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NO. 7

BREEDING BIRDS OF THE SOUTH PENNINE MOORS

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Report title: Breeding birds of the south Pennine moors.

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Comments: This report provides the results of the 1990 systematic survey of the moorland breeding birds of the S.Pennines, 725km² between Skipton in Yorkshire and Leek in Staffordshire. 27 bird species were found breeding and accounts for each include historical data and information on distribution, abundance and density. These latter are compared with similar data from elsewhere in Britain. Maps showing distribution at two scales (for overview and for detail respectively) accompany the accounts. Data collected in 1990 are compared with those from previous national, regional and local surveys and trends in distribution and, where possible, abundance in the study area, are identified. The S.Pennines are much disturbed by recreational pressures. The impacts on birds are briefly reviewed and measures to protect birds at risk are discussed. Current protection afforded the breeding bird population of the study area is evaluated.

Restrictions: Three versions of this report have been produced. Two contain information on the location of breeding pairs of rare and often persecuted raptors. Those copies of the report marked 'In Confidence' contain the results of the JNCC survey conducted in 1990 and are available to JNCC and those who co-funded the survey. A limited number of copies incorporate information kindly supplied by individuals and groups who monitor the breeding performance of raptors in the area. These reports are marked as 'In Strict Confidence' and are not available outside JNCC and NCCE (Midlands and North-West Regions). Those with a bona fide interest may, however, approach the above to seek access to this information. Unmarked copies of the report do not contain locational information on rare birds and their circulation is unrestricted.

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Dr. C.A.Galbraith
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CONTENTS

SUMMARY

The South Pennine moors are here defined as the unenclosed uplands betweeen Skipton (Yorkshire) in the north and Leek (Staffordshire) in the south. These moors mainly overlie rocks of the Carboniferous millstone grit series and are thus quite distinct from the upland grasslands to the north and south. This report describes the distribution and numbers of birds found breeding on these moors during a systematic survey carried out between 12 April and 28 June 1990. A total of 725 km^2 of moorland was visited twice - the whole of the S.Pennine moorlands other than for small outlying areas of less than 4km^2. This is the first time a comprehensive statement of the breeding bird fauna of this important area has been made.

Data concerning the distribution and numbers of twenty-seven species of breeding birds are presented, together with observations on two non-breeding birds of exceptional conservation importance. Each species account gives a brief history of the species in the area as extracted from county avifaunas, reports on distribution and numbers in 1990, provides values for breeding densities, where possible, and compares these to a wide range of data derived from moorland bird surveys conducted elsewhere. Each account is accompanied by a map of the study area showing the distribution of records such that a clear impression of the overall distribution of the species in the study area is given. A series of maps at the rear of the report repeat this information but at a much larger scale, allowing more accurate pinpointing of records. Because of this, each of these maps is divided into seven parts (a key to parts being provided).

Data collected during the survey concerning the distribution and abundance of ten selected species are compared, where possible, with data from national, regional and local surveys conducted during the last 20 years within the study area. The comparison suggests that whilst merlin peregrine and (possibly) curlew have increased in range and abundance, there has been no marked change in distribution of red grouse, golden plover, short-eared owl or twite. Numbers of golden plover do not appear to have declined during the 20 year period since first surveyed. Data for dunlin, ring ouzel and wheatear could not be compared rigorously.

The S.Pennines are amongst those UK uplands most disturbed by man through varied recreational use of the moors. The data available concerning the effects of recreational disturbance are briefly reviewed and simple guidelines for minimising any impacts are recommended, notably the creation of temporary sanctuary areas during the breeding season.

The moors are clearly of national importance, holding some 10% of British breeding merlin, 3% of golden plover, 1.6% of dunlin and 2% of curlew. The density of golden plover is relatively high and the population of twite is isolated from others in Europe (and these from the Asian population). The populations of merlin, red

grouse, golden plover, dunlin, short-eared owl and twite are the southern-most viable populations in England. Much of the resource is not currently within protected SSSI's although much lies within the Peak District National Park and the Peak Environmentally Sensitive Area.

A subsequent report concerning the breeding birds of the S.Pennines will detail the relationships between birds, topography, vegetation and other features of their habitats.

'There is little in the way of bird life in these wild places, the red grouse barely manages to survive and even the hardy meadow pipits are few in number.'

A.H.V.Smith (ed.) on the birds of the Peak moorland plateau *in* Birds of the Sheffield area, Sheffield city Museums and Sorby Natural History Society, 1974.

