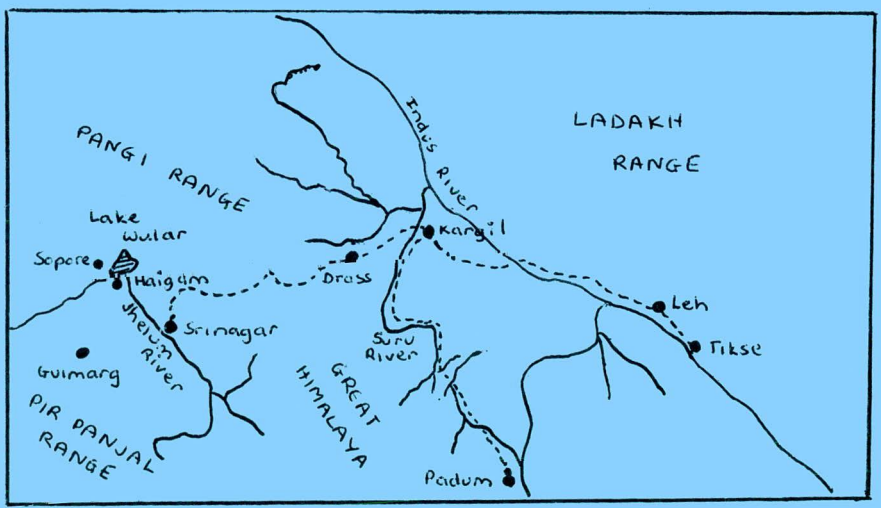
OXFORD UNIVERSITY EXPEDITION

TO KASHMIR, 1983

REPORT



REPORT OF THE OXFORD UNIVERSITY EXPEDITION

TO KASHMIR, 1983

Edited by P.R.Holmes, H.J.Holmes and A.J.Parr

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Expedition members

Peter Holmes	(Formerly Exeter College, Oxford) Cranfield Institute of Technology (Now Liverpool School of Tropical Medicine)	Leader
Adam Gretton	St. Catherine's College, Oxford	Deputy Leader
Ian Sleigh	St. Catherine's College, Oxford	Treasurer, Cameraman
Mark Hunter	St. Catherine's College, Oxford	Secretary, Sound Recordist
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Contents

Introduction to the expedition

The previous Oxford Ornithological Expedition to Kashmir visited Haigam Rakh, in the Vale of Kashmir in 1978 with the aim of studying the breeding birds of the Rakh, and in particular the Little Bittern (Ixobrychus minutus) (Holmes, 1979). At the end of the expedition, PH had carried out a small amount of trapping of birds along the Suru River in Ladakh. The trapping of two Blyth's Reed Warblers (Acrocephalus dumetorum) showed that some trans-Himalayan migrants entered the valley. The present expedition arose out of discussions between PH and AG in September 1982, concerning the need to follow up the studies at Haigam, and to investigate bird migration in the Suru Valley.

The expedition was planned with these two aims. Firstly it was proposed to revisit Haigam Rakh during July and August to conduct a study of the breeding birds for comparison with 1978, and also to carry out an intensive ringing programme. Secondly a study would be made of birds and bird migration in the Suru Valley between mid August and mid September. Expeditions from Southampton University had examined in detail the avifauna of the nearby Upper Indus Valley, but the Suru Valley had been less studied. The latter has recently been opened up by the construction of a road, which must have serious consequences for the ecology of the valley. The principal objective of this part of the expedition was to study the resident and migrant birds,

before irrevocable changes occur. The expedition would split into three groups to enable the concurrent study of three points along the valley.

Since both these proposals were labour intensive, a relatively large party was needed. This provided the opportunity of selecting a team with a range of fieldwork experience, so that those with more experience could train the others in general expedition techniques.

PH had previously led the 1978 Kashmir expedition, and an expedition to Sulawesi, Indonesia in 1979. AG had led an expedition to Venuzuela in 1982. We first enlisted MH and IS, second year zoologists at Oxford, who had no previous expedition experience, and HH who had joint-led the Sulawesi expedition. BH had been planning a solo ornithological trip to India, but we persuaded him to join with us. Finally AP, a very experienced bird ringer, was recruited to strengthen the ringing team. Because of prior commitments, HH and AP were only involved with the first half of the expedition at Haigam.

The expedition was awarded one of six grants by the B.B.C. to take part in the Mick Burke Expedition Film Competition. We were thus able to record our work and achievements on film. This turned out to be a mixed blessing since the filming equipment with which we were supplied was faulty (see Filming Report

in the Appendices), which caused a degree of disappointment in the filming team. However despite these major difficulties, we understand that our film was placed third in the competition.

The aims of the expedition were accomplished successfully, and the results of the studies are detailed in this report. Despite the obvious logistic difficulties of organising several groups in an area of poor communications, there were no major hitches during the course of the expedition, with everything going as to plan.

Introduction to Haigam

The Vale of Kashmir is a large basin at a height of 1600m which forms the flood plain of the river Jhelum. The Vale is now largely devoted to agriculture, and the study site, Haigam (or Hygam - the spellings appear interchangeable) Rakh, is the largest of the few remaining reedbed areas in the Vale. It is a reserve maintained by the Department of Game as a winter shoot for ducks. The reserve area is about $14km^2$, about half of which is reedbed. Map 1 shows a sketch of the reserve, with approximate areas of each vegetation type.

The Rakh (Rakh=marsh) is largely covered by a dense growth of reed and other emergent species. The commonest species are Sedge (Carex sp.), Common Reed (Phragmites communis), Bulrush

(Schoenoplectus sp) and Lesser Reedmace (Typha augustifolia). Vegetation grows either from the bottom of shallower areas or from a floating mat of roots and silt. The reedbed is partitioned by a series of boat channels varying in width from 1m to 4m. Water in the Rakh varies in depth between 0.5 and 1.0m. Two species of water lily and water chestnuts grow in areas of open water.

Inside the bank a strip of willows has been planted. These act as a silt trap, but when full grown will also supply the villagers with many useful materials - leaves for cattle feed, sticks and wood. There is no understorey in this plantation since all the lower vegetation is heavily grazed. The reserve is largely surrounded by a protective bank. Outside this bank, and in some places inside, the land is mostly devoted to rice paddy. Slightly further from the bank, at least around Haigam, there are extensive orchards.

The Rakh is at the southern end of Lake Wular. The nearest main town is Sopore, but the Rakh is surrounded by villages. Haigam village itself does not border the reserve. An offshoot village, Hanjypura, which is near the edge of the reserve, has the reserve office.

Near to Hanjypura, at the water's edge, there is a government hut, the Tippenshed (Tippen=duck). The Chief Game Warden,

MAP 1

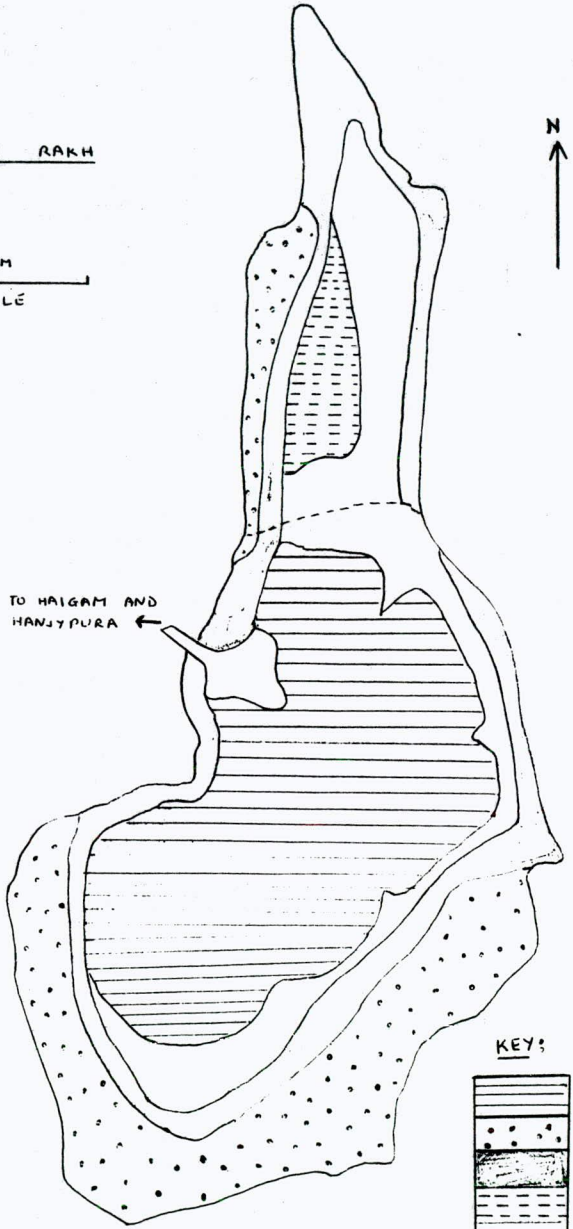
HAIGAM RAKH

1 KM

SCALE

N

TO HAIGAM AND HANJYPURA



KEY:

REED BED

PADDY FIELD

WILLOW PLANTATION

THIN, HEAVILY GRAZED REEDS

OPEN WATER

BANK

Mr. Inayatullah, very kindly allowed us to use this as our base. The Tippenshed is served by a boat channel, and we were given the use of several punts. Map 2 is a rough sketch map of the area that we studied. Most ringing was carried out in the sites called "Gretton's Channel", "Pond" and "Kingfisher Bridge", as well as in the vicinity of the Tippenshed.

The local people use the Rakh for many purposes, legal and illegal. It is not always easy to decide which are which. These uses include:

1) Cutting reeds for fodder or thatching.
2) As a grazing area for cattle.
3) For fishing.
4) As rice paddy - there are several areas of encroachment.

Reed cutting is carried out on a much larger scale by contractors. They work from much larger boats than the local people, and completely clear large areas of reed.

There is a serious threat to Haigam from silting. Two factors contribute to this problem. Firstly large-scale deforestation in the surrounding mountains has resulted in an increase in the silt load of water coming into the Vale. Secondly since most of the Vale is agricultural land, there are fewer places for this silt to be deposited. As a result, the very existence of Haigam Rakh is due to the careful management of silt by the

Birds recorded at Haigam, 1983

A.J.Parr

Records refer to the period 9 July to 20 August, with some supplementary records for 17-20 and 23 September.

Status Code:
B = Confirmed breeding
S = Suspected breeding
P = Passage migrant / Winter visitor
U = Status uncertain

Tachybaptus ruficollis Little Grebe (B)
Fairly common in more open areas of Rakh.

Ixobrychus minutus Little Bittern (B)
Abundant July/August. Several nests found in Rakh, but relatively few fledged juveniles by mid-August (only 7 ringed). Many adults fed in paddies at the edge of the Rakh, often from the stems and branches of young willows. Only one confirmed sighting in September, an immature on 23/9, suggesting birds are migratory.

Nycticorax nycticorax Night Heron (S)
Often seen in small numbers flying over Rakh, or sometimes in paddies, in evening. Maximum of 5 on 27/7 (4 juveniles) and 9/8 (3 juveniles).

Ardeola grayii Paddybird (U)
One on 10/7 on pond.

Egretta garzetta Little Egret (U)
On pond; two on 13/8, then 1-2 daily until 20/8.

Egretta sp. (U)
Unidentified egrets, probably Great White Egret (E.alba) or Intermediate Egret (E.intermedia), recorded on 18/7 (3 flying over) and 19/7 (single).

Ardea cinerea Grey Heron (S)
Common. Regular activity in one area of Rakh suggests reed-bed nesting. Up to 14 present on pond at dawn on most days.

Anas platyrhynchus Mallard (P)
Two on 15/8.

Anas sp. (P)
One unidentified duck on 8/8, three on 14/8. Probably Mallard or Pintail (A.acuta). The lack of ducks in September is remarkable.

Milvus migrans Black Kite (S)
Common. Occasionally recorded fishing, and on one occasion attracted into a mist net by sparrows already caught.

Circus aeruginosus Marsh Harrier (P)
1-2 female/immatures seen regularly over Rakh from 7/8 to 20/8, with four present on 17/8.

Falco subbuteo Hobby (U)
Occasional records of singles, often hunting in swallow roost.

(Raptor sp.) (U)
Single large unidentified raptors seen over Rakh on four occasions during July, and on 23/9.

Rallus aquaticus Water rail (B)
Abundant in Rakh.

Porzana pusilla Baillon's Crake (S)
Heard in Rakh fairly frequently; two seen on 15/8.

(Crake sp.) (S)
Trilling calls heard from rice paddy at dawn were thought to be made by Ruddy-breasted Crake (Porzana fusca) or possibly Brown Crake (Amaurornis akool). At least four individuals present.

Gallinula chloropus Moorhen (B)
Common in Rakh. Two young seen on 12/7.

Hydrophasianus chirurgus Pheasant-tailed Jacana (S)
Occasional records July, regular during August with up to three birds on flooded pasture at edge of Rakh. Probably nest/young nearby. Numbers have declined since 1978, probably due to the increase in reed cover; at Hokasar the species was numerous (see Appendix).

Rostratula benghalensis Painted Snipe (S)
Four records of 1-2 birds at edge of Rakh, including a male ringed 2/8. Dawn and dusk only.

Himantopus himantopus Black-winged Stilt (P)
1-4 on pond most days from 5-19/8, then 22 on 20/8.

Recurvirostra avosetta Avocet (P)
One called in briefly to pond 15/8.

Charadrius dubius Little Ringed Plover (U)
Possible family party seen on pond intermittently late July-August.

Pluvialis dominica fulva Lesser Golden Plover (P)
Adult still in partial summer plumage seen on pond 18/8.

Vanellus indicus Red-wattled Plover (U)
One heard at edge of Rakh 2/8.

Calidris minuta Little Stint (P)
Often a few on pond with C.temminckii late July-August. Maximum of 20 on 26/7 when few C.temminckii present.

Calidris temminckii Temminck's Stint (P)
Common on pond late July-August. Often 30+ present.

Calidris ferruginea Curlew Sandpiper (P)
One on pond from 2-5/8.

Philomachus pugnax Ruff (P)
Four seen on pond after heavy rain on 23/8.

Gallinago sp. (U)
Single unidentified snipes, either Common Snipe (G.gallinago) or Pintail Snipe (G.stenura),seen flying over Rakh on 27/7, 17/9 and 19/9.

Tringa erythropus Spotted Redshank (P)
Adult still in partial summer plumage flying over Rakh on 13/8.

Tringa totanus Redshank (P)
Occasional records throughout period. Thirteen flying over on 14/7. On pond, one 10/8 (ringed), two 18/9 and one 19/9.

Tringa nebularia Greenshank (P)
Many records of singles during July/August. Three on 23/7.

Tringa ochropus Green Sandpiper (P)
One on pond 15/8 with following species.

Tringa glareola Wood Sandpiper (P)
Regular in small numbers on pond from last week July to August. Largest numbers 10 on 24/7 (flying over) and 12 on 26/7.

Actitis hypoleucos Common Sandpiper (P)
1-2 daily during August; on pond or other wet pasture.

(Wader sp.)
Several small unidentified waders noted on pond 17-20/9. Some at least probably C.minuta and C.temminckii.

Chlidonias hybrida Whiskered Tern (B)
Common breeder in Rakh. Maximum of 40 adults seen on 28/7; fledged juveniles from 25/7 onwards.

Streptopelia decaocto Ring (Collared) Dove (S)
Common, feeding on dry paddies. c300 on 23/9. Wing moult observed.

Psittacula himalayana Slaty-headed Parakeet (U)
Roost in trees at edge of Rakh. Up to 100+ seen flying over at dusk.

Cuculus canorus Eurasian Cuckoo (S)
Several sightings of juveniles in July.

Ceryle rudis Lesser Pied Kingfisher (S)
Nearly daily sightings. Family party of male, female and 4 young seen 11/8.

Alcedo atthis Common Kingfisher (B)
Abundant. Good breeding success. Nest sites found in the earth banks which are used as paths. Full grown young on 10/7, learning to take fish from adult.

Halcyon smyrnensis White-breasted Kingfisher (S)
1-2 seen regularly. (Adult in moult caught 9/8, 10/8.)

