Such serious deficiencies must make one wonder whether there is any justification for such large scale ringing. Enen the relatively small interference in the life of a bird caused by catching and ringing it should not be carried out solely to provide a satisfying, interesting, indeed at times, exciting hobby, for a small number of people. There is so much to be learnt from ringing that the lack of published results commensurate with the time, effort and money put into it becomes less a matter of the sheer waste of laboriously gathered information though it is certainly that, and much more a complete failure to see the potential value of the results. Although a proportion of what can be discovered from ringing is pure knowledge that cannot be applied in any useful way, though none the worse from that, there is a great deal to be learnt that is instantly relevant in the fields of conservation and of species or habitat management. The use made by migratory birds of threatened habitats throughout their range, or the causes and effects of changes in the mortality rate of a species, are just two examples.

Every ringer should be seriously considering both the present values of his ringing and the way in which he can present his findings to a wider public. There is a powerful case to be made for much co-operation between ringers, coupled with strong leadership from the BTO. Some progress has already been made along this road but clearly much more needs to be done.

THE TIMING OF WING MOULT IN SOME PALAEARCTIC WADERS WINTERING IN EAST AFRICA

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Palaearctic waders which winter at temperate latitudes usually complete their main annual wing moult in late summer or early autumn, either near the breeding grounds or shortly after the completion of autumn migration. In either case, moult is a rapid process involving extensive feather replacement and high energy requirements over a period of a few weeks, and birds are usually fully moulted well before the winter months. The young of such species retain their juvenile flight feathers throughout their first year and undergo their first moult when about a year old, only shortly before the moult period of older birds. With species which migrate to tropical wintering areas the situation is very different. Adult wing moult is partly or wholly delayed until after autumn migration and may begin as late as October or even November, persisting commonly into December, January and in some cases March. The young of a number of smaller tropical wintering species undergo a complete moult of their flight feathers during their first winter, thus fitting in an extra moult as compared with similar species wintering at higher latitudes.

Since 1971 some 12,000 waterbirds have been caught at the rift valley lakes of southern Kenya, many of which were in moult. Primary moult data have been recorded for most birds caught, and in many species it has recently been possible to age first winter birds with confidence. Observations relating to the timing of primary moult in the main species handled are summarised below. They serve to underline the basic differences between tropical and temperate wintering populations, and to emphasise some of the difficulties involved in interpreting moult in Africa. They should provide material with which data from other tropical areas, particularly in south and west Africa, could be usefully compared.

GREENSHANK

Moult is usually well advanced by October, and complete by January. Most adults probably arrive in a partly moulted condition then renew their remaining flight feathers over a period of some two or three months.

Young birds do not normally moult their primaries or secondaries during their first year, and many Kenyan birds are very worn by their first spring. Occasionally, one or two outer primaries are renewed in each wing between February and March in particularly abraded birds.

MARSH SANDPIPER

Particularly abundant throughout winter on the marshy pools and muddy lake edges of Lakes Nakuru and Hannington. Small numbers oversummer, but the main autumn influx is during September and October, with first year birds already present in numbers by mid-September.

Many of the moulting birds present during August are presumed to have been first summer birds which had failed to migrate. Most adults evidently return to their wintering area either fully moulted or in an arrested advanced state of moult. 50% of the August and 70% of the September-November birds which had not completed moult had arrested with the inner 6-9 primaries renewed. Practically all late moulting adults have finished by the end of November.

Young birds usually retain all their juvenile primaries and secondaries throughout winter, although many have become very worn by their first spring. Because of the difficulty of ageing birds in late summer it is not possible to be precise, but an estimated 10-15% renew some or all of their outer four primaries during February and March.

WOOD SANDPIPER

Very scarce during summer (May-July) but abundant during the rest of the year on marshy pools and swampy areas. We have caught this species mainly at Naivasha, Nakuru and Hannington. Adults reappear in some numbers from August, and young birds from early September. Birds reaching Kenya during September must arrive in a partially moulted state, most of them with at least the inner four primaries already renewed. Moult then seems to continue rather slowly, being completed usually between December and February. Some 20% of the moulting birds were trapped in arrested moult; the rest usually had only one primary (occasionally two) in growth per wing.