INTRODUCTION

This report is concerned with the distribution and abundance of a limited number of bird species which nest on the unenclosed moors of the south Pennines, that area of Pennine upland to the south of the market town of Skipton in Yorkshire. Although many bird species nest on the moors in this area, those such as the blue tit, chaffinch, wren, tree pipit and kestrel cannot be considered *moorland* birds as the vast majority of their kind nest in other habitats. They have not therefore been considered here.

The opposite is true of such species as the golden plover, dunlin, merlin, short-eared owl, ring ouzel and twite; moorlands provide a nesting ground for the great majority of their species. This report is primarily concerned with these species and also those such as curlew, lapwing and redshank which nest on the moorland fringe and for which the moorlands clearly hold significant fractions of their total populations. These species cannot be truely considered as *moorland* birds as just as many nest on our salt-marshes, in agricultural fields or lowland wet meadows. Table 1 lists those species which were surveyed, together with their latin names.

The moors of the south Pennines present a diversity of breeding bird habitats. The vast blanket bog of the plateau supports breeding golden plover, dunlin andmeadow pipits. On the more well-drained, gentle slopes, breed twite, curlew, red grouse and the short-eared owl. Peripheral areas of acid grassland and *Juncus* flushes may hold dense populations of curlew, snipe and lapwing whilst cloughs, tors and gritstone edges, with their associated rock litter and bracken are characterised by breeding ring ouzels, whinchats and wheatears. The larger rivers dissecting the area, together with the shores of the many reservoirs, hold little ringed plover, common sandpiper, dipper and grey wagtail.

As in all moorland areas, there have been significant losses of these habitats through agricultural 'improvement', poor management of burning and grazing regimes and plantation afforestation. Few moorland areas, however, have faced such a diversity of insults as the S.Pennines. Surrounded on all sides by the heavy industry of northern England, the vegetation of the S.Pennines has been severely degraded by atmospheric pollution, overgrazing and poor management. Peat is exposed over large areas and is rapidly eroding. Local deposits have been worked for various minerals, notably lead and many hills bear the scars of quarrying. Much land has been 'improved' for agriculture with fertiliser and reseeding converting heather moor to acid grassland. Relatively little coniferous afforestation has taken place but proposals from the Department of the Environment for afforestation in the 'Industrial Pennines' have recently given cause for concern. The moors are severly overgrazed by sheep and acid grassland is the dominant vegetation over much of the area. A large proportion of the land is owned by the Water Industry, as the gritstone moorlands provide gathering grounds for copious supplies of water. This is stored in large reservoirs on and around the moors for supply to the

adjacent cities. Concern has grown that a recently privatised water industry might sell land of considerable conservation interest for development. Information derived from this survey will aid all parties in deciding on the fate of such land.

It is with the close proximity of huge urban areas, however, that the S.Pennines perhaps comes under most pressure. Within one hour's drive of the moors lie most of the large industrial towns of Lancashire, Yorkshire, Cheshire, Merseyside, Greater Manchester, Birmingham and the West Midlands. The great scenic beauty of the area, coupled with its ease of access by road, the designation of much of it as Britain's first National Park, rights of access to large areas of 'wilderness' through open access agreements between Park Authorities and landowners and the very proximity of the area have made it a playground for huge numbers of visitors throughout the year. Visitors engage in rambling, mountain cycling, hang-gliding, para-gliding, rock climbing, long-distance walking, horse-riding, orienteering, fell-running and a host of other sports and the S.Pennine moors are often the venue for national competitions in such events. Access facilities are ever-increasing. One of the more recent proposals is for a 270 mile Pennine bridleway which would pass through the area specifically to facilitate access to the moors by horse riders and mountain-bikers. The presence of so many people poses a number of problems, including the disturbance of breeding birds, the erosion of moorland and the increased risk of fire during prolonged spells of dry weather. Several new roads have been built to accomodate the large volumes of visitor traffic, and as the moors lie between the industrial centres of the North-West of England and Yorkshire and the East coast ports, they are crossed by a series of now largely inadequate roads running in a west to east direction. Even though the trans-pennine (M62) motorway was constructed through the area, new roads are called for to relieve congestion. Road building, such as that currently proposed for the Longdendale valley, may thus continue to erode the moorland resource. This is also true of other schemes, for example that to construct a wind turbine farm in the Forest of Rossendale.

Yet the moorlands of the south Pennines retain the most southerly viable populations of typical moorland breeding birds in England, and for a number of species the S.Pennines may hold the southern-most viable breeding populations in the world. They hold large numbers of red grouse, golden plover, dunlin and curlew and raptors such as merlin may be increasing in the region. The area also harbours important populations of ring ouzel and the twite population is isolated from others both in Britain and abroad. A number of studies have investigated some part of this resource, either by surveying a particular bird species or by a local study of the breeding bird assemblage. There has never been a comprehensive survey of the breeding birds of this important region and partly because of this, its national and international significance has not hitherto been appreciated.