Merops apiaster European Bee-eater (U)
20-30 seen mid-July, feeding over pond and paddies. One on 31/7, then regularly 13-20/8 with maximum of c30.

Coracias garrulus European Roller (B)
Seen in small numbers at several sites during July and August. Five on 23/9.

Upupa epops Hoopoe (S)
Initially common; numbers declining during August, but singles still present 19/9 and 23/9.

Jynx torquilla Wryneck (U)
One caught in plantation on 13/8 in early stages of moult, retrapped in same site on 19/9 still in moult.

Dendrocopos auriceps Brown-fronted Pied Woodpecker (S)
Fairly regular sightings of singles in willows around Rakh. One male trapped 15/8, in moult.

Dendrocopos himalayensis Himalayan Pied Woodpecker (U)
Singles in willows on 29/7, 5/8.

Picus squamatus Scaly-bellied Green Woodpecker (U)
One seen over Rakh on 31/7.

Riparia palaudicola chinensis Indian Sand Martin (P)
All Riparia sp. identified were this species. Fairly common amongst Swallows at roost in July and August; a few feeding during the day over the Rakh. Largest catch of 24 on 30/7. All individuals caught were in moult.

Hirundo rustica Swallow (B,P)
Breeds in houses in Hanjypura village. Large roost of several thousand near edge of Rakh; numbers slowly decreasing during August. Small roost still present in mid September. See the 1978 report for a discussion of moult in this species.

Anthus trivialis Tree Pipit (P)
One caught at the edge of the Rakh 19/9. Three pipit sp. on 23/9.

Motacilla citreola Citrine Wagtail (S,P)
Fewer than M.alba during early July, but increasing from the last week of July to become the commoner wagtail. Large numbers feeding and resting in the Rakh from early-mid August. Medium-sized roost present in September by pond. Some individuals trapped were in a very worn juvenile plumage, usually with a brood patch. It is thought that these were mostly first summer females which for some reason had not moulted into adult plumage. Similar birds were caught in Ladakh. Ali and Ripley (1983) state that some first summer males breed in the juvenile plumage. For an analysis of moult in this species at Haigam, see Holmes (1979).

Motacilla alba Pied Wagtail (S,P)
Relatively few in early July, but increased numbers late July and August. Mainly seen by pond. Still many present in September.

Pericrocotus ethologus Long-tailed Minivet (U)
Uncommon. Two in willows on 10/7, and a few later records July/August.

Pycnonotus leucogenys White-cheeked Bulbul (B)
Common around habitation.

Luscinia svecica Bluethroat (P)
One adult male caught on 8/8. Numbers built up rapidly; common by 20/8. Much more common in mid September, when 22 ringed in 3 days. Occupied both the middle of the Rakh and the willows around the edge.

Saxicola torquata Collared Bush Chat (Stonechat) (P)
Male seen in Rakh on 15/8. Two present on 23/9.

Turdus unicolor Tickell's Thrush (B)
Common breeder around Rakh, many juveniles.

Acrocephalus concinens Swinhoe's Reed Warbler (B)
Breeds in small numbers in Rakh, often near isolated willows. About 10 territories found. Fledged young caught on 29/7 and 14/8. Only caught in Rakh.

Acrocephalus agricola Paddyfield Warbler (P)
One first year caught in Rakh 17/8.

Acrocephalus dumetorum Blyth's Reed Warbler (P)
One first year caught in plantation on 13/8.

Acrocephalus stentoreus Clamorous Reed Warbler (B)
Abundant breeder in the Rakh. Many individuals feed in the willows around the edge of the reeds. First juveniles ringed on 6/8, then regularly from 9/8. The total number of juveniles caught was however quite low, only 27 out of 323 A.stentoreus caught. Presumably breeding is partially synchronised, with many young still unfledged by mid August. Although the plumage of A.stentoreus is apparently quite susceptible to abrasion, the advanced feather development and state of wear of some newly trapped juveniles raises the possibility that they may be migrants from elsewhere rather than local birds. Two adults (one male, one female) were retrapped from 1978. Very few were present 17-20/9; the Kashmir population migrates to the plains in winter (Ali and Ripley, 1983).

Sylvia curruca Lesser Whitethroat (P)
One ringed in plantation 19/9.

Phylloscopus inornatus Yellow-browed Warbler (P)
Singles caught in plantation 18/9, 19/9.

Phylloscopus magnirostris Large-billed Leaf Warbler (P)
One first year ringed in plantation 18/9.

Phylloscopus trochiloides Greenish Warbler (P)
One first year ringed in plantation 16/8.

Phylloscopus sp.
Several unidentified Phylloscopus warblers seen mid September.

Muscicapa leucomelanura Slaty-blue Flycatcher (U)
Adult female with brood patch caught in the Rakh on 24/7. A juvenile male was trapped in the plantation on 18/9.

Terpsiphone paradisi Paradise Flycatcher (S)
Seen daily during July and August. Present in two sites at edge of Rakh, and in Hanjypura village. At one site on 12/7 a breeding male was seen with a female and a first/second summer male, suggesting co-operative breeding. Recorded snatching prey from water surface. One still present on 19/9.

Parus major cashmiriensis Grey Tit (B)
Common. Several family parties caught.

Oriolus oriolus Golden Oriole (B)
Common in mature trees around Rakh. Still present mid September.

Lanius schach Rufous-backed Shrike (B)
Common breeder around Rakh. One seen feeding a cuckoo fledgling 24/7. Adults moulting in August.

Dicrurus adsimilis Black Drongo (U)
One in Hanjypura village on 18/9.

Corvus splendens House Crow (S)
Common. Often seen in Rakh itself. Adult in moult caught 15/8.

Corvus macrorhychos Jungle Crow (U)
Two records in July.

Corvus monedula Jackdaw (S)
Fairly common. Adult in moult caught 13/8.

Sturnus vulgaris Starling (S)
Fairly common. A flock of c150 on 4/8. Birds moulting in August and September.

Acridotheres tristis Common Myna (B)
Fairly common.

Passer domesticus House Sparrow (B)
Very common. Large flocks (up to 700+) feeding in paddies.

Carduelis carduelis Eurasian Goldfinch (P)
Party of 5 seen 19/8.

Carpodacus erythrinus Common Rosefinch (P)
Medium-sized flock present in plantation mid September, with 39 caught in 2 days.

BIRDS SEEN BY THE 1978 EXPEDITION, BUT NOT RECORDED IN 1983

Anas crecca/querquedula	Teal/Garganey
Anas acuta	Pintail
Amaurornis phoenicurus	White-breasted Waterhen
Tringa terek	Terek Sandpiper
Scolopax rusticola	Woodcock
Strix aluco biddulphi	Tawny Owl *
Pelargopsis capensis	Brown-headed Stork-billed Kingfisher
Hippolais caligata rama	Booted Warbler
Lonchura punctulata	Spotted Munia

* - BH saw an owl sp. at dusk one evening at the end of July or beginning of August.

RECORDS OF THE 1978 EXPEDITION NOW THOUGHT DOUBTFUL

Accipiter badius	Shikra
Haliaeetus leucoryphus	Pallas's Fishing Eagle
Rallus striatus	Blue-breasted Banded Rail

CORRECTIONS TO 1978 REPORT

For Himalayan Pied Kingfisher (Ceryle lugubris) read Lesser Pied Kingfisher. For Riparia chinensis read R.palaudicola chinensis. Insert Golden Oriole.

A study of the breeding ecology of the Little Bittern (Ixobrychus minutus) at Haigam Rakh

B.J.Hatchwell

Introduction

The aim of this study was to investigate the breeding ecology of the Little Bittern at Haigam. The population at Haigam is of the race I.m.minutus, which has a breeding range extending from Europe to about 80 E, so the Kashmir population is one of the most easterly. Although this race has been studied in Europe (review in Cramp and Simmons, 1977), little work has been carried out on the species in the Eastern end of the Palearctic. In view of this lack of information on the Little Bittern, a wide variety of observational data was gathered.

In the family Ardeidae (Herons and Bitterns) the breeding strategies have been extensively studied in several species, notably the Grey Heron and the Cattle Egret (Bubulcus ibis). (For review see Cramp and Simmons, 1977). However the strategies of members of the subfamily Botaurinae (Bitterns) are less well known. In the Little Bittern, clutch size is reportedly 2-7 depending on latitude (Hancock and Elliott, 1978) with eggs being laid at two day intervals and incubated immediately (Baker, 1934; Bates, 1943; Ali and Ripley, 1983). Hatching is

therefore asynchronous. It has generally been assumed that synchronous hatching is the normal condition and that deviations from this synchrony require explanation. Several hypotheses have been proposed on this basis.

a) 'Brood reduction hypothesis'. Lack and Moreau (1965) were the first to postulate the function of hatching asynchrony as enabling parents to obtain a brood whose size was relatively easily adjusted to the prevailing conditions. By producing offspring of different ages, parents can rely on sibling competition for food to be effective in adjusting the numbers of offspring to that which can be reared, given the level of food available.

b) 'Predation hypothesis'. This was proposed by Perrins (1977) for situations where nest predation is heavy and continuous over the life of the nest. By incubating before completion of the clutch, parents may speed up the time of fledging for at least some young.

c) 'Peak load reduction hypothesis'. By spreading out hatching times parents also spread out the peak food demands of individual offspring. Therefore, the amount of food needed on any day may be less than if growth was synchronous (Hussel, 1972).

Clark and Wilson (1981) have questioned the assumption that hatching synchrony is the usual condition and have instead proposed a model based on the supposition that asynchrony is usual. Their 'nest failure hypothesis' holds that when the presence of

nestlings increases the probability of nest failure, the onset of incubation should be delayed, and hatching synchrony adopted.

Two hypotheses based on hatching asynchrony were tested in this study: firstly, that first hatched young would grow more rapidly than the second, the second more rapidly than the third etc.; and secondly that the nestlings in small broods would grow more rapidly than the nestlings in large broods.

Methods

i) For a description of the study site see the introduction to Haigam.

ii) Observations.

Nests were located by observing adults flying to and from particular areas and by searching through the reeds. Most searching was necessarily done close to boat channels and also having found several nests close to distinct patches of vegetation, searching was concentrated in such areas. The searching was therefore biased. Phragmites forms very distinct patches, being taller and a darker green than the commoner species. It is possible that the siting of nests close to such landmarks may be important for the location of nests by parents in what is a fairly homogeneous environment. Some nests were also located by the conspicuous white splashes of excreta over reeds in the area

of the nest site.

Eight nests were studied in detail. These were coded by the letters A-H.

Hides were erected at a distance of 2.5 to 3.0m from five Little Bittern nests. To make nests visible from the hides, vegetation was either cut or tied back over a two or three day period to minimise disturbance. The behaviour of both adults and nestlings was recorded during hide sessions varying in length from 0.5 to 4.0 hours through incubation and brood rearing. Total observation time was 95 hours.

Brief observations of feeding (2.5 hours) were made at the young willow plantation at the edge of the Rakh. Some Little Bitterns also fed in the reeds, on patches of water chestnut, in paddy fields, and by wading in shallow water. The density of feeding birds in these other feeding areas was lower, and since the time available for observation of feeding behaviour was limited, the study concentrated on the willows. This has probably resulted in some bias in the data, particularly as regards feeding strategy. Holmes (1979) describes observations for Little Bitterns feeding in patches of water chestnuts. The willows had not been planted in 1978.

iii) Diet

Information on the diet of nestlings was collected by identifying and weighing the food regurgitated on 22 occasions during weighing of Little Bitterns (9.5%). On 25 occasions (19.7%) food was also regurgitated by adults either during extraction from nets or during processing. This food was also collected and analysed. Individual items were weighed when possible but in some cases they were too light to be weighed accurately. The regurgitated food was identified as fish, amphibian (adult or larva), insect (Orthoptera, Coleoptera or Odonata), snail or spider.

iv) Growth Rates

All Little Bittern nests found containing eggs or nestlings were visited every morning and most evenings. The eggs and nestlings were weighed at each visit, to an accuracy of 0.1g using a 50g balance or 1.0g using a 200g balance. Each nest was visited at approximately the same time each day, with a maximum of 35 minutes variation from day to day during the period of weighing.

v) Breeding density

There does not appear to be any record of a rigorous survey of breeding density. Rough estimates for different sites vary between one pair per 600 m^2 and one pair per 250,000 m^2 (Cramp and Simmons, 1977). It is unusual for nests to be less than 50m apart although in exceptional cases nests have been found 5-10m apart (Braschler et al., 1961).

In order to obtain an estimate of the breeding density of Little Bitterns on Haigam Rakh, an area of dense reeds covering 14,000 sq.m. was selected and searched systematically. The number of nests in use or used in the current year were recorded. From a survey of the Rakh, a rough estimate of the area likely to contain Little Bittern nests was made. This area was assumed to have a density of nests similar to that of the sample plot.

Results

Behaviour of Little Bitterns in the breeding season.

i) Changeovers at the nest.

Two nest reliefs were observed during incubation and 26 reliefs were recorded after hatching. The male relieved the female on 16 occasions and the female relieved the male on 12 occasions. The observations suggest that during incubation only two changes-over occurred during the day, with the female incubating until late morning and the male taking over until late afternoon, when he was relieved by the female. It has been reported elsewhere that the female sits at night and the male during the middle of the day (Cramp and Simmons 1977). However since Little Bitterns are reported to be nocturnal (Cramp and Simmons), it may be that the male incubates for some time during the night. Except when disturbed, there was always at least one parent at the nest.

After hatching, nest relief seemed to occur more frequently. Two nests (B and G) were observed for 10 and 9.5 hours respectively over a 13.5 hour period. At each nest, four changeovers were observed. However at nest B, a minimum of six changeovers must have occurred in the 13.5 hour period and at nest G, the minimum number was five. The average brooding time was therefore at most 2.25 hours for nest B and 2.67 hours for

nest G. The high number of changeovers and short average brooding time suggest increased changeover frequency during brooding.

The frequency of nest relief may vary according to the demand for food by the nestlings, but continuous observation for several days at various stages of nestling growth would be needed to confirm this. No data was collected concerning the relative times of male and female brooding.

The behaviour of the male and female during nest reliefs was the same during incubation and after hatching, although perhaps less protracted in the former case. The returning bird always landed in a particular patch of tall reeds, 5-10m from the nest. As the returning parent approached, the bird at the nest would stare into the reeds and begin the "greeting ceremony". This involved repeated "gaping" at 3-4 second intervals, at the same time raising and lowering the dark crown feathers. The neck, and to a lesser extent the back feathers were ruffled throughout the display. On several occasions after hatching, when the male was being relieved at the nest, bill-flushing was observed. The base of the beak changed from yellow/orange to red for a minute or so. This was only observed in the male. Another aspect of the nest relief ceremony was recorded at nest A on four occasions. While performing the gaping display, the male also uttered a quiet, low-pitched "wooff" each time the beak was opened.

These four components of nest relief behaviour, gaping, feather raising, wooffing and bill flushing were also recorded in 1978, when beak flushing was also observed in females (Holmes 1979).

Once the returning bird arrived at the nest, the sitting bird stood up and backed away to the side of the nest with crown feathers raised. The returning bird approached the nest with the neck and head feathers flat, but on arrival at the rim of the nest, the crown feathers were usually raised.

Nest relief was completed by the relieved bird moving off quietly through the reeds. The bird usually flew off 4-16 mins later, after climbing up the reeds to a height of 0.5-1.0m above the water level. The 'take-off point' was from any tall reeds (usually Phragmites) within 10-15m of the nest.

Before incubating, the returning bird turned the eggs with its beak. The frequency of egg-turning varied considerably during the day, being more frequent during hotter periods, when the interval between turning varied from 15-20 mins. After hatching, the bird either settled on the nest immediately or fed the young. Before hatching, nest relief was accomplished very rapidly, with both parents on the nest for only 25 seconds. After hatching this lasted much longer, with both parents at the nest for up to 14 minutes.

ii) Behaviour at the nest and feeding of nestlings. (see also Cramp and Simmons, 1977; Holmes, 1979)

During the early morning and evening the incubating bird sat practically motionless, with only occasional shifts of position. Similarly, during periods of heavy rain the incubating parent sat very tightly. During hotter parts of the day the parents frequently shaded the eggs by standing over them with wings half open, for periods of 10-20 minutes.