First year birds have not been found to undergo a complete wing moult in Kenya (compare Stresemann & Stresemann 1966). Some 40-50% however do replace the outer 4-5 primaries in each wing (but not the secondaries) between January and early April. Even birds which retain all their juvenile primaries are not usually unduly worn by their first spring.

GREEN SANDPIPER

A bird of ditches and small marshy pools, caught only rarely at Nakuru. An adult on 25 September had a primary score of 37, and one on 31 October a score of 39; others on 31 December and 2 January had finished moult. This species apparently completes moult earlier than the Wood Sandpiper.

COMMON SANDPIPER

Commonly frequents freshwater pools and lake edges from August to April. At the alkaline lakes of the rift valley where it is normally scarce, there is a considerable passage during August and September. However, data from November onwards have been obtained mainly from birds caught near Nairobi.

In contrast to the previous five species, the Common Sandpiper does not begin to moult before its arrival in Kenya. Eleven adults caught during August and September have all had completely old plumage. Moult in wintering adults usually commences in October and finishes in late January, February or even March.

First winter birds renew most of their flight feathers, commencing early in January and finishing in March. This moult, however, usually proceeds outward from the fourth or fifth primary, and the old inner feathers are often retained. The secondaries are renewed rapidly, and somewhat randomly, and the old outer feathers (in some cases all the old feathers) may be retained. This first winter moult is much more rapid than the main adult moult. It also differs in that it does not necessarily involve the tertials, coverts and tail, although these may be replaced at the same time in the course of the normal spring partial moult which adults also undergo.

LITTLE STINT

The most abundant wintering wader of the muddy open shores of the rift valley lakes. Some 7 000 have been handled in recent years in Kenya, and a detailed account of moult is in preparation. The main conclusions may be summarised as follows: Most adults reach the area during late August and September, and most young birds between mid-September and October. Practically all adults complete their migration before beginning their wing moult. Most begin to moult between mid-September (exceptionally early September) and mid December. The most rapidly moulting birds finish in late November/early December, but others not until March. Wintering birds commonly arrest their moult for several weeks with three to five old primaries remaining in each wing, so that whilst some complete the process in three months or slightly less, others appear to take up to five months.

Adults which complete moult by December do so some five months before spring migration, and many such birds renew some of their outer primaries again in the intervening period. Fully moulted birds trapped between late January and March have often been found to be replacing these feathers (typically the seventh to ninth) a second time. It is estimated that at Magadi (a particularly alkaline environment) at least 20% of all adults moult some of their outer primaries twice.

First year Little Stints undergo a wing and tail moult which is in most cases complete and identical in pattern to that of adults. The earliest birds begin to replace their tertials and inner primaries during early December, but the majority not until late December or January. Moult tends to be more rapid than in adults, and is usually completed in March or April. Some 20-25% of young birds have been found to retain their old inner 2-4 (sometimes more) primaries and outer secondaries. These are mostly birds which have not begun to moult until February or early March. Over 95% of young birds acquire a new or mainly new set of flight feathers and full spring plumage, and migrate north in May in a state similar to that of adults.

CURLEW SANDPIPER

In Kenya, this is mainly a species of the coast. It winters in numbers at Lake Magadi, but elsewhere in the rift occurs mainly as a passage migrant in September and May. The great majority of birds caught at Nakuru, Hannington and Naivasha between October and April have been first winter.

Moult in the species has been particularly difficult to interpret, mainly because of inadequate knowledge of the pattern followed by first summer and second year birds. The first adults to arrive back in the rift in late August and early September have already lost most of their red breeding plumage, but few have commenced wing moult. Most wintering adults appear to begin in late September and finish between December and February. Speed of moult is evidently very variable, however, and some birds must arrest for long periods. A number of birds still complete moult into late February and March, and it is thought that most of these are in their second year. A retrap with a primary score of 25 in late February had been ringed as a first year bird the previous winter. However, a bird retrapped with score 40 on 24 March had been ringed as an adult with traces of red plumage and the two inner primaries missing on 26 August of the same year, so that some of the older birds evidently extend their moult over more than six months.