The present study provides a definition of the moorland breeding bird resource as it stands in 1990. It attempts to place the region in a clear national and international context with respect

to its breeding bird populations. Information on the bird populations obtained in this study is compared with that from previous work where this is possible, in order to provide some insight into long-term change in the bird populations. It also assesses the current level of protection afforded the moorland breeding bird resource and makes recommendations for further safeguards. Sites of importance are placed in a regional, national and international context. An examination of the association between the various bird species and their habitats will be reported separately and used to recommend measures to safeguard, through proper management, the bird resource in the wider countryside.

TABLE 1 BIRDS FOR WHICH INFORMATION WAS RECORDED DURING THE S.PENNINES BREEDING BIRD SURVEY

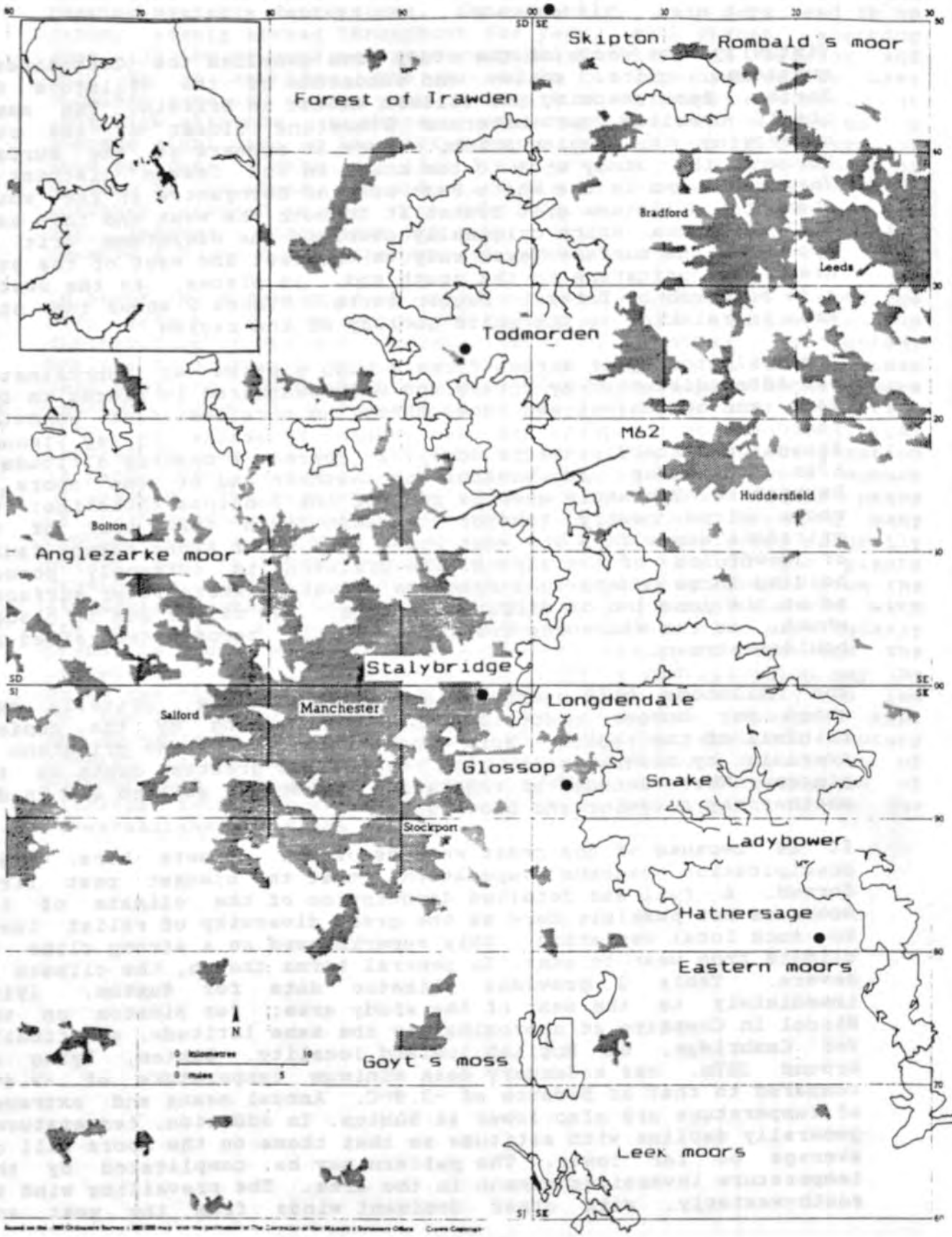
canada goose	*Branta canadensis*
teal	*Anas crecca*
mallard	*Anas platyrhynchos*
goshawk	*Accipter gentilis*
merlin	*Falco columbarius*
peregrine	*Falco peregrinus*
red grouse	*Lagopus lagopus*
little-ringed plover	*Charadrius dubius*
dotterel	*Charadrius morinellus*
golden plover	*Pluvialis apricaria*
lapwing	*Vanellus vanellus*
dunlin	*Calidris alpina*
snipe	*Gallinago gallinago*
curlew	*Numenius arquata*
redshank	*Tringa totanus*
common sandpiper	*Actitis hypoleucos*
black-headed gull	*Larus ridibundus*
cuckoo	*Cuculus canorus*
short-eared owl	*Asio flammeus*
skylark	*Alauda arvensis*
meadow pipit	*Anthus pratensis*
grey wagtail	*Motacilla cinerea*
dipper	*Cinclus cinclus*
whinchat	*Saxicola rubetra*
wheatear	*Oenanthe oenanthe*
ring ouzel	*Turdus torquatus*
carrion crow	*Corvus corone*
twite	*Carduelis flavirostris*
reed bunting	*Emberiza schoeniclus*

THE STUDY AREA

The study area of approximately 725 km² comprises the unenclosed uplands of the Pennines to the south of Skipton in Yorkshire. The choice of a study area boundary is difficult and to some extent arbitrary, as there is no precise definition of the term 'moorland'. In this study, the term moorland refers to the unenclosed upland, be it vegetated with heaths, grass or bog. In fact, all land in many upland areas is enclosed by wall or fence, though the enclosures may be very large indeed. The change from such a landscape may be abrupt, as at a reservoir, plantation, natural woodland, intensively managed pasture or gritstone edge. Setting a survey boundary in such cases is clearly straightforward. More often however, a zone of hill farmland lies between the unenclosed land and the intensive agriculture of the lowlands. This zone may expand or contract with the changing economics of upland agriculture. It is frequently characterised by the presence of hill farms, a complex pattern of enclosure and a greening due to reseeding or limited fertiliser input. It also often holds very high densities of breeding birds, some of which, such as lapwing or curlew also breed on the moors. A distinction between such land and moorland is arbitrary. In this study, enclosures of less than 10 ha were not surveyed and non-moorland within otherwise surveyable squares was also not surveyed (eg plantation, improved pasture, reservoirs, abandoned reseeded areas). All remaining land was surveyed. Figure 1 shows the study area with major towns and moorland areas indicated.

Figure 1 The S.Pennines study area showing area boundary, major towns and larger moorland areas mentioned in text.

(inset shows location of the S.Pennines 1990 study area)



THE PHYSICAL BACKGROUND

Virtually the whole of the study area overlies the Carboniferous mudstones, grits, shales and sandstone of the Millstone Grit Series, here reaching its fullest extent in Britain. The series itself overlies carboniferous limestone, oldest of the rocks underlying the region which, where it appears at the surface, borders the study area to the north in the Craven district of Yorkshire and in the White Peak area of Derbyshire in the south, where the millstone grit flanks it to both the west and the east. Coal measures which originally overlaid the Millstone Grit now appear as the surface layer only to the east and west of the study area. The gritstone to the south and, in places, to the west is also bordered by Triassic Keuper marls. Figure 2 shows the study area in relation to the solid geology of the region.

The Millstone grit series forms a huge plateau at approximately 500-600m, dissected by rivers and much weathered in places to form tors and boulder strewn edges where the more resistant sandstone component of the grits has been exposed by weathering (eg Stannage Froggat and the Blackstone edge). It reaches a maximum altitude of 636m on Kinder Scout towards the southern end of the moors in Derbyshire. The whole area is part of the Pennines anticline: the rocks slope gently towards the east such that most of the gritstone edges face the west where they occur along abrupt faults or downfolds of the strata. The gritstone is extremely porous, holding large underground reserves of water. Where water surfaces, as at the junction of differing strata, the rivers run in cloughs which, as the Millstone fractures readily, become steep-sided and boulder-strewn.

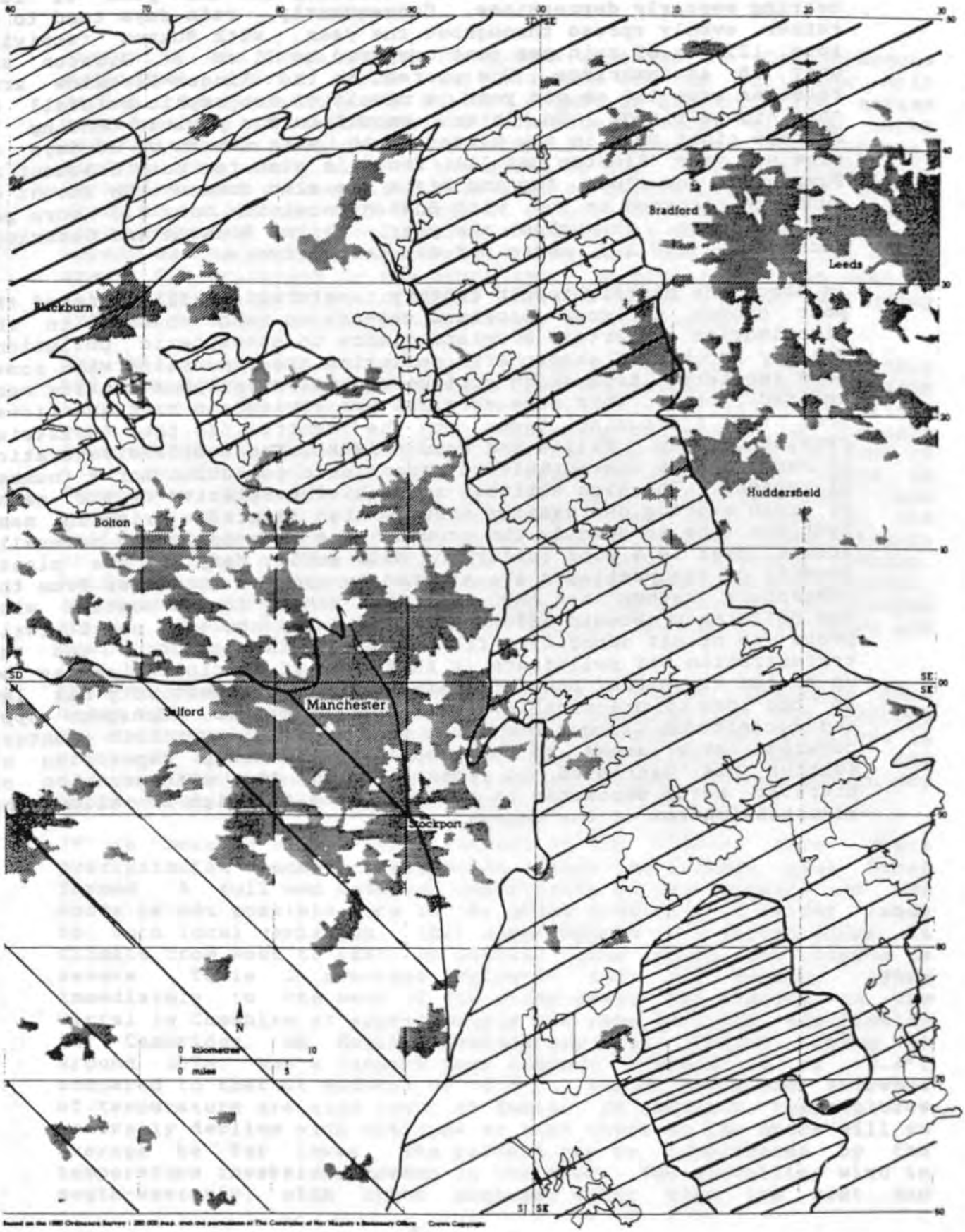
The Millstone grit weathers to produce a coarse, gravelly soil which may become podzolised through leaching by the copious rainfall of the region. More usually, however, the gritstone is overlain by blanket peat which reaches its greatest depth on the plateau. Where denuded of vegetation it becomes gullied and in dry weather may fragment and blow away.

It is because of the great wetness of the climate here, where precipitation exceeds evaporation, that the blanket peat first formed. A full and detailed description of the climate of the moors is not possible here as the great diversity of relief leads to much local variation, this superimposed on a strong cline in climate from west to east. In general terms though, the climate is severe. Table 2 provides climatic data for Buxton, lying immediately to the west of the study area; for Bidston on the Wirral in Cheshire at approximately the same latitude, and finally for Cambridge, an English lowland locality. Buxton, lying at around 307m, has a January mean minimum temperature of -9.4°C compared to that at Bidston