When newly hatched, the nestlings are covered with orange down, and have distinctive blue-grey eyelids. On the first day the nestlings have difficulty holding their heads up for more than a few seconds, but this activity seems to be an important stimulus for the adults to initiate feeding. In response the adult points its beak vertically downwards, with the tip close to that of the nestlings, and then regurgitates on to the nest. The regurgitated food is pecked at briefly by the nestling before the adult picks it up and reswallows it. Although feeds were very brief they were also very frequent, with intervals between feeds of from 30 seconds to 40 minutes.

The third hatched nestling at nest A was very weak and light, having taken four days to emerge from the egg. This chick was not seen to lift its head at all, and was not fed during five hours of observation. A weight loss of 19% during the

36 hours before its death also suggests that it was not fed by the parents.

By the second day the young were noticeably stronger, moving clumsily around the nest with wings and head as supports. A strong grasping reflex develops a day after hatching. This is probably important for nestlings on a small platform over water. The strength of this grip increases with age. From an age of two days onwards, thermo-regulatory behaviour was observed during the hotter parts of the days. This involved stretching the neck upwards and throat-fluttering in which the beak was held open and the throat rapidly vibrated. Holmes (1979) mentions ways in which the adults may also cool chicks. On the third or fourth day after hatching, the nestlings adopt the "bittern posture" when approached, with the neck and body stretched upwards and the beak pointing up. When closely approached, they abandon this camouflage and lunge with beaks open.

When a day old the young pecked at the adult's beak to elicit regurgitation, and by the third day would grasp the parent's beak. From the fourth day on, beak-seizing became more vigorous with violent wrestling matches sometimes resulting. When a parent arrived at the nest, the oldest nestling was generally the first to start begging for food. During a bout of feeding the first few regurgitations were usually transferred directly from the beak of the adult to that of the young. The other

young in the nest would attempt to seize some of the regurgitated food, but since any individual nestling only begged two or three, or exceptionally four, times before moving away or lowering its head, its siblings usually took their turn without a great deal of squabbling.

In about 35% of cases following begging, the adult regurgitated food but the nestling which was actually begging would miss it and other nestlings would pick it up from the nest. The fact that beak to beak transfer is not always achieved may be important in that the older nestlings do not obtain all the food from returning adults. In addition, in any particular feeding bout an individual chick appears to be satiated after two or three feeds, while up to 11 regurgitations were recorded in a bout. This suggests that the parents were quite capable of bringing adequate food to feed all the nestlings to satisfaction, at least during the ten days or so after hatching.

This certainly seemed to be the case at nest A, with only two nestlings. On arrival at the nest, the returning parent would feed the nestlings two or three times each in response to begging, but in 40% of all regurgitations observed at this nest, regurgitation was not preceded by begging, and the adult would regurgitate directly onto the nest. One or both of the nestlings occasionally picked food from here, and if both parents were present at the nest they would both eat some of the regur-

gitate. In general however the parent would reswallow the food. This regurgitate/reswallow sequence would be repeated several times in succession. At nest B, which contained four young, this was only observed on two occasions, although even here the parent would sometimes point its beak downwards, the usual signal for initiation of begging, but get no response from the nestlings if they had been recently fed.

Co-ordination and movement around the nest improved rapidly with age, and by the fifth day after hatching the nestlings started wandering into the reeds around the nest. When moving about among the reeds they used their wings and necks as levers to keep balance. This ability to move through the reeds made it difficult or impossible to catch nestlings above a certain age (7-11 days).

Throughout the nesting period, the nest remained remarkably unsoiled. There were five records of a nestling backing up to the nest rim and defacating over the edge into the water. Weller (1961) from studies of Least Bitterns (Ixobrychus exilis) suggested that the loose structure of the nest maintained by the parents jabbing at the nest base with their beaks facilitates the draining of the extremely fluid faeces. Similar jabbing movements were not observed in the present study site.

iii) Adult feeding behaviour in the willow plantation.

Hunting involved perching stationary on the trunk of a sapling, up to 0.5m from the water surface, with the neck and body held horizontally or pointing slightly downwards. Once in this position there was little or no movement until prey was seen. When prey was spotted, the bird would strike by rapidly extending its neck, and legs if necessary, and grasp the prey with its beak. On two occasions birds were seen to plunge into the water becoming almost totally submerged, and then flap back onto the willow, both times having caught a large fish about 150mm long. Both the upper and lower mandibles of the Little Bittern's beak are serrated enabling them to seize slippery prey.

A total of 68 feeding attempts by 22 birds were observed, giving a strike rate of one every 2.2 minutes. Prey was identifiable on 22 occasions, 17 of which were fish, four were frogs, and one damselfly was seen to be picked from a reed.

The success rate of feeding attempts was difficult to ascertain. In 38 cases the strike was definitely successful (56%). This probably represents a conservative estimate since smaller prey may have been swallowed too quickly to be seen. A similar success rate was recorded in 1978 (54% for males and 56% for females, Holmes, 1979) for birds feeding from water chestnuts.

Although no antagonistic behaviour was seen between adults in the vicinity of the nests, some aggression was shown at the feeding area. The willows were planted about 3m apart and on several occasions when 2 adults were hunting from adjacent willows, one would fly at the other displacing it. This was repeated until the displaced bird was more than 10-15m away. Hancock and Elliott (1978) also report that Little Bitterns are aggressive towards competitors on the feeding grounds. It was not determined whether particular individuals used the same feeding sites at each visit to the feeding area, nor was enough information collected to determine whether particular individuals were consistently 'displacers' or displaced.

Studies on the breeding strategy

i)Breeding Density.

From the surveyed area, the nest density was estimated as one nest per 1750 m^2. The area of suitable nesting habitat was estimated to lie between 1.5 km^2. and 3.5 km^2, giving an upper estimate of the breeding population as 2,000 pairs and a lower estimate of 850 pairs.

Therefore, although the data collected at Haigam Rakh can only be regarded as a very rough estimate, they do suggest that the breeding density is relatively high, with some nests built fairly close together (minimum separation was 16m) even though

Little Bitterns are not colonial breeders.

ii) Breeding season

All chicks in the nests studied hatched between 27th July and 12th August. Since all nests were found after the clutches were complete, the length of the incubation period could not be determined. However Ali and Ripley (1983) report an incubation period of 16-17 days and Hancock and Elliott (1978) 16-19 days. Therefore egg-laying in the nests studied probably stretched from about the 10th-26th July.

However, four juveniles were seen on the 10th July and three were caught in mist-nets before the end of July (on 23rd, 28th and 30th) so clearly some pairs were breeding earlier than those studied. The fledging period is 25-30 days (Cramp and Simmons, 1977; Hancock and Elliott, 1978), so the earliest of these juveniles must have hatched by the 16th June at the latest, and so the clutch must have been completed by the end of May. There was also strong evidence for early breeding from the number of empty but used nests found during the study.

Data from Central and Southern Europe show that eggs are common from the last week of May to the first week in July, but can still be found up to the third week in July. Young are commonly found from mid June to mid August, and more rarely until

the end of August (Cramp and Simmons 1977). Thus the breeding season of the Kashmir population of Little Bitterns appears to start at a similar time to, but extend beyond that of the Central and Southern European populations.

iii) Eggs, Clutch size and Hatching Success.

The mean weight of the 17 eggs weighed was 11.3g (10.1g-12.4g). Three full clutches of four eggs were weighed and the following means recorded: 12.2g (11.8g to 12.4g), 11.3g (10.9g to 11.7g), and 10.6g (10.3g to 11.0g). Unfortunately, the two latter nests were predated prior to hatching. Seven nests contained four eggs or young and one nest contained five eggs. The modal number of eggs was thus four, the same as in 1978 (Holmes, 1979).

Only two of the successful nests were found early enough for the whole hatching period to be recorded. In nest A, the three eggs hatched at two day intervals, whereas in nest B, two eggs hatched on 30th July, one on 31st July and the fourth on the 2nd August. The time between the first signs of chipping and escape from the eggshell varied from 1-2 days, with the exception of the last hatched nestling from nest A which took four days and died two days later. Once an egg had hatched, the shell was removed shortly afterwards by one of the adults.

Of the 33 eggs recorded in eight nests, 18 eventually hatched (55%). However, three nests were predated prior to hatching and if these are removed from the sample then the hatching success becomes 90%. This agrees with the hatching success recorded by Holmes (1979). The failure of one egg to hatch at nest A was due to infertility. One of the eggs in nest F also failed to hatch, although the reason for this was not ascertained.

iv) Growth Rates.

There was a settling period for the growth rate of each nestling of from 2-3 days after hatching. After this the growth rates appeared constant. The growth rate for each nestling was determined by least squares regression excluding the data for the settling period. The growth rates are shown in Table 1.

Table 1 - Growth Rates (g/day) for nestlings calculated from morning weights.

	Hatching Order			
Nest	1	2	3	4
A	8.63	9.21	-	-
B	9.82	9.58	10.57	9.48
E	10.33	11.07	9.78	9.99
F	9.39	11.59	7.63	-
G	8.22	7.87	9.78	9.85

Table 2 - Adult and nestling regurgitations.

	Adult		Nestling	
Prey type	Frequency	%Weight	Frequency	%Weight
Fish	60	76.1	63	72.0
Amphibian	9	16.3	6	18.2
Insect	13	7.5	11	9.6
Other	1	0.1	1	0.2
Total	83	100.0	81	100.0
Mean pellet weight = 6.7g Mean prey weight = 2.0g			Mean pellet weight = 2.9g Mean prey weight = 0.8g	

There is no significant difference between the regurgitations of adults and nestlings. This is not surprising since the food regurgitated by trapped adults was probably being taken back for the nestlings. Prey weight and nestling age, and also pellet weight and nestling age were examined by calculating the regression coefficients in both cases and testing for significance. A positive correlation was found in both cases ($P<0.05$).

The predominance of fish in the diet contrasts with data collected in Europe and elsewhere in Kashmir. (Witherby et al., 1939; Cramp and Simmons, 1977; Pandit, 1982) where between 25.5% and 42.2% of the diet was recorded as fish. The diet will obviously vary considerably with locality, availability and time of year. The preponderance of fish in the diet of the Kashmir population of Little Bitterns probably merely reflects the abun-

dance of fish in Haigam Rakh.

vi) Predation

Three of the nests found were predated prior to hatching. Nest C contained four eggs which were being incubated, but eight days after discovery, two eggs disappeared and the other two were cold. These eggs were broken open on the next day and were found to contain almost fully grown young. Nest D also contained four eggs which all disappeared ten days after discovery.

Nest H contained five eggs but 24hrs after discovery, all the eggs had gone from the nest and two eggshells were found in the water beneath the nest. The reeds above the nest had been cut by reed cutters the day the nest was found, leaving it very exposed and easily visible. A pair of House Crows were nesting in a willow nearby and it is likely that they were the predators.

Nests C and D were both close to a large area of cut reeds and the predation of these nests coincided with a marked increase in the frequency with which Marsh Harriers and Black Kites were seen flying over the Rakh. Nest A was also close to a cut area and on three occasions a Marsh Harrier was seen flying over, 5-10m above the reeds. The female Litle Bittern was brooding on all three occasions and she immediately adopted the

'bittern posture', as did the nestlings, only relaxing after 4-5 minutes. These observations suggest that these raptors may be important predators of Little Bitterns. The activity of reed cutters also increases the probability of predation. It is also possible that the hides erected at nests C and D attracted predators to the vicinity of the nests which would increase the chance of predation, even though no vegetation was removed at either site.

Discussion

i) Hatching Asynchrony.

In a study of European Little Bitterns, Wackernagel (1950) recorded weights at three nests containing three, five and seven chicks. There is no significant difference between his results and those calculated from the present study. Furthermore as at Haigam, there was no significant correlation between growth rates and hatching order. However, the youngest chick from the nest containing seven young died two days after the first weights were recorded after a weight loss of 22% (11.25g to 8.75g).

Wackernagel's data therefore suggests that brood sizes of three and five are sustainable by the adults, ie the parents are capable of producing sufficient food to rear the young at a normal growth rate. In the nest containing seven chicks, six of the young had a normal growth rate. The death of the last hatched chick may be an example of brood reduction as described by Lack and Moreau (1965), although it is possible that the chick was unfit for a reason other than sibling competition, as was the case with chick 3, nest A at Haigam.

If there were a plentiful food supply, brood reduction would not be expected. Two observations support the idea that 1983 was a good year for Little Bitterns at Haigam. Firstly, there was an absence of intense fighting between siblings at feeding time, in contrast to Bates' (1943) observations. Secondly there were frequent unelicited regurgitations by parents, which met with no response from the nestlings. Both of these observations suggest an abundance of food, although the second observation might be explained by food being too large for the chicks to swallow and the parents reswallowing it for further digestion.

It may well be that in other years food is less abundant at Haigam, and brood reduction becomes more important. To investigate this hypothesis more thoroughly, a long term study of breeding success and food availability is required, perhaps with

artificial manipulation of brood sizes.

The peak load hypothesis (Hussel, 1972) can be neither proved nor disproved by this study, although the above arguments suggest that this function of hatching asynchrony did not operate in this particular season.

Under the nest failure hypothesis, hatching should be synchronous when the presence of nestlings increases the chance of nest failure (Perrins, 1977). The results of this study suggest that nest failure may be quite frequent during incubation, but less frequent after hatching as the chicks are not as conspicuous as eggs, and after a few days are capable of hiding in the reeds. Therefore the presence of nestlings would appear to decrease the probability of complete failure, so the onset of incubation would not be expected to be delayed. The results appear to support the nest failure hypothesis, but the sample is small and more information is required on the temporal distribution of losses through the nest cycle.

ii) Clutch size.

The clutch size of Little Bitterns appears to vary with latitude. Hancock and Elliott (1978) report clutch sizes of 2-3 in the tropics and subtropics and 4-7 at higher latitudes, both north and south. Cramp and Simmons (1977) report clutch sizes

of 5-6 (4-9) for Europe. The clutch sizes recorded at Haigam (4-5) support this trend.

For many bird species, the lowest clutch sizes occur in the tropics, where in the passerines in particular, the most frequent clutch is 2 compared with 4-6 in temperate climates. Lack (1947, 1948) correlated this difference with the amount of daylight available for the parents to gather food for their offspring. Spring and summer days are long in temperate latitudes compared to the tropics. However, Little Bitterns are reported to be nocturnal (Cramp and Simmons, 1977) and in the present study adults were observed hunting at dawn and dusk. Therefore, it is unlikely that Lack's daylength hypothesis alone could account for the observed trend in the clutch sizes of Little Bitterns.

A second explanation which extends Lack's theory, has been proposed by Owen (1977). This theory holds that the effect of high species diversity in the potential food of tropical birds, especially in tropical forests, results in food being less obtainable, perhaps because of the inability to form a search image. Therefore, clutch size is reduced by natural selection to correspond with the largest number of young the parents can on average successfully feed. Since the prey of Little Bitterns, mainly fish and frogs, are likely to be relatively constant over the whole of its range, this explanation is not

thought likely.

The predation hypothesis of Perrins (1977) states that if there is a high risk of predation at the egg stage, there will be a selection in favour of smaller broods. Since three clutches were predated in the present study, this may support the hypothesis, but no information is available on the rate of predation of clutches in temparate regions.

Ashmole (1961) proposed that temperate populations are reduced to below the carrying capacity of the environment by losses on migration and in winter. Therefore, breeding populations will tend to be low in relation to food availability, resulting in less competition which would favour large clutches. Tropical populations would be closer to the carrying capacity, with clutch sizes correspondingly smaller. Cody (1966) suggested that the unstable habitat at high latitudes produces a trend towards r-selection, whereas the more stable habitat at low latitudes leads to K-selection.

The European population of Little Bitterns winters mainly in East Africa, and the populations from the USSR and Iran are believed to do the same (Dement'ev and Gladkov, 1951). The African and Australasian races are sedentary. The Kashmir population is described by Ali and Ripley (1983) as locally migratory, and Baker (1934) noted that Little Bitterns visit the plains

of Punjab. There are no records of Little Bitterns occurring south of Sind (25N).