No primary moult has been observed in young birds before January. Indeed, even before April and May, most first year birds still have juvenile primaries which are by then extremely worn. Some 20-30% of Magadi birds, however, replace their outer primaries (but not the secondaries) from the fifth or sixth outwards in late February and March. It is not clear whether other young birds undergo a similar partial primary moult in summer after leaving East Africa, or whether their first wing moult would be a full one. Moulting birds have not been trapped at Magadi in either May or August. Stresemann and Stresemann (1966) record post-juvenile wing moult in oversummering birds in Africa in April onwards, which in some cases appears to be a complete one.

Again, a more detailed account of wintering and moult in this species is in preparation, but the main findings may be summarised as follows: The Ruff occurs abundantly on the rift valley lake edges between late August and early May. The main arrival of adult females is during late August and September, and first year birds are commonly present from early September. For most of the season males are outnumbered by females by about 15 to one. A slightly higher proportion of males (about one bird in five) during August suggests that they tend to return a few weeks earlier than females, whilst their virtual absence in late spring, indicates, together with weight data (see Pearson, Phillips & Backhurst 1970), a rather early departure.

The great majority of September birds, and most August birds, are already in moult, with the first three to eight primaries new or growing. Most wintering birds evidently begin their moult before reaching the tropics. They probably arrive in Kenya in an arrested condition, and more arrested individuals are in fact caught during September than later in autumn. Some unmoulted birds are present during late August and early September, but there is evidence from weights and retraps that these are mostly passage migrants bound for farther south. Moult in Kenya continues rather slowly, for although a few birds finish during November (exceptionally earlier), the majority do so in December and early January. Only the occasional bird is still moulting in February.

Male Ruff have been reported to complete moult near their breeding grounds before autumn migration (Stresemann & Stresemann 1966, Snow 1967) but many birds passing through Britain in autumn are still only in the early stages (Anderson 1973), and Kenyan wintering birds evidently moult in the tropics in the same way as females. Males tend to be slightly more advanced than females throughout the autumn, however, and many finish in Kenya during late November and December.

First winter Ruff retain their juvenile flight feathers throughout their first year, although one or two outer primaries may occasionally be replaced during February or March in very worn birds.

RINGED PLOVER

This species occurs only in small numbers on the rift valley lakeshores between September and April. Twenty-two birds trapped by the author were all considered to have been first winter. Complete wing moult is evidently unusual in young birds between about December and March.

DISCUSSION

For a number of reasons, interpretation of moult in waders caught in Africa can be difficult, especially where only small numbers of birds are handled. Firstly, there tends to be great variation in both the timing and the duration of the main moult, and adults of the same species may differ by as much as four months in dates of onset and completion. Secondly, feathers of the same generation can be at very different stages of wear, for whilst adult wing moult is generally a slow process the rate of deterioration of new feathers is rapid. As a result presumably of strong sunlight,

often coupled with a highly saline or alkaline environment, new flight feathers fade in the tropics within a few weeks, and may be considerably abraded after as little as four months. By the time birds are growing their outermost primaries, the inner primaries, tertials and wing coverts renewed early during the same moult no longer look new. Two wing moults may even be in progress at the same time for the main primary and secondary moult is not always complete before prenuptial tertial moult begins.

In Europe, wing moult in adult waders is usually complete before the ageing of young birds becomes a problem. In the tropics it continues into the winter, and it is therefore important to be able to identify first year birds up to February or March. In some species this is not always possible. Young waders usually acquire first winter body plumage in Africa during October. As a result of abrasion, they then tend to lose most or all of the diagnostic pale tips to the juvenile median and lesser coverts between November and January. Additional guides to age, such as the degree of fading and wear of the flight feathers and the state of the inner primaries relative to the outer primaries may be very useful.

A final complication in the tropics is the tendency for waders to moult the outer primaries (or some of them) outwards, beginning from the middle of the tract. This type of partial moult, confined mainly to first winter birds, can easily be taken for a complete moult which was arrested for some time at an earlier stage. A bird moulting only the outer primaries however will have uniform and probably faded secondaries. During complete wing moult primary and secondary replacement are closely co-ordinated, and moult should be in progress in the secondaries by the time the sixth primary is dropped.

