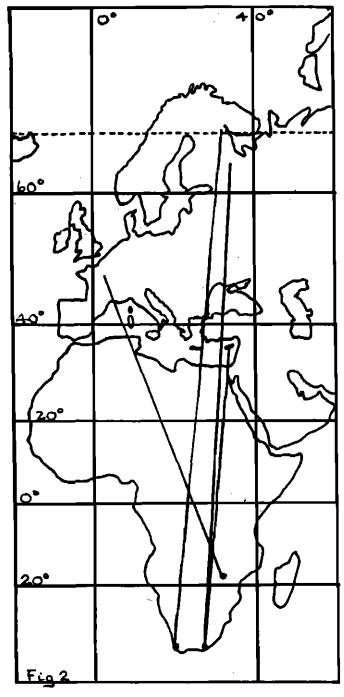

Figure 2. Long-distance movements of Greenshanks ringed in southern Africa.

migration route and winter-*ortstreue* is strongly developed with a proportion of all ringed birds returning regularly each August and remaining until the following March. However, a number of birds appear to be highly nomadic, stopping off only briefly in the estuary and continuing their wanderings elsewhere. These may be inland wanderers (hence the brief visit of the Zimbabwean bird) forced to coastal localities by drought or flooding of their highly variable inland sites. Discussion of the effects of rainfall on migration in Zimbabwe has been made by Tree (1982). No colour-ringed birds have been seen elsewhere in southern Africa to date despite intensive searching in the eastern Cape, in particular.

All ringing recoveries and colour-ring resightings are shown in Figure 1 (for southern Africa) and Figure 2 (for Europe). The movement from Harare to Port Alfred has already been mentioned whilst the Port Alfred bird found in the Transvaal is of particular interest as it was a local regular (adult female) that was reported on southward migration on 25 July, an exceptionally early date. It seems very likely that this bird had flown direct from Europe, implying that at least some of these birds may stop in the African interior before reaching the south coast in mid-August. The bird ringed in Harare and reported from Zambia in early March, two years and two months later, may have changed wintering area, since these birds do not usually start northward migration until April.

The Greenshanks reported from northern Russia in May and October are from well within the breeding grounds. The bird from Cyprus was shot in May; thus migrants from southern Africa must spend much time south of their breeding grounds since they leave such wintering areas in late March. The Zinbabwean bird in France was totally unexpected and sighted in August almost exactly six years later. It does, perhaps indicate the highly nomadic nature of birds wintering within the African interior.

Why birds leave the south coast so early when their breeding grounds are not likely to be ice-free until well into May remains a mystery. We are still also unsure as to whether or not these birds stop off in East Africa for refuelling, or continue direct to the Mediterranean or even to the Black or Caspian Seas. East African observers will be keeping a watch out for these birds in the period late March until early May and also from late July till the end of September to determine possible utilisation of that region on southward migration as well. The most important region for observations is likely to be the eastern Mediterranean and I would especially request that people living in or visiting that area during these periods carefully check all Greenshank seen.

Finally I must emphasise the tremendous importance to this study of the registration of the colour-marking schemes. (We heartily concur. Eds.) Fortunately I had registered my scheme with the Wader Study Group and so was notified, in South Africa, from Britain, of a bird ringed in Zimbabwe and seen in France. How better to emphasise the international nature of wader movements.

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