The main study at Haigam Rakh was concluded on August 20th, when Little Bitterns were abundant and very much in evidence. On a subsequent visits between September 17th-23rd, there was only one sighting, of a juvenile. It is possible that the Haigam population had dispersed to other wetland areas in Kashmir. However, the mean January temperature in Srinagar is -0.5C, and most winter precipitation falls as snow (Kendrew 1937). Therefore, it seems likely that the Kashmir population of Little Bitterns migrates out of the vale in the first half of September, probably over the Pir Panjal range as far south as Sind.

Since the Kashmir population appears to undertake a short migratory flight, winter losses might be expected to be intermediate between those of the European and African populations. On the basis of migration distance and assuming mortality to be correlated with the length of flight undertaken, the data collected on clutch size, may support Ashmole's hypothesis.

However, the data collected at Haigam on clutch size in both this study and in 1978 differ from other data from Kashmir. Ali and Ripley (1983) reported clutch sizes of 4-6/7 and Baker (1934) 4/5-6/7 with six usually found in full sets. It may be

that since 1934, the reduction in suitable breeding habitat for Little Bitterns in Kashmir, due to agricultural expansion, has resulted in a particularly high breeding density in the available breeding areas. The consequent increase in competition may have reduced clutch size, with 4-5 being the most common throughout Kashmir. Alternatively, clutch size in Little Bittern may vary throughout Kashmir and be primarily dependent on other factors such as food diversity and local habitat, rather than the length of the migratory flight as suggested by Ashmole's theory. To investigate this problem, extensive comparative studies would be required between the different populations in Kashmir in order to determine breeding densities, food supplies, mortality rates, intensity of competition and the lengths of migratory flights.

Measures proposed for the conservation of Haigam Rakh

There are many threats to Haigam Rakh. Perhaps the major long-term threat is the amount of silt that is being deposited. The changes noticed from 1978 were largely the result of silt deposition. There was less open water than in 1978, with no large patches of chestnuts or lotuses, which probably explains the lower numbers of Pheasant-tailed Jacanas recorded. Also at least one patch in the Rakh had solidified to the extent that terrestrial plant succession had begun, and cattle were able to walk on the surface.

The Game Department have been very active in controlling silt input. Several of the smaller inflow streams have silt traps. In two places small areas of the Rakh have been sacrificed by building dykes to divert silt laden water. The willows planted around the Rakh also act to trap silt.

It has been suggested that as well as these measures, some clearing of the reedbed is necessary. A figure of 25% of the reed area was quoted to us. The expedition members agree that some reed clearance is essential to combat silting, but the areas to be cleared must be chosen very carefully. We would suggest the following as an initial step:

1) The clearance and dredging of all areas which have solidified

and now support terrestrial vegetation, and the clearance and dredging of such areas when they appear.

2) The annual dredging of all boat channels.

3) Further investigation of the possibility of silt traps on a larger scale, for example large settling tanks as at the Bharatpur reserve. An area excavated within the Rakh to a depth of 3m or more would act as a silt trap, and also attract diving ducks.

In the Camargue, smallish open areas are created in late autumn by reed-cutting; these attract large numbers of duck, but new growth makes them suitable for breeding birds in the following summer (J.B.Wood, pers comm). The suggestion to clear 25% of the reed area was not only to arrest the silting process, but also to create a permanent area of open water attractive to ducks. If any area is to be cleared, and we are not convinced that such a large open water area is necessary, it would be preferable to clear at the Tarzoo end of the Rakh, where the reeds are thinner and more disturbed.

However these measures can only delay the silting process, and in the long-term measures such as the reforestation of the surrounding hills will be much more important in reducing the silt load at source.

The second major consideration in the conservation of Haigam Rakh is the human exploitation of the area. It would ap-

pear that the present level of human activity has not resulted in any noticeable decline in the breeding bird numbers between 1978 and 1983. However it is important to contain human usage.

The local harvesting of reeds is not as yet a threat to the Rakh. This appears to be a sensible and sensitive harvesting of a renewable resource, and providing there is a degree of monitoring to ensure there is no large scale increase, this local activity should not be discouraged. It was believed by the expedition members that the local people, or at least those from Haigam and Hanjypura, have a sympathetic attitude to nesting birds.

The grazing of cattle in the Rakh causes some damage to the reedbed. This is minimal around Hanjypura, but appears to be much more serious around villages on the other side of the Rakh. It would probably be difficult to decrease stock grazing, and indeed undesirable for the bad feeling it would create, so instead it may be necessary to operate a containment policy, perhaps by allowing grazing only in areas of low breeding bird density. Stock levels should be carefully monitored.

The large scale harvesting of reeds by contractors is a much more obvious problem. Since areas are completely cleared, all the nests in those areas are destroyed. On two occasions, nests under study by BH were destroyed by the contract reed

cutters.

Since the contractors provide much needed revenue for the reserve, it is not easy to make recommendations for controlling this activity. One possibility is to prohibit reed harvesting in those areas which appear to have the most dense nesting populations. These appear to be those areas accessible from the boat channels to the right of the Hanjypura channel, and also the first few hundred metres to the left. It may well be that there are other areas which should be protected. A full survey of the Rakh in early July would reveal the best areas.

Perhaps the most insidious problem is the encroachment of rice paddy within the reserve boundaries. We were informed that certain of the paddies were "illegal", but it is probably the case that once established these cannot easily be removed. There has been a constant nibbling away at the reserve area, but we were assured that further encroachment had now ceased. Planting within the reserve area must be strictly prohibited, and any illegal planting must be removed immediately.

Our studies have demonstrated the importance of Haigam for breeding marshland birds. It is also apparent that large numbers of migrant birds pass through the reserve area in autumn. We consider that it would be of great benefit to establish a permanent ringing station at Haigam, to continually moni-

A brief history of ornithological work in Ladakh and the Suru Valley

One of the earliest collectors to visit Ladakh was Dr. Abbott in 1892 and 1893. The collections he made are described in Richmond (1895). From his itinerary it appears that he did not visit the Suru Valley. The first documented ornithological work in the Suru Valley is that of Ludlow. In 1919 he travelled as far as Parkachik along the Suru River, as well as visiting Rupshu, mainly looking for nests (Ludlow, 1920).

Other explorers visited Ladakh in the 1920s, included Wathen in 1922 (Wathen, 1923), and Meinertzhagen and La Personne together in 1926 (Meinertzhagen, 1927 - systematic; LaPersonne, 1928 - anecdotal), but these did not travel along the Suru. However in 1925 Osmaston made a detailed survey of breeding bird species in the Dras and Suru Valleys in July and early August (Osmaston, 1926).

In September 1931 Koelz visited Rangdum Gompa and Zanskar, and from 11-27 July 1933 he travelled to Rangdum and from there to Kargil along the Suru, a region he terms Purig (Koelz, 1939). Unfortunately the purpose of his visit was not ornithological, and he only spent three days actually travelling along the Suru River, with stops at Parkachik and Sanku.

After this period, access to Ladakh became much harder, and ornithological work apparently ceased. With the reopening of the area in the 1970s, interest was revived. In particular there has been a series of expeditions from Southampton University that began in 1976 (Southampton University Expeditions 1976, 1977, 1980 and 1981/82 Reports). The focus of this work has been in the Indus Valley at Tikse and Shey, with visits in autumn 1976, 1977 and 1980. From August 1981 to July 1982 the Tikse site was manned almost continuously.

In 1977 the Suru Valley was also visited by a Southampton University team (Southampton University Expedition 1977 Report), and a study made of the birds at Rangdum. In 1980 further work was conducted at Rangdum, and in the same year both a breeding bird survey and an alpine transect study were conducted at Panikhar (Southampton University Expedition 1980 Report). In 1978 PH visited sites near Parkachik and Rangdum Gompa and spent some time trapping. The site near Parkachik was the same as the one studied in 1983.

A useful introduction to the area, with good descriptions of the terrain, is the book by Schettler and Schettler (1981), although with the opening of new roads, the information presented is already outdated.

A description of the Suru Valley and the sites studied

From its source near to Zanskar, the Suru River runs north-west to the plain at Rangdum Gompa. From here it turns due west for about 60km to Parkachik, and then due north for the final 100km before it joins the Indus. Between Rangdum Gompa and Parkachik there is first a 20km length of wetland which is a reserve. After this the valley is very steep sided, and mostly consists of boulder scree with very little vegetation, mostly willows (Salix sp.) and buckthorn (Hippophae sp.).

After Parkachik the river turns due North. There are more flat areas along the river's edge where agriculture is possible, and after Panikhar much of the valley is agricultural land, interspersed with willow and buckthorn scrub.

The valley floor is at an altitude of 4000m at Rangdum Gompa, falling to 2700m at Kargil.

The valley has only been easily accessible to tourists since the mid 1970s when a road was constructed as far as Rangdum. This now goes all the way to Padum. Initially all transport was by truck, but there is now a bus service as far as Panikhar. The road is being improved beyond Panikhar, presumably with the intention of running buses to Padum.

Increasing numbers of visitors are following the route to Zanskar. These include mountaineering expeditions working in the Nun-Kun massif, and trekking parties intending to start out from Padum. The most well represented countries appear to be Germany, Switzerland, France and Japan, with rather fewer Britons. However the range of nationalities discovering the Suru is wide; we even met a Polish mountaineering party.

The valley is very steep sided, and both the vegetation and tourist traffic are concentrated at the bottom. This must put a great deal of pressure on the sites we were examining. At Rangdum it was noticed by both PH and the Southampton University Expedition (1980) that the scrub is disappearing rapidly. At least part of this is probably due to burning the scrub in Yuldo to supply tea for tourists at the tea stalls. There have also been reports in the national press in Britain of Ladakh being disfigured by the litter left by trekkers.

The following are the sites examined in the present study.

Mingi site

The site was up a side valley, about a kilometre from the Suru River. It consisted of an area of approximately four acres of fields, which were bordered on the southern edge by a strip of trees 2-10m wide. The area was surrounded by boulder desert.

The tree strip was in four relatively distinct layers. On the desert side it comprised wild roses, about chest high. Inside these there were willows, growing to about 4m. Next there was a layer of buckthorn, about knee to waist high. Finally bordering the fields there were apricot trees.

The fields were growing a flowering, herbaceous crop that was not identified. There were a few houses at the top end of the area, and storage huts in the fields. No grazing animals were seen. The area was dependent on a series of irrigation channels for the agricultural development.

For the first few days, the site studied was the plantation at Baru, 3km from Mingi on the bank of the Suru. Few birds were present in this site so the base was moved up the hill where bird numbers were higher.

Sanku

The Sanku area covers an area of 4+km^2. It lies on a plain formed by the junction of the Suru with a large tributary. Most of the area is covered by small barley fields, all separated from each other by hedges of willow and buckthorn. There are some strips of scrub along the edge of the river, and also along an inflowing stream. Some shingle islands in the river are also scrub covered, and one of these became a major netting site.

The area is well populated, with perhaps 250-500 people. They own large numbers of cattle and sheep, which are often driven into the scrub to graze. The area is thus heavily disturbed. It was in this area that local children killed young Hobbies in a nest, apparently for amusement. Also local children with catapaults fired stones into nets.

Panikhar

Panikhar is set about 1-1.5km away from the Suru River, on the bank of a large tributary. The road crosses the tributary at this point. Just before the bridge there is a police checkpoint.

There is an extensive agricultural area at Panikhar, spreading over several square kilometers. A smaller area is present on the other side of the tributary. In both areas there are willows between fields and among houses. Towards the desert edge there are some quite extensive buckthorn patches. The area is described fully in the Southampton University Expedition 1980 Report.

Ringing was carried out in a strip of mature willows along the tributary edge. The strip was up to 30m wide, with some buckthorn understorey. It extends for possibly 1km. The other bank of the tributary, around the police checkpoint, has a more

scrub-like vegetation, with a few small fields.

Parkachik site

The site is about 5km upstream of the extreme end of the agricultural area of Parkachik. Between this site and Parkachik is a stretch of road that was blocked by snow until the 1st August. Every year this is the one of the last stretches of snow to clear on the Kargil-Rangdum road.

The vegetation at this site is largely willow scrub, extending for about 1.5-2km along the road. Several small snow melt streams run through the site. The north-western two-thirds are a narrow strip (c50m) between the road and the river. The scrub here was relatively sparse, with a undercarpet of herbaceous plants. The scrub at the south-eastern end was thicker, about 3-4m high. There were two 'steps' down to the river. The first had scrub growing with little other vegetation, whereas the second level by the river was a continuation of the strip described above. At this end the scrub extended above the road, perhaps up to 500m up a gully. All netting was carried out at this end.

There was no agriculture at the site, and no resident people. At the south-eastern end there were the remains of a small settlement. People from Parkachik village harvested grass and

herbs from the slopes above the site, and on one occasion a passing herd of goats moved through the site grazing the willows. No evidence of the gathering of firewood was seen; the local people went further along the road for sticks.

There is a smaller patch of sparse scrub about 2km nearer Parkachik. About 2km further towards Rangdum there is another area of sparse scrub. After this, there are no further scrub patches before Rangdum.

Padum

Padum town stands on a glacial moraine hill in the middle of a vast open plain, formed by the Stod and Zanskar Rivers. There are a surprisingly large number of fields in this plain, but there are virtually no bushes. One area of about an acre has been enclosed for willow replanting. The walls are breached in several places, and children were grazing sheep inside.

On the SE side of Padum hill there is a small enclosed garden, about a third of an acre. This consists of mature trees (willows), with some understorey. The hill is very steep, and the garden is apparently little disturbed. All ringing was carried out in this garden.

Birds recorded from the Suru Valley, 1983

A.B.Gretton and P.R.Holmes

M: Mingi S: Sanku
Pan: Panikhar P: Parkachik

Anas crecca Common Teal
S: Singles on 31/8, 1/9.

Anas querquedula Garganey
S: Two sightings on 2/9.

Anas clypeata Shoveler
S: Recorded on 2/9 and 3/9, three sightings.

Milvus migrans lineatus Black Kite
M: One 30/8, perched on rocks.
S: Two individuals, 2/9 and 3/9, hunting along valley bottom.
Padum: One on 5/9.

Accipiter nisus melaschistos Sparrowhawk
M: A female present 22-24/8.

Hieraaetus pennatus Booted Eagle
S: Three flying south at a moderate height 1630hrs 25/8. One on 8/9.

Circus aeruginosus Marsh Harrier
S: A female/immature on 28/8 flying north, low, 1700hrs. Another present 8/9, 9/9, being mobbed by the resident Hobbies.

Falco subbuteo Hobby
M: One on 19/8, hunting across the valley.
S: Nest found near camp on 23/8, 40 feet up a poplar tree. The nestlings were killed the same day by the local boys, apparently for amusement. The pair remained in the area.

Falco tinnunculus Kestrel
S: Singles on 25/8, 29/8. The latter bird circled up until very high, then glided off southwards with the wind.

Falco sp.
M: An unidentified large falcon mobbed by a chough on 25/8.

Tetraogallus himalayensis Himalayan Snowcock
S: A group of 5 seen at c.13,000 ft on 29/8. Two at c.14,000 ft on 6/9.

Alectoris chukar Chukar
S: Parties of 7-8 birds seen between 12,500 and 14,000 ft on 29/8, 6/9 and 8/9.

Ibidorhyncha struthersii Ibisbill
S: One usually present from 31/8-8/9.

Calidris temminckii Temminck's Stint
Padum: One on 5/9 in wet replanting area.

Gallinago sp. Snipe sp.
Padum: 3-4 in wet replanting area 5/9.

Tringa nebularia Greenshank
S: One individual roosting on pebble bar near camp 3-4/9.

Tringa glareola Wood Sandpiper
S: Singles recorded on 3/9 and 5/9.

Actitis hypoleucos Common Sandpiper
S: A single bird on 3-4/9.

Sterna hirundo tibetana Common Tern
S: 1-4/9, up to 4 birds feeding in the calmer parts of the river.
P: 1-4 seen most days, occasionally feeding from fast-flowing river.

Columba leuconota Snow Pigeon
S: Three birds at c12,500 ft on 29/8.
Pan: Common on hills.
P: Common.

Columba livia Blue Rock Dove
S: Seen on 24/8, 26/8; 4 birds.

Streptopelia orientalis Rufous Turtle Dove
S: Fairly common. Up to 10 individuals in vicinity of camp. Nest with two eggs found on 31/8, in thick willow scrub near river.

Cuculus canorus Cuckoo
M: One on 17/8.
S: Fairly common near camp. Four on 24/8; one ringed 27/8.

Caprimulgus europaeus European Nightjar
P: One caught and ringed 12/9.

Apus melba Alpine Swift
S: A single bird seen 3/9.

Apus apus Common Swift
M: Large flocks on 18/8. Some at high altitude early morning 23/8.
S: Often flocks in late afternoon, usually 30-40. 150 on 26/8 and 2/9, 250 on 28/8.

Coracias garrulus European Roller
S: One in field near village 26/8.

Upupa epops Hoopoe
M: Three present 18-20/8, 30/8.
S: Common until 28/8, when numbers began to fall. Two on 7/9.
Pan: One caught in willows 30/8.
P: Only one record, a single on 28/8.
Padum: Four caught in garden, apparently a family party.
One individual was seen from a truck in the middle of the barren plain at Rangdum.

Jynx torquilla Wryneck
M: Quite common, 4 ringed.
S: One caught and ringed 23/8. No sight records.

Alauda gulgula Eastern Small Skylark
S: Common in grassy meadows above river, 6/9.
Pan: Common in cut barley fields.

Eremophila alpestris Horned Lark
Abundant in stony plains from past site P along the Suru Valley, and along the Stod Valley to Padum.

Hirundo rupestris Crag Martin
S: Fairly common along valley sides and crags.
P: Present on cliffs above camp.

Delichon urbica House Martin
P: A few feeding above highest part of scrub patch on most days.

Anthus trivialis Tree Pipit
S: Two trapped on 7/9, and one on 9/9.

Anthus roseatus Rose-breasted Pipit
P: Two adults in heavy moult caught on 26/8. One retrapped on 2/9.

Motacilla citreola Citrine Wagtail
M: Peak of five on 17/8.
S: Passage peaking 2-4/9 along river bank.
Pan: Common around fields; behaviour of adult male and female suggested the presence of a nest on 31/8.
P: Common. A very newly fledged juvenile caught on 24/8.
Padum: Several present in replanting area 6/9.

Motacilla alba Pied Wagtail
M: Peak of five on 18/8.
S: Common. Numbers increasing to 40+ along river at end of August.
Pan: Common.
P: Uncommon. Only one ringed.
Padum: Several in replanting area 6/9.

Troglodytes troglodytes Wren
M: Possibly one on 25/8.
One seen from truck near site P on 15/9.

Prunella strophiata Rufous-breasted Accentor
P: Fairly common, probably bred.

Luscinia svecica Bluethroat
M: Not very common, only 7 ringed.
S: Very common, 84 ringed.
P: Fairly common.

Phoenicurus ochruros Black Redstart
Very common at all sites. One seen at c14,500 ft at S on 6/9.

Chaimarrornis leucocephalus White-capped Redstart
M: Two on 25/8.
P: Singles on 28/8 and 13/9.

Saxicola torquata Collared Bush Chat (Stonechat)
M: One recorded on 18/8.
S: One pair near camp.

Oenathe deserti Desert Wheatear
Pan: Adult female and juvenile in rocks outside village on 31/8.

Oenanthe sp.
M: Singles caught in fields, 19/8 and 4/9. The identity of these birds is not certain, but they were possibly Pleschanka's Chat (O.pleschanka).

Monticola solitarius Blue Rock Thrush
S: Seen at three sites between c11,500 and 13,000 ft.
Pan: One seen among fallen rocks 31/8.
P: Recorded on hillside 12/9.

Myiophonus caerulus Blue Whistling Thrush
M: Singles caught on 18/8 and 21/8.

Acrocephalus dumetorum Blyth's Reed Warbler
S: One trapped on 9/9.
P: One trapped on 12/9.

Sylvia nisoria Barred Warbler
P: One immature trapped on 2/9 was possibly only the fourth record for India.

Sylvia curruca althea Hume's Lesser Whitethroat
M and S: Common.
Padum: 2-3 present in garden on 7/9, one ringed.
This species was noticeably absent from site P.

Phylloscopus collybita tristis Chiffchaff
M: One ringed on 30/8.

Phylloscopus sindianus Mountain Chiffchaff
M and S: Common.
Pan: Few present in willows; one ringed 10/9. Much more common in scrub outside village.
P: Common. Very newly fledged juveniles caught 2/9 and 3/9, probably from the same brood, and 12/9.
Padum: 2-3 in mixed warbler fock in garden 6-7/9; one ringed.

Phylloscopus affinis affinis Tickell's Willow Warbler
M: Two ringed on 16/8, and a single on 22/8.
P: Singles trapped on 26/8 and 13/9.

Phylloscopus griseolus Sulphur-bellied Warbler
P: Six caught between 12-13/9. Probably a later migrant.
Padum: One caught in garden on 7/9.

Phylloscopus inornatus Yellow-browed Warbler
M: Not common, only 10 caught.
S: More common a little way up valley side, rather than near river.
Pan: One ringed on first visit (30-31/8). Much more common at second visit (10-11/9) when 26 ringed.
P: Became increasingly common as time progressed (see ringing totals).
Padum: Some in mixed warbler flock in garden; 2 ringed.
The evidence suggests that this is a later migrant than the next species.

Phylloscopus magnirostris Large-billed Leaf Warbler
M: Uncommon, one ringed 17/8.
S: Uncommon, singles ringed 23/8, 28/8.
Pan: Common, probably bred. Five caught 30-31/8, of which 4 were adults, one with a brood patch. Fewer present 10-11/9, three caught.
P: Common at first visit, much less so subsequently. A female with an incubation patch trapped on several occasions had been ringed as a juvenile in the same site in 1978.
Padum: Two caught in mixed warbler flock in garden.
The evidence suggests that this is an early migrant. This spe-

cies and the next are very difficult to separate in the hand; some may be wrongly ascribed. See concluding note.

Phylloscopus trochiloides Greenish Warbler
S: One juvenile ringed on 29/8.
Pan: One juvenile ringed 11/9.

Cephalopyrus flammiceps Fire-capped Tit
S: One trapped on 23/8. Adult observed feeding young on 31/8.
P: At least 4 present on 26/8, when 3 caught. An unringed juvenile and a retrap caught on 2/9.

Parus major Grey Tit
M: Common, 13 ringed.
S: Uncommon.

Tichodroma muraria Wallcreeper
M: One seen at snowline on 25/8.

Oriolus oriolus Golden Oriole
M: Two on 18/8, 3 on 20/8, one on 31/8. Three ringed.
S: One pair present; a juvenile trapped on 28/8.
Padum: Singles caught in garden 6/9, 7/9.

Lanius tephronotus lahulensis Grey-backed Shrike
Padum: A female and a newly fledged juvenile trapped in garden.

Lanius schach Rufous-backed Shrike
M: Singles ringed 25/8, 26/8 and 31/8.
S: At least one pair present in buckthorn/willow scrub.
Padum: Two trapped in garden; present with above species.

Pica pica Magpie
M: Common.
S: Common. Seven on 30/8. Four trapped 4-5/9.
Pan: Common.

Pyrrhocorax graculus Alpine Chough
S: Two at c13,500 ft on 6/9.

Pyrrhocorax pyrrhocorax Red-billed Chough
M: First recorded 21/8, and then seen on most days until 2/9, maximum 12.

S: Fairly common around crags at 11,000-12,000 ft. Maximum 10.
Pan: Common on hills around village.
P: Common on hills. Some fed on a slope about 400 ft above the camp.
Padum: Common in fields.

Corvus macrorhynchus Jungle Crow
S: Two on 23/8 in village.

Sturnus pagodarum Brahminy Myna
Padum: Four+ present in garden 6/9, one trapped.

Sturnus roseus Rosy Pastor
S: Two immatures seen on 25/8. One immature ringed on 31/8.

Passer domesticus House Sparrow
Fairly common at all sites except P, where none present. Large mixed flock with rosefinchs at M, 2/9.

Carduelis carduelis Eurasian Goldfinch
M: Three on 25/8.
S: Singles on 23/8 and 24/8. Two at c14,000 ft on 6/9.
P: Became increasingly common with each visit. A total of 13 ringed.

Serinus pusillus Red-fronted Serin
M: Common from 17/8, usually in small flocks.
S: Present in one area near road.
Pan: A male in moult ringed on 11/9.
P: Became increasingly common as with goldfinch. 11 ringed.

Leucosticte nemoricola Hodgson's (Plain-coloured) Mountain Finch
S: Ten at 14,000 ft on 6/9, two on 7/9.
P: One juvenile ringed 12/9.
This was probably the common finch species seen on the truck journey between Parkachik village and Rangdum.

Carpodacus erythrinus Common Rosefinch
Abundant at all sites except Padum.
M: Peak numbers of 100+ 31/8-2/9, from only 8-10 on 30/8.
S: Two newly fledged individuals on 9/9.
Pan: Large numbers on buckthorn scrub. Also very common in villages between Panikhar and Parkachik.
P: Many pairs nested. A medium sized roost present above road on later two visits.

trapped were magnirostris, since all possessed a hook, although this was more marked in some individuals than in others. It appeared to be more prominent in males. However this character is of no use for identifying juveniles, since the hook only develops over the first winter.

The third character was used to identify juveniles, and it was on this basis that the two trochiloides juveniles were separated. However one of the races of trochiloides that migrates through the region, viridanus, also has the longer 8th primary. Therefore a shorter 2nd primary should identify trochiloides, whereas a longer 2nd primary does not necessarily identify magnirostris.

The winglengths we recorded for magnirostris were in the range 57-67mm, at the lower end and below the range of 59-76mm given by Williamson (1976). The range for the adults (identified by the presence of the hook) was 59-67. It is possible that some of the juveniles were not fully grown, but in general it would appear that the population of magnirostris is a small form.

It is not surprising that Ali and Ripley (1983) say that the two species are inseparable in the hand.

What detailed work which has been conducted on migration in mountain regions has, for logistical reasons, often tended to concentrate on the larger, more obvious species such as raptors (eg Gyllin, 1971). Casual observations from climbers similarly refer mostly to these groups. In recent years studies of passerine migration have become rather more common. There is now a permanent ringing station at Col de Bretolet, in the Swiss Alps, and in the Western Himalaya important studies of both passerine and non-passerine migration have been made by teams from Southampton University (Southampton University Expeditions to Ladakh, 1976, 1977, 1980, 1981/1982).

It is now emerging that large numbers of migrants do cross major mountain ranges. Some are known to fly directly over the peaks; Bar-headed Geese (Anser indicus) apparently can cross the Himalaya at 7500m, while cranes (Grus sp.) have been reported at over 6100m on migration (Fleming et al., 1979). Although direct observations of passerines at these high altitudes are few, radar studies have shown some migrants to be capable of reaching 6000m (Elkins, 1983). The physiological effects of altitude seem to be less severe for birds than for man, due to the more efficient absorption of atmospheric oxygen (Elkins, 1983).

While direct overflying is thus clearly important in many instances, large numbers of birds seem to concentrate into valleys and passes during migration. These features may provide

flight lines - low altitude migrants often follow river valleys (Dorst, 1962) - but probably more importantly allow mountain barriers to be crossed at lower altitudes and under more favourable conditions. Valleys with vegetation, by supplying food and cover, also allow migrants temporarily to break their migration to feed and rest if necessary. In the Himalaya there is evidence that the Indus Valley in the west and the Brahmaputra Valley in the east are migration routes (Ali, 1979; Southampton University Reports, 1976, 1977, 1980, 1981/1982).

In the present study we investigated aspects of autumn migration in the Suru Valley. During the period 15th August - 14th September 1983 intensive ringing was carried out, supplemented by visual observation, principally in the better vegetated north-west section of the valley. A short trip was made along the length of the Valley and over the Pensi-la pass into the Stod Valley, and on to Padum.

Our aims were:

i) To assess the importance of the Suru Valley as a migration route for different species.

ii) To obtain evidence as to the origins and destinations of migrants. Because of the very low recovery rates for most ringed birds, and the problems associated with field taxonomy, it was accepted that most evidence relevant to this area would be circumstantial.

iii) To investigate the local breeding birds, many of which are known to be long distance or altitudinal migrants (Ali and Ripley, 1983). There is little published information on the preparation for migration in these birds.

iv) To gain further insight into the strategies of migration across mountain barriers.

For much of the time work was carried out simultaneously at three sites. As well as increasing the breadth of coverage, this provided comparative information between areas, and also increased the chances of identifying migrants moving gradually up or down the valley.

Methods

The study sites are described earlier, and are shown on the map (Map 3). In general ringing at the main sites (Mingi, Sanku and Parkachik) was carried out from dawn to dusk (c5am to c6pm), weather permitting. For each bird the following information was noted:

i) Age and sex (where possible)

ii) Winglength (maximum chord)

iii) Weight

iv) State of moult

v) Estimate of fat deposition

In estimating the amount of fat, a subjective ranking method was used. The abdomen, flanks and neck were examined, and each area was scored on a scale of 0-3, where 0 indicates no visible fat and 3 indicates bulging fat layers. The maximum possible fat score is thus 9. This method is non-interventive, and unlike measures based on weight is not affected by individual variation in size. However as a subjective measure it is influenced by observational variation. In the present study examination of the fat scores for birds recaught soon after ringing revealed that variations in scoring between different people could be substantial, which probably reflects in part the unfamiliarity of the technique to some of the expedition members. This has to be borne in mind when analysing much of the data. Thus birds with a total fat score of only 1 were not treated as different from those with a score of 0, since observer variation would mask such fine distinction. Analysis of birds carrying more fat was done in a semi-quantative fashion, and where suitable controls were available (eg birds caught at similar times of day, or retraps of the same individual) some weight data were also used to give an indication of fat deposition.

The abbreviations used on the figures are:

B - Baru M - Mingi

S - Sanku (S1,S2 earlier and later sites)

P - Parkachik Pan - Panikhar

Results

Full lists of the birds seen and ringed in the Suru Valley are presented elsewhere in this report. This section concentrates on those species caught in large numbers. Some species known to be migratory, but caught in smaller numbers are also included, as are visual sightings of known migrants.

Unless otherwise stated, significance tests are examining for differences from frequencies expected from a binomial distribution.

ANATIDAE (WATERFOWL)

Duck passage was very light, the only records being of ones or twos of Common Teal, Garganey and Shoveler seen at Sanku during the period 31/8-3/9.

ACCIPITRIDAE AND FALCONIDAE (RAPTORS)

Few definite migrant raptors were seen. There were two records of Marsh Harrier, including one at Sanku flying north. A group of three Booted Eagles went south at Sanku on 25/8. Another on 8/9 might have been a migrant.

Tree Pipit

Full-grown birds were caught at Sanku on 7/9 (2) and 9/9. The first two individuals had no fat deposits, but the third had small amounts. The breeding range of the Tree Pipit (A.t.haringtoni) may include Ladakh (Meinertzhagen, 1927), so the status of these individuals is uncertain. Since all records are from the final few days of the study, and since none were recorded in the Suru Valley in July 1980 (Southampton University, 1980 Report), it is possible that these were migrants, and that peak passage in 1983 did not occur until after recording had finished.

Motacilla

Two species of wagtail were recorded in Ladakh, namely Citrine (Yellow-headed) and Pied (White).

Citrine Wagtail

The species was recorded at all sites, but was commonest at Sanku where the river widened. A total of six adults and 27 first years were ringed. One very recently fledged juvenile was caught at Parkachik, so local breeding was occurring during the study. Of the six adults caught, two had not started to moult, and another had just started, also suggesting that some birds

were still breeding or had only recently finished. However it must be noted that many adults at Haigam had not started, or only recently started moult (this report, and Holmes, 1979), suggesting that many individuals migrate from the hills before moulting.

There was evidence at Sanku of birds moving within the valley. Numbers seen increased during August, and peaked in early September. This pattern was also seen in the ringing totals (Figure 1). None of the 26 birds caught at Sanku were retrapped, suggesting that even at the population peak there may have been some turnover. In general individuals had little fat, but six first years at Sanku had some fat, with a maximum score of eight.

Pied Wagtail

As with the Citrine Wagtail this species was most common at Sanku, but was recorded from all other sites. A total of eight adults and 15 first years were ringed. The numbers present at Sanku built up to 40+, peaking at the end of August, slightly earlier than the Citrine Wagtail. The moult was more advanced than in the Citrine Wagtail, with all adults caught in August in moult. By 8/9 one adult was in complete new plumage. The majority of birds had no fat, but five had substantial deposits, with one individual weighing 29.2g (fat score nine, mean for all

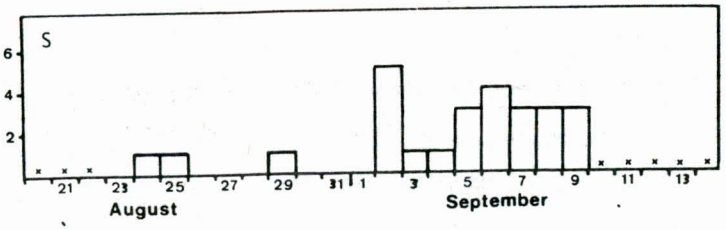


Figure 1 - Numbers of Citrine Wagtails trapped at Sanku

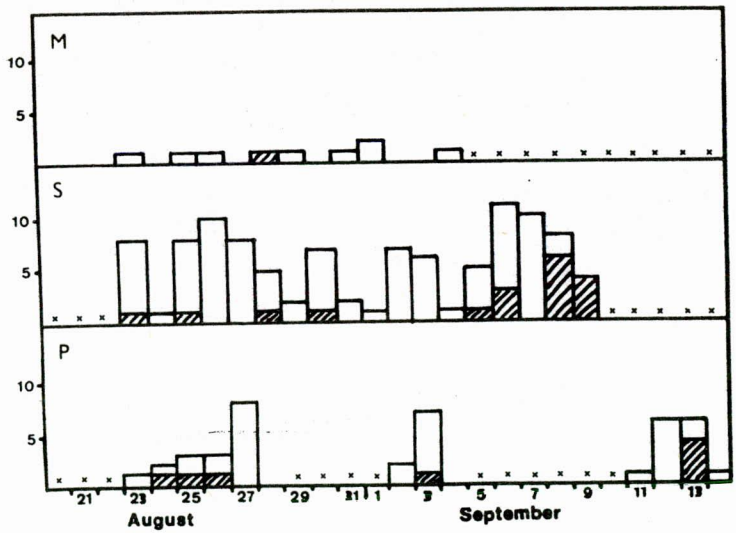


Figure 2 - Numbers of Bluethroats trapped
(hatched = adults, unhatched = first years)

TURDIDAE (THRUSHES)

Bluethroat

This was the only Luscinia species recorded in the Suru Valley during the present study. The species was common at Parkachik, and abundant at Sanku, but much less common at Mingi. Altogether 21 adults and 98 first years were ringed, with the daily catching rate at each site being relatively constant (Figure 2). Retrap rates were high: at Mingi 29% (two out of seven birds), Sanku 17% and Parkachik 36%. The higher Parkachik figure probably reflects the greater insularity of the site, which is much smaller than the vegetated area at Sanku. Intervals between first and last capture ranged up to 19 days for adults and 17 days for first years at Parkachik. The maximum interval at Sanku was only seven days, but this probably reflects the change in ringing site.

This data is compatible with the continual presence of many local birds throughout the study. At Sanku six first years were still in distinct juvenile plumage and eight (out of 15) adults were in wing moult, suggesting that the breeding season had only recently finished. The season at Sanku appears to have been slightly behind that at the other sites since no juveniles or moulting adults were caught elsewhere. The proportion of birds carrying fat was also significantly higher at Parkachik (28%)

than at Sanku (10%, $P<0.01$) as might be expected if breeding had finished earlier at Parkachik.

Although many local birds were apparently still resident, there may also have been migrants passing through or local birds departing. Migrants had started to appear in the Vale of Kashmir as early as 9/8 (this report). A first year caught at Parkachik on 27/8 and retrapped six days later had gained 2.4g, so may well have been preparing to migrate.

Other evidence for active migration comes from the observation that in the last few days of the study (6-13/9) there were days when the proportion of adults in the catch was much greater than usual (Figure 2). It is conceivable that this is due to birds having finished moult and starting to move about more, thus becoming more prone to capture. The sudden synchronous appearance of many adults however suggests that an influx of migrants is more likely.

One additional point to emerge was the large sex imbalance of Bluethroats in the Suru Valley. The Southampton University Expedition, 1980 (see 1980 Report), found a similar situation in the nearby Upper Indus Valley. The sexing criterion is that females have little blue on the breast and none on the throat (Ali and Ripley, 1983; Svensson, 1983). Using this character, 86% of the adult Bluethroats trapped were males. For first years

which had completed the post-juvenile moult 68% were males, 26% females and 5% indeterminate (both adults and first years significantly different from 50:50 at $P<0.01$).

Several explanations can be put forward to account for this anomaly. It may be that some birds have been wrongly sexed; adult females and first year males of the subspecies that occur in Europe, L.s.svecicus and L.s.cyanecula, can have similar amounts of blue (Svensson,1983). However, slight plumage differences between adults and first years leading to good ageing characters (Svensson, 1983) makes this unlikely to be a major source of error. The similar retrap rates (22% for males cf 26% for females) discounts the possibility of males being easier to catch. It is possible that females of the populations involved develop more blue than is normal for the more studied races, with the presence of indeterminate individuals hinting at a spectrum of 'blueness'. However the species is common, and has been collected in some numbers in Ladakh, so that it would be expected that any doubt as to the reliability of this character would have been noted before.

Finally it may be that there is a real sex imbalance. It is unlikely that such a marked excess reflects differential mortality between the sexes. A more likely explanation is that males and females have a different migratory strategy, either as regards route or timing (cf the Ruff Philomachus pugnax, where

sexual differences in timing of autumn migration and wintering area are well known (Cramp and Simmons, 1983)). Further investigation is needed to solve this problem.

Black Redstart

Many of the Phoenicurus species in the Himalaya are altitude migrants. The Black Redstart was recorded as common at all sites, and a total of 14 adult males, 17 adult females and 49 first years were ringed. Catch rates were usually in the range of 1-4 birds per day (Figure 3), though larger catches were made at Baru on 17/8 (nine) and Parkachik on 12/9 (ten). The retrap rate was 15%, with no differences observed between age classes or sites. Intervals between first and last capture ranged from 2-14 days.

During August all adults caught were in wing moult, with some having finished by the second week in September. Many of the first years were in post-juvenile body moult. It is likely that the birds present were from the local breeding population. The occasional elevated catches were possibly due to flocking, although the large catch at Parkachik on 12/9 might represent a small arrival of birds from higher up the hills.

Of 80 birds caught, only two (an adult male and a first year) had visible fat.

SYLVIIDAE (WARBLERS)

Acrocephalus

Many species of Acrocephalus warbler from the Palaearctic region winter in the Indian sub-continent, and there are records of several on migration in Ladakh (Ali and Ripley, 1983; Southampton University, 1980, 1981/1982 Reports). During the present study two Blyth's Reed Warblers were caught, one at Sanku on 9/9 and the other at Parkachik on 12/9. Both were first years, and were carrying slight fat reserves.

The passage period for Blyth's Reed Warblers in the Upper Indus Valley in 1980 was found to be September (Southampton University, 1980 Report). In 1978, one individual was caught at Rangdum on 29/8, and another at Parkachik on 30/8 (Holmes, 1979). In 1983, one reached the Vale of Kashmir as early as 13/8 (this report). However, the fact that both individuals trapped in the Suru Valley in 1983 were caught in the last four days of the study suggests that in 1983 the peak passage of this species through the Suru Valley may not have been until after mid-September.

Sylvia

The genus Sylvia has its centre of distribution in the

Western Palaearctic. However the breeding range of the Lesser Whitethroat extends to N.W.India, and two other species occur in winter (Ali and Ripley 1983). Recent Southampton University expeditions to Ladakh have recorded other vagrant species (see 1980, 1981/1982 Reports). In the present study the species recorded were Barred Warbler and Lesser Whitethroat.

i) Barred Warbler

A first year with moderate fat reserves trapped at Parkachik on 2/9 is believed to be only the fifth record for the Indian sub-continent. This species breeds across Siberia as far east as the Altai and western Mongolia, and winters in Arabia and Africa. The individual caught was undoubtably on migration to its winter quarters. As the most recent previous records of Barred Warblers in India were from the Upper Indus Valley in autumn 1980 and 1981, it is tempting to suggest that this species is a regular passage migrant through the area. However the majority probably go round the Himalaya rather than over them.

ii) Lesser Whitethroat

This species was common in the north of the valley at Baru, Mingi and Sanku, with 110 birds ringed at these sites (Figure 4). Approximately 30 of these were adults, but age determination was sometimes a problem due to the possible presence of

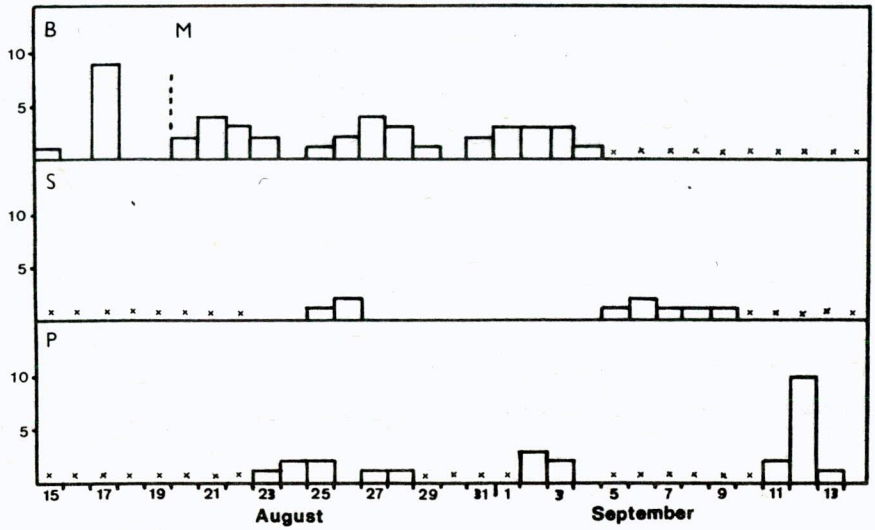


Figure 3 - Numbers of Black Redstarts trapped

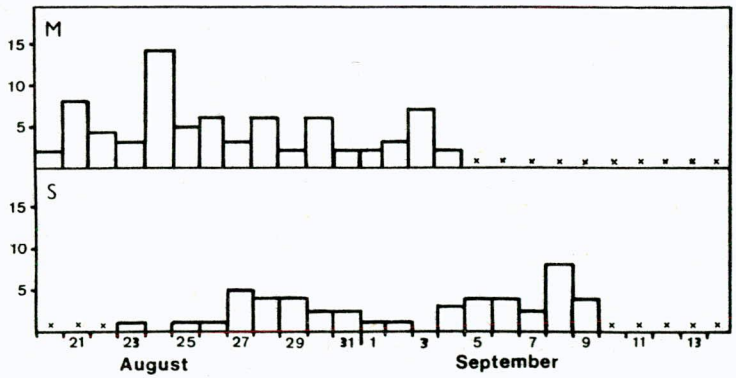


Figure 4 - Numbers of Lesser Whitethroats trapped

newly moulted adults in fresh plumage. This species was not recorded further south along the Suru Valley, although a juvenile with slight fat reserves was caught in Padum on 7/9. In the north of the valley Lesser Whitethroats were associated with buckthorn scrub, feeding on the berries, although none were observed in the buckthorn at Panikhar.

Catch rates at Mingi and Sanku were roughly constant from day to day, with the one exception of the catch at Mingi on 24/8 which was slightly in excess of the maximum expected from a Poisson distribution ($P<0.05$). There was no difference in retrap rates between the two sites. Of all Lesser Whitethroats caught, 17 (15.5%) were later recaptured, with two being retrapped twice. Intervals between first and last capture ranged up to eight days. These figures are compatible with a substantial proportion of the population being local birds. This is supported by the observation that many of the adults were in wing moult.

There was little sign of pre-migratory fat deposition; only two juveniles at Mingi, on 29/8 and 30/8, had in excess of a trace of fat. It may be that this species remained in the Suru Valley for some time after the expedition had departed. However, Lesser Whitethroats move out of the Upper Indus Valley in mid-September (Southampton University, 1977 Report), and probably leave the Suru Valley at the same time.

Although there is no evidence of substantial migratory movements of Lesser Whitethroats in the Suru Valley during the present study, some of the birds trapped may have been migrants. A single first year had reached Haigam by 19/9. The large catch at Mingi on 24/8 might have included migrants, and birds caught at Mingi on 31/8 and at Sanku on 6/9 with weights of 11.2 and 11.9g respectively, as opposed to the range for the rest of 13.5-16.3g, may also have been newly arrived migrants.

Phylloscopus

Sixteen species of Phylloscopus warbler have been recorded in Kashmir and Ladakh (Williamson, 1976; Ali and Ripley, 1983). Seven of these were found in the Suru Valley during the course of this study. Some were still on their breeding grounds, while others were probably migrants. Substantial differences were noted between the relative abundance of the commoner species at each site.

i) Chiffchaff

One individual without fat reserves was caught at Mingi on 30/8. This species is known to winter in the Himalaya, but not to breed (Williamson, 1976), so this bird was almost certainly a migrant.

ii) Mountain Chiffchaff

This species was common at all sites, with 46 adults and 124 first years ringed. Catch rates at each site were essentially constant with time (Figure 5) implying the absence of major migratory movements during the study period. Several adults were caught with active brood patches, and the capture of three newly fledged juveniles at Parkachik confirmed the presence of locally breeding birds.

The pattern of retraps was also consistent with the presence of resident birds at each site. The retrap rates were similar at all sites, with a compiled rate of 13% of adults and 9% of first years retrapped at least once. Two adults were retrapped twice. The difference between adults and first years is not significant. Intervals between first and last capture ranged fairly evenly from 1-10 days for adults and 1-11 days for first years. This pattern would be expected with a large resident population from which a small sample is collected every day. The implication is that at least the majority of Mountain Chiffchaffs caught were local birds, although the presence of a few migrants cannot be ruled out.

During the study 13 adult and 8 first year birds were recorded as carrying fat reserves. The average fat score of fat-carrying birds of both age classes is similar, but the pro-

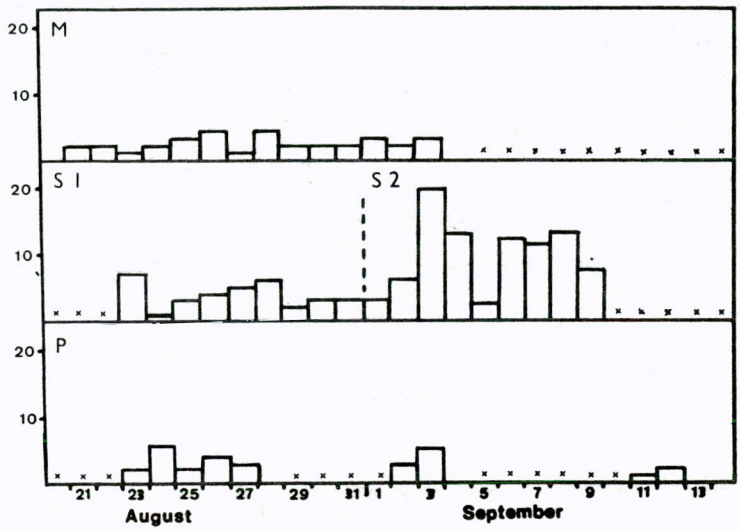


Figure 5 - Numbers of Mountain Chiffchaffs trapped

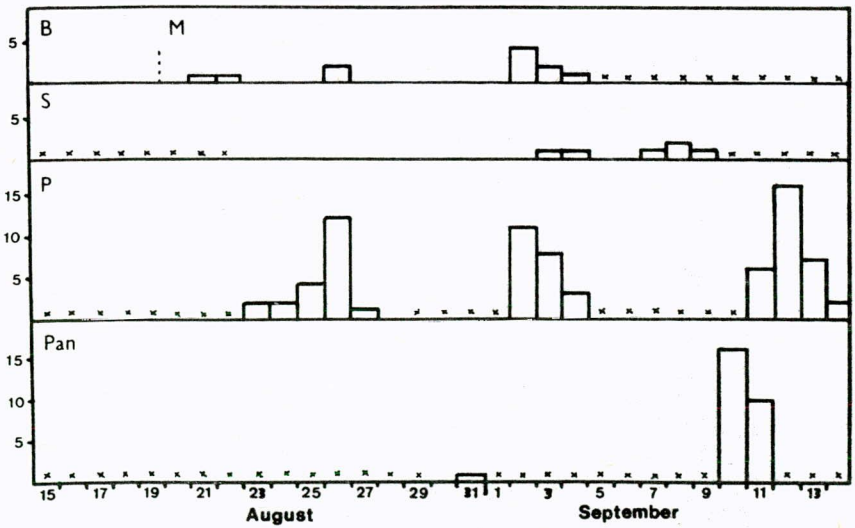


Figure 6 - Numbers of Yellow-browed Warblers trapped

portion of adults is significantly higher than that of first years ($P < 0.01$). This may indicate a difference in timing of migration between adults and first years.

All but one bird with fat were recorded at Sanku, the exception being an adult at Parkachik on 24/8. It appears that at the higher elevation at Parkachik the breeding seaon was later than at the lower two sites. This is confirmed by the capture of newly fledged juveniles in September at Parkachik, and because only three out of eight adults caught had started their post-nuptial moult. The paucity of fat birds at this site is thus understandable. At Mingi and Sanku the season was more advanced, with all adults caught at Mingi in moult even as early as 15/8, and only three out of 28 adults at Sanku (all three caught in August) not in moult. Since the moult starts after breeding (Williamson, 1976), the breeding season had essentially finished at these two sites. The number of Mountain Chiffchaffs caught at Sanku was 3-4 times higher than at the other sites, which suggests that the site was particularly favourable. It is possible that there was an abundance of food at Sanku, which allowed early fattening. Selective use of resticted localities for pre-migratory fattening is known in some species; see Bibby et al. (1976) and Insley and Boswell (1978) for details relating to the Sedge Warbler (Acrocephalus schoenobaenus).

iii) Tickell's Willow Warbler

Two adults and three first year birds were caught at intervals throughout the study. None were carrying fat, and the adults were in wing moult. It is likely that these birds were at or near their breeding area.

iv) Sulphur-bellied Warbler

Apart from the single bird caught on 7/9 in Padum, the only records of this species were of six individuals at Parkachik on 12 and 13/9. These comprised three full grown birds and three adults, of which two were in moult. As this area had been studied since 23/8, this represents a significantly non-uniform pattern of abundance. At least some of these individuals are likely to have been migrants, although probably only altitude migrants from elsewhere in Ladakh. None were carrying fat reserves.

v) Yellow-browed Warbler

In total, 109 individuals were caught, including 13 definite adults and 96 full grown birds. The species was common at Parkachik and Panikhar, but less so at Mingi and Sanku. The early work of Osmaston (1926-1927), and more recently a study including detailed observations at Panikhar (Southampton Univer-

sity 1980 Expedition), failed to record Yellow-browed Warblers in the Suru Valley during the breeding season, although they are known to breed in other areas of the N.W. Himalaya. The large numbers found during the present expedition are thus likely to have been migrants. All adults caught were completing or had completed moult, which is in line with the migrant hypothesis. Migrant Yellow-browed Warblers were also known to have reached the Vale by mid-September (this report).

The numbers of birds caught on each day in each site are shown in Figure 6. There is a significant tendency for numbers to increase with time, and over a shorter time scale there were fluctuations in catching rate consistent with falls of migrants. There are also fluctuations in the proportion of birds carrying fat reserves (Table 3). With catch rates elevated at more than one site on 26/8 and 2-3/9, these falls might involve arrivals along the length of the valley.

Retrap analysis at Parkachik, the only site with suitable data, showed that 9 out of 63 birds (14%) were retrapped. Five birds were last recorded within 1-3 days of ringing, but four were known to have been present for 7-9 days. All four of these long-staying birds were first caught on 26/8. An adult known to have stayed at least 11 days was caught at Mingi on 22/8. These birds may have represented local breeders, but it is thought more likely that they were migrants that had broken their migra-

Table 3 - Fat analysis of Yellow-browed Warblers

		AUGUST										SEPTEMBER												
		23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Parkachik	No. caught	2	2	4	12	1	0	-	-	-	-	11	8	3	-	-	-	-	-	-	6	16	7	2
	No. with fat ⩾ 2	0	0	0	0	0	0	-	-	-	-	7	3	0	-	-	-	-	-	-	0	1	2	0
Panikhar	No. caught	-	-	-	-	-	-	-	0	1	-	-	-	-	-	-	-	-	-	16	10	-	-	-
	No. with fat ⩾ 2	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	7	2	-	-	-

tion. The completion of long-distance migration in two or more distinct stages is a well established strategy (Dorst, 1962). Breaks between stages are usually short, with birds rapidly restoring energy reserves, but much longer intervals have been recorded in some situations (eg see Curry-Lindahl, 1981).

None of the long-staying Yellow-browed Warblers laid down any fat, suggesting that they would remain in the area for some time. Although Yellow-browed Warblers are known to winter in the N.W.Himalaya (Williamson, 1976), the harsh winter conditions in the Suru Valley make it unlikely to be a regular wintering area.

The records from 1978 (Holmes, 1979) and the present study appear to be the only observations of Yellow-browed Warblers from the Suru Valley, although Koelz (1939) thought the species to be not uncommon in Zanskar in September. Very few Yellow-browed Warblers have been recorded at Tikse by the Southampton University Expeditions.

vi) Large-billed Leaf Warbler

Only three individuals were caught at Mingi and Sanku in the north of the valley. The species was much more common further south, with a total of 14 adults and 18 first years captured at Panikhar and Parkachik. Two first years were caught at

Padum. An adult female trapped at Parkachik had been ringed as a first year at the same site by PH in 1978.

Several of the adults caught were refeathering brood-patches, so it is likely that at least some had bred in the area. At Panikhar and Parkachik, out of the 14 adults ringed 4 (29%) were retrapped at least once (two on two occasions, including the 1978 retrap), with intervals between the first and last captures of 11-17 days. The high frequency of retrapping, and the long retrap intervals relative to the length of the study period, are also compatible with the presence of local breeders. The retrap rate for first years (3 out of 18) was not dissimilar to that of adults, but the longest retrap interval was only two days. This suggests that the first years may be more mobile than the adults, having perhaps started to disperse or migrate.

During the study, 17 birds were caught carrying more than trace amounts of fat. The proportion of birds with fat was not significantly affected by either age class (40% of adults cf 50% first years with fat) or by date, although two retrapped adults were found to have started to lay down fat subsequent to their first captures on 26/8. It would appear that birds were starting to lay down fat in preparation for migration.

The numbers of individual Large-billed Leaf Warblers caught

each day at Parkachik are shown in Figure 7. There is a tendency for higher totals on earlier days. This was also seen at other sites, although the numbers involved were much smaller. Overall the trend is significant. In some species (eg see Bibby et al. 1976) it is known that fattening birds become more difficult to catch. However in the case of Large-billed Leaf Warblers it seems probable that some birds were actually leaving the area. The species was recorded in the Vale of Kashmir by mid-September (this report). None have been recorded from Tikse in the Upper Indus Valley (Southampton University Reports).

vii) Greenish Warbler (see note 1 in Suru bird list)

Two first year birds, neither carrying fat, were caught. One subspecies of Greenish Warbler (ludlowi) breeds in Kashmir, with another (viridanus) occurring on passage. Since both individuals had a short second primary, it is likely that they were ludlowi so the status of these two individuals is not known.

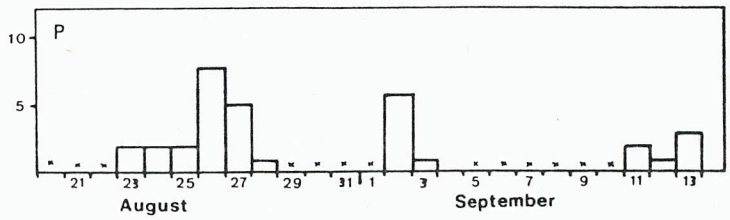


Figure 7 - Numbers of Large-billed Leaf Warblers trapped at Parkachik

FRINGILLIDAE (FINCHES)

Eurasian Goldfinch

Of the two Carduelis species that occur in the NW Himalaya, only the Eurasian Goldfinch was recorded during the present study. Although occasionally seen at other sites, it was most abundant at Parkachik where seven adults and four first years were ringed. Two females still had active brood patches, and five of the adults had not started their post-nuptial moult. Birds were thus still breeding or had only just finished. In addition two of the adults were retrapped 7-9 days after ringing, so that it seems likely that the local breeding population is involved. Increases in the catch rate as time progressed (Figure 8) presumably result from post-breeding flocking, which is typical of many finch species. All but one of the first years and three of the adults had fat reserves, which in some cases were substantial (maximum fat score of seven), so it would appear that birds were starting to prepare for migration.

Red-fronted Serin

This species was present in small numbers at all the major sites. A total of 15 adults and three juveniles were caught. At least one female still had an active brood patch, indicating that breeding was continuing. However eleven adults were in

wing moult, indicating that the main season was over. The birds were presumably from the local breeding stock; as with the Goldfinch, a tendency for the catch to increase with time (Figure 8) probably represents increased post-breeding flocking. Seven of the adults had started to lay down fat, but the amounts involved were mostly small.

Common Rosefinch

The Himalaya are the stronghold of the genus Carpodacus. However during the present study only the Common Rosefinch was observed in Ladakh (one other species was recorded near Gulmarg, in the Pir Punjals). The species was very common at all the major sites, with 403 adults and 86 first years trapped. Significantly fewer females were trapped than males ($P<0.05$). Since some females were caught with active brood patches, it is likely that these represent local breeders, and that the slightly lower numbers of females caught was due to some breeding continuing.

The breakdown of the daily catching rates is shown in Figure 9. Until 30/8 catch rates were generally in the range of 1-10 per day. The catch at Parkachik on 26/8 is significantly higher, and with the catch at Mingi on the same day also slightly elevated it is possible that migrants were involved.

By the first few days of September catch rates had increased substantially. The new birds contained a higher proportion of juveniles than in the initial population (Figure 9). These were not very recently fledged juveniles, implying that this was not just the local fledging of juveniles.

Retrap analysis showed no significant difference in the retrap rate between sites. In total 34 birds were retrapped, with intervals between first and last capture of up to 18 days for males and 19 days for females (both at Parkachik, which was studied over a slightly longer period than the other sites). Clearly some birds were remaining in the area throughout the study.

More detailed breakdown of the retraps shows that no first years were recaught (significantly different from adults at $P<0.01$). Of the 34 (9%) of adults retrapped, nine (26%) were retrapped more than once. This figure is in excess of that expected if all adults behaved similarly. Sex differences do not account for the effect. Instead it would appear that there are two classes of adults, one (local breeders?) with a higher retrap rate and another (passage birds?) with a lower retrap rate.

Analysis of the fat reserves (Table 4) shows a sharp rise in the proportion of birds carrying fat, which coincides with the period when numbers are increasing. From early September

Table 4 - Fat analysis of Common Rosefinches

		AUGUST												SEPTEMBER												
		20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mingi																											
Adults	No. caught	0	0	1	1	2	6	9	3	3	2	8	17	16	33	11	10	-	-	-	-	-	-	-	-	-	-
	No. fat ≥ 2	0	0	0	0	0	1	3	1	2	1	6	14	12	27	8	9	-	-	-	-	-	-	-	-	-	-
	No. fat ≥ 6	0	0	0	0	0	0	0	0	2	0	1	4	3	14	4	5	-	-	-	-	-	-	-	-	-	-
1st	No. caught	0	0	0	0	0	0	0	0	0	0	2	3	2	7	3	5	-	-	-	-	-	-	-	-	-	-
years	No. fat ≥ 2	0	0	0	0	0	0	0	0	0	0	1	3	1	3	2	2	-	-	-	-	-	-	-	-	-	-
	No. fat ≥ 6	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	-	-	-	-	-	-	-	-	-	-
Sanku																											
Adults	No. caught	-	-	-	0	5	8	4	3	3	1	2	2	10	12	19	14	6	18	9	13	7	-	-	-	-	-
	No. fat ≥ 2	-	-	-	0	0	3	1	3	2	1	1	1	9	10	11	9	5	15	7	7	4	-	-	-	-	-
	No. fat ≥ 6	-	-	-	0	0	0	1	2	1	1	1	0	6	3	4	3	2	7	0	3	1	-	-	-	-	-
1st	No. caught	-	-	-	0	0	2	1	1	0	0	0	0	1	1	1	2	1	2	1	3	3	-	-	-	-	-
years	No. fat ≥ 2	-	-	-	0	0	1	0	1	0	0	0	0	1	1	0	0	0	2	0	0	1	-	-	-	-	-
	No. fat ≥ 6	-	-	-	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	-	-	-	-	-
Parkachik																											
Adults	No. caught	-	-	-	3	4	6	18	6	4	-	-	-	-	20	27	26	-	-	-	-	-	-	17	29	24	10
	No. fat ≥ 2	-	-	-	0	1	0	0	1	0	-	-	-	-	15	21	18	-	-	-	-	-	-	12	21	20	5
	No. fat ≥ 6	-	-	-	0	0	0	0	0	0	-	-	-	-	3	2	2	-	-	-	-	-	-	1	2	2	0
1st	No. caught	-	-	-	0	0	0	0	0	0	-	-	-	-	0	8	2	-	-	-	-	-	-	6	16	8	2
year	No. fat ≥ 2	-	-	-	0	0	0	0	0	0	-	-	-	-	0	0	0	-	-	-	-	-	-	2	7	4	0
	No. fat ≥ 6	-	-	-	0	0	0	0	0	0	-	-	-	-	0	0	0	-	-	-	-	-	-	0	0	0	0

onwards several birds were carrying substantial fat deposits. It is apparent that the newly arriving birds were carrying more fat than those present at the start of the study. The situation was similar at each of the three main sites, with approximately 75% of the adults and 42% of the first years carrying fat in early September. The proportion of first years carrying fat is significantly less than that of the adults ($P<0.01$). First years with fat were also carrying less fat than adults with fat.

Some differences were noted between sites. At Mingi, a significantly higher proportion ($P<0.01$) of third year plus males had fat scores of 6+ compared to other adults (females and second year males were not separated at this site). At Parkachik there was no significant difference between the amount of fat on second year compared with 3+ year males. There appeared to be a trend for males of all age classes to have more fat than females, although the difference was not quite significant. At Sanku no sex difference was observed. This may well reflect slightly different timings of the breeding season at the three sites. Females still breeding or only recently finished might be expected to show little fat deposition, and so depress the average recorded.

From the results presented it can be seen that some Common Rosefinches remained at or near the breeding areas during the course of this study. From the last few days of August numbers at all sites were increased by the arrival of new birds which were more dispersive and which had more extensive fat deposits. As with the other finch species discussed earlier, this could reflect increased post-breeding flocking of local birds. There was probably an element of this involved, indirect evidence being that there was no obvious refeathering on the brood patches of females trapped. Migrant females might have been expected to have refeathered their brood patches.

As the Common Rosefinches which breed in Central Asia and winter in peninsula India are from the race C.e.erythrinus whereas Ladakh breeding birds are from the race C.e.ferghanensis (Ali and Ripley, 1983), it might have been possible to identify some individuals as migrants. However the differences between subspecies are small, and there is wide variation within subspecies, so field taxonomy was not useful. It was observed at Parkachik that the amount of red on 3+ year males was noticeably more or less extensive, which might indicate the presence of more than one subspecies.

Other observations are consistent with the migration of Common Rosefinches through the Suru Valley. The pattern of capture of first years in particular is unusual. At Mingi and Par-

kachik especially, the initial proportion of first years present was low. With the influx of new birds the proportion rises. The initial population is clearly first year depleted. There is some late breeding - a female was carrying an egg at Parkachik on 26/8 - but this was not enough to explain all the increase in first years noted, especially since the majority of first years caught were not newly fledged. These fluctuations could be explained by flocking, but two additional pieces of evidence favour migration as an important factor. There were no retraps of first year birds, and those migrants that had reached Haigam by mid-September were mostly first years (29 out of 39). The pattern of fat deposition in these Haigam birds was similar to that seen in the Suru Valley, with the adults heavily laden with fat, but the juveniles with very little. These age differences may indicate different migratory strategies, with first years migrating less far, or in shorter steps.

Conclusions

The literature on the birds of Ladakh is sparse; the only detailed information relating to the Suru Valley comes from the collecting trips of Osmaston (1926) and a recent census in July 1980 (Southampton University, 1980 Report). The information we report for the period of mid August to mid September 1983 is thus a substantial addition to knowledge of the area.

During the study period, many species of local breeding bird were still present in large numbers, though some such as Large-billed Leaf Warbler had apparently started to leave the area. Fat deposition was noted in a number of species whereas in others, particularly Lesser Whitethroat and Black Redstart, no significant fattening had occurred. The study was not of a sufficient duration to determine how much of the variation in fat reserves between species was due to differences in timing of deposition, rather than differences in degree of fattening. The amount of fat a bird lays down is related to the distance of the migratory flight to be undertaken (Odum, 1960). Certain species such as the Common Rosefinch, in which fat reserves were already substantial, could be identified as likely long distance migrants.

In addition to local birds, the Suru Valley also receives a variety of species which are clearly migrants. These include various ducks, raptors, waders, and passerines such as Blyth's Reed Warbler and Barred Warbler. There was also evidence for the occurrence of migrant individuals of several species which also breed in the area. The actual area of origin of these birds is not clear from the present study, but would be clarified by ringing recoveries.

Our observations suggest that the Suru Valley may be a significant migration route. However in the case of much

non-passerine migration, the Suru Valley is apparently less important than the nearby Upper Indus Valley, as shown by the greater number and variety of waterfowl, waders and gulls/terns in the latter reported by the Southampton University Expeditions (1976, 1977, 1980, 1981/1982 Reports). This may also be true for raptors, although much raptor passage occurs after the present expedition finished (Southampton University, 1980, 1981/1982 Reports). In the case of passerines, the relative importance of the two valleys is difficult to assess in detail since peak passage occurs during September-October (Southampton University, 1980, 1981/1982 Reports). The common early migrants in the Indus Valley, such as Blyth's Reed Warbler and Tree Pipit, were also caught in the Suru Valley. In addition some species, such as Yellow-browed Warbler, were more common in the Suru Valley than in the Indus Valley. With the number and variety of migrants increasing towards the end of our study, it seems possible that the Suru valley may approach the Indus Valley in importance for passerine migration.

By the nature of our ringing activities, migrant passerines were primarily encountered in areas of vegetation. Rainfall is rare in the Suru Valley, so birds do not often encounter the conditions where they would be forced down as 'falls'. On the one wet day recorded, at Parkachik, there was no noticeable increase in the numbers of birds present. The situation may be different later in the year. The Southampton University

1981/1982 Expedition recorded some falls following bad weather in late September/early October. The migrants that are present are apparently deliberately breaking their migratory flight to feed or rest, and this break may be up to a week or more in some cases.

In future studies it might be worthwhile trying to look for signs of continuing daytime passerine movements, although during the period of the present expedition IS spent up to four hours per day looking for such movements, without success. Nocturnal movements of birds not normally stopping in the valley could also be examined by the use of bright lights to attract the birds down (cf Pearson and Backhurst, 1976; see Mead, 1983).

By catching and ringing birds at several sites we had hoped to examine if birds, whether migrants landing in the Suru Valley or local breeders, gradually filtered along its length before migrating on. No movements of ringed birds between study sites were recorded, but this result is probably of no significance. Details of the movements of birds within the valley are thus still lacking.

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* Reference work not quoted in text.

APPENDIX 1 - Ringing totals at Haigam

Species	9/7-20/8	17-20/9
Little Bittern	125	
Water Rail	2	
Pheasant-tailed Jacana	1	
Painted Snipe	1	
Little Ringed Plover	1	
Little Stint	7	
Temminck's Stint	11	
Redshank	1	
Wood Sandpiper	1	
Common Sandpiper	2	
Collared Dove	5	2
Common Kingfisher	297 (+112)	(47)
White-breasted Kingfisher	2	
Kashmir Roller	1	
Hoopoe	1	
Wryneck	1	
Brown-fronted Pied Woodp.	1	
Plain Sand Martin	50	
Swallow	1228*	34
Tree Pipit		1
Citrine Wagtail	58	13
Pied Wagtail	9	3
White-cheeked Bulbul	2	
Bluethroat	18	22
Tickell's Thrush	15	
Swinehoe's Reed Warbler	9	
Paddyfield Warbler	1	
Blyth's Reed Warbler	1	
Clamorous Reed Warbler	320	1
Lesser Whitethroat		1
Yellow-browed Warbler		2
Large-billed Leaf Warbler		1
Greenish Warbler	1	
Slaty-blue Flycatcher	1	1
Paradise Flycatcher	5	
Grey Tit	46	3
Rufous-backed Shrike	12	
House Crow	1	
Jackdaw	1	
Starling	17	2
Common Myna	1	
House Sparrow	**	8
Common Rosefinch		39

Figures in brackets for kingfishers are birds tail-clipped after ring supply expired. * Many swallows released unringed. ** All house sparrows released unringed.

APPENDIX 3

Hokasar game reserve; a comparison with Haigam.

Hokasar is situated about 15km west of Srinagar. It is only a tenth of the area of Haigam, and at least two-thirds of the reserve is open water. Like Haigam it is used for duck-shooting in winter. In summer it is relatively undisturbed, with entry by permit only. The reserve was visited on 27/9 by AG, when the following species were recorded (numbers are minimum estimates).

Paddybird	(40)
Little Egret	(52)
Grey Heron	(35)
Pintail	(30)
Teal	(10)
Mallard	(30)
Wigeon (Anas penelope)	(10)
Garganey	(5)
Shoveler	(60)
Duck sp.	(350+)
Black Kite	(5)
Water Rail	(1)
Baillon's Crake	(1)
Moorhen	(70)
Pheasant-tailed Jacana	(12)
Black-winged Stilt	(1)
Spotted Redshank	(1)
Greenshank	(130)
Common Sandpiper	(2)
Common Kingfisher	(5)
White-breasted Kingfisher	(1)
Citrine Wagtail	(200)
Starling	(5)

The numbers of Greenshank present were remarkable. Also notable were the large numbers of duck present, at least 500. Many of these remained unidentified due to poor light condi-

IS, MH and BH returned to Kargil on 11th September. PH and AG spent a few more days near Nun-Kun before moving back to Panikhar on 14/9. PH returned to Haigam from 17-20/9, and AG followed on 22-23/9.

APPENDIX 5 - Equipment report

Rings

Rings were kindly provided by the Bombay Natural History Society. In addition we had permission from the British Trust for Ornithology to use British rings on Common Kingfishers (size SO), for which no suitable Indian rings exist. As Indian rings are pure aluminium, it was decided to ring all waders caught above the tarsus to prolong ring life.

Nets

Mist-nets used were predominantly 2.5m high Japanese standard mesh nets, in lengths from 6-20m. In addition a small number of both normal mesh and superfine Gundry nets were used. At Haigam much of the netting was conducted using lines of longer nets, whereas in the Suru Valley nets were set singly and all sizes proved useful.

During the expedition the nets suffered significant wear

and tear. Little Bitterns have serrations on the beak, which frequently led to bad tangling of the net and the production of small holes. In the Rakh, erecting and operating nets from punts was not without its problems, and nets were sometimes holed by the boats.

Domestic animals were also a problem. At Haigam, two nets were damaged by cows. Several nets were damaged in the Suru Valley, and one 9m net was totally destroyed by a mixed flock of sheep and goats.

Other ringing equipment

We obtained 2m and 4m bamboo poles in Srinagar. The 4m poles were used in sites around the Rakh. To operate in the Rakh itself we lashed together 2m and 4m poles to produce poles about 5.5m long. These were only just long enough.

Standard ringing equipment (wing rules, balances etc) was brought out from Britain. With care Indian rings can be closed with B.T.O. pliers. Since many of the birds are European or Palearctic, standard reference works were very useful. In particular the Svensson guide to European passerines and the Williamson warbler guides were invaluable.

Nylon guy cord was brought out from Britain. This was

found to be very popular with the local people, and both at Haigam and in the Suru Valley guys sometimes disappeared from nets left furled overnight. We recommend future expeditions to take a large excess!

Miscellaneous equipment

At Haigam, punts were kindly provided by the Kashmir Department of Game. A pair of chest waders (brought from Britain) were useful, especially for survey work in the more densely vegetated areas of the Rakh.

Pifco headlamps were useful for ringing at dusk, although the severe problems with mosquitos at Haigam meant that ringing sessions were normally terminated before it was completely dark.

APPENDIX 6 - Medical report

Before departing all expedition members except HH and AP had the following vaccinations - Cholera, typhoid, paratyphoid, rabies, beta-gammaglobulin. HH and AP did not have the rabies vaccination. During the expedition all members took Maloprim anti-malarial tablets as prescribed.

Health at Haigam was generally poor, due to insanitary conditions existing in the area. The local people were also often

in poor health. All expedition members suffered from enteric complaints at some time. Because of the crowded conditions it was difficult to stop these spreading between members. Intestinal parasites identified from stool samples on our return were Campylobacter enteris (1 person), Giardia lamblia (1 person), Ascaris lumbricoides (2 people) and Entamoeba coli (1 person). It is likely that this is an incomplete list.

Whilst working in shallow water at the edge of the Rakh, several expedition members were affected by an irritating rash that we termed 'Rakh itch'. This rash did not occur if the legs and feet were kept covered by trousers and shoes. This rash was probably cercarial dermatitis caused by the invasion of the skin by the cercariae of avian schistosomes which are otherwise non-pathogenic.

Despite the poor state of health in Haigam, very few man-days were lost to illness. All members continued to work despite extreme discomfort. The amount of illness might have been worse if it had not been for the successful control of houseflies in the Tippenshed with a Vapona strip brought out by HH and AP. This also reduced the numbers of mosquitos, and remained effective for a month.

Two of the five members who travelled to the Suru continued to suffer there from intestinal complaints brought with them.

The health of the other members improved rapidly.

APPENDIX 7 - Filming report

The following filming equipment was supplied by the B.B.C.

Main camera - Beaulieu 6008S

Backup camera - Braun Nizo 801

Panasonic cassette recorder RQ335

Dynamic microphone AKG D190

Sennheiser Electret gun microphone

Headphones

Heavy duty battery pack for Beaulieu (adapted for Braun)

Small Beaulieu battery charger

Braun NiCd battery box

Short and long microphone leads

Microphone lead extender (8m)

Tripod (replacement brought out by HH and AP)

Film - 90 minutes highlight Kodachrome, 60 minutes lowlight Ektachrome; divided into sound (Beaulieu only) and silent (both cameras). Due to failure of Beaulieu most sound film unused - used 60 minutes of silent film (half of which had been bought by the expedition as a precaution).

Major equipment faults/failures were -

1) Light meter (auto and manual) on Beaulieu failed to work

2) NiCd battery charger for Braun actually discharged NiCd cells

In addition, we are indebted to the following people for their support, help and advice in organising and conducting the expedition.

Mr. and Mrs. Holmes for once again allowing their house to be turned into a transit camp.

All the parents of expedition members.

The British Pharmaceutical Industry for providing medical equipment.

Dr.B.E.Juel-Jensen, for medical advice.

The staff of the British Museum (Natural History), Tring, for letting us examine specimens from the collection.

The British Trust for Ornithology for allowing us to use British Kingfisher rings.

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Our special thanks go to our friends in Kashmir.

Mhd. Ranzan Dar, Reserve Manager, Haigam Rakh, and all the reserve guards, for their constant help.

Shabeer and Moqbool in Haigam, for their friendship and company in many a long discussion.

Naseema War and her family in Hanjypura, for inviting us to join in the family's wedding celebrations.

Mhd. Gulum Hassan, and all the people of Haigam and Hanjypura villages for welcoming us like members of their own families.

To Mhd. Yosuf Dar and his wife, his father and mother, and his

Plate 1 - Young Little Bitterns, showing the size difference of nestlings. The egg hatched soon after the photograph was taken.

Plate 2 - The study site at Mingi

Plate 3 - View across the Sanku area

Plate 4 - The ringing site near Parkachik

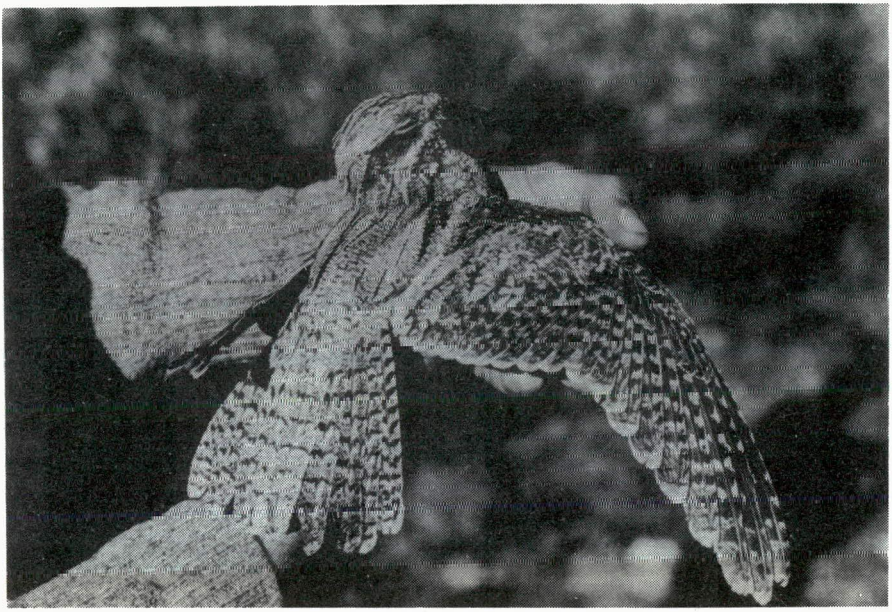

Plate 5 - European Nightjar Caprimulgus europaeus

Plate 6 - Barred Warbler Sylvia nisoria

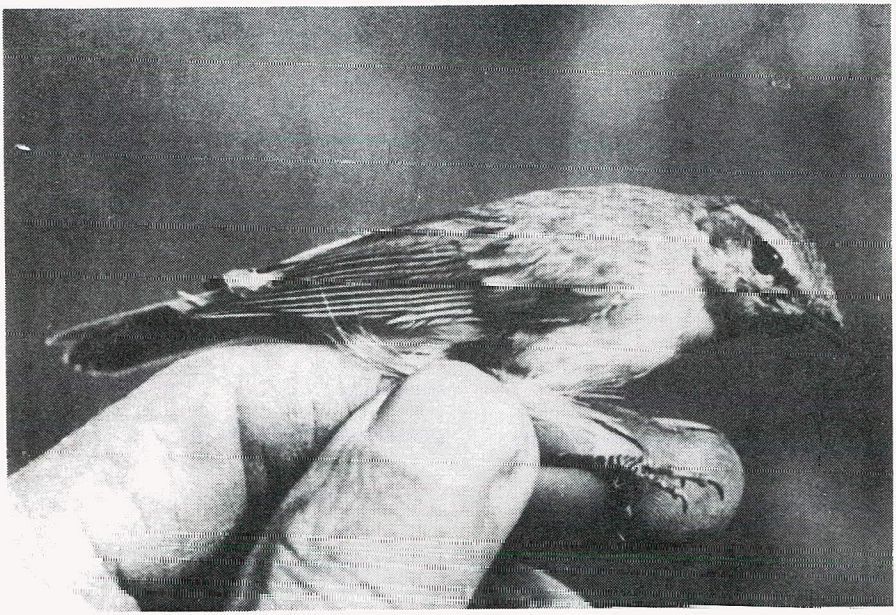

Plate 7 - Large-billed Leaf Warbler
Phylloscopus magnirostris

Plate 8 - Fire-capped Tit Cephalopyrus flammiceps