The main features of flight feather moult in adults and first year birds of the seven wader species most frequently caught in inland Kenya are summarised below.

Timing of adult wing moult

Adult Marsh Sandpipers usually complete most or all of their moult before arrival in Kenya. This is presumably associated with the fact that of the species under discussion here it has the most southerly breeding range. Spring departure is rather early, during late March and early April, and nesting activities are presumably over in time to give adults a few weeks to moult before the approach of colder weather in the breeding area. Other species fall into two groups: those in which moult has usually started before arrival, but which complete most of it in Africa, and those which delay the whole of moult until after migration.

Adult wader moult in Kenya is invariably a leisurely process. After growth of the four inner primaries, actively moulting birds are rarely found to be replacing more than two primaries per wing concurrently. Birds in arrested moult are frequently caught outside recognised times of arrival and passage. There are perhaps

	Adult Wing Moult		1st W.Wing Moult
	Normally in progress before arrival?	Frequently recorded over the period:	
Greenshank	Yes	Aug-Dec	No
Marsh Sandpiper	Yes often complete	Aug-Nov	Occasionally the outer 1°
Wood Sandpiper	Yes	Aug-Feb	Frequently the outer primaries
Common Sandpiper	No	Oct-Feb	Most of the primaries and most/all the secondaries
Little Stint	No	Late Sept-March	Usually complete
Curlew Sandpiper	No	Late Sept-March	Frequently the outer primaries
Ruff	Yes	Aug-Jan	No

two reasons why the speed of wing moult is so different than that normal in temperate wintering areas. Firstly a full complement of flight feathers is probably required at high latitudes from late autumn onwards to give sufficient mobility to avoid severe weather if necessary, and to support the considerable reserves of winter fat carried by most birds. Tropical wintering birds encounter little climatic stress and remain very lean throughout the winter months. Secondly, because of rapid primary wear, it may be particularly advantageous for tropical winterers to finish moult in late winter. By adopting a leisurely rate, many birds replace their large outer primaries only two to three months before an extremely long northward migration; Little Stints which finish moult early in winter often seem to need to renew their outer primaries again before spring migration.

First winter wing moult

The young of migrant waders which winter in the tropics seem less well able to delay their post-juvenile wing moult until the beginning of their second year than migrants from arctic or subarctic breeding grounds which winter, for instance, in western Europe. Not only does plumage deteriorate more rapidly in the tropics, but a young bird which migrated north in its first spring, then completed moult along with adults during its second winter, would have to retain its juvenile outer primaries for three long migrations and up to 18 months. Some Ruffs and Wood Sandpipers

for example seem to do this, but many young birds of these and similar species are caught in Kenya in spring at low weights and in poor plumage. They presumably do not migrate far, and may well begin to moult in late summer a few weeks earlier than adults. There is, however, a tendency for first year birds to renew primary feathers in tropical Africa during late winter. In some small species in which wear is extremely rapid and in which breeding is probably common during the first summer, an extra full wing moult is introduced during the first winter.

In the Greenshank and the Ruff, first winter primary replacement is uncommon, and confined to one outer feather in each wing. The same pattern is observed rather more often in the Marsh Sandpiper and very commonly in the Curlew Sandpiper and the Wood Sandpiper in which the four to six outer feathers in each wing are typically renewed. The Common Sandpiper has developed a more complete first winter moult, which usually involves the secondaries as well as the primaries. It is more rapid than that of adult birds however, and does not involve the tertials. Moreover, some old inner primaries, and some of the secondaries are usually retained. A complete first winter moult identical in pattern to that of adult birds occurs in the Little Stint and the Ringed Plover. The situations to be seen in Kenya in the Marsh Sandpiper, the Wood Sandpiper and the Common Sandpiper may well represent a series of stages in the evolution of this development. It would be valuable to learn more of the moult habits of these species in other wintering areas.

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We look forward to comments on this article from our local wader ringing groups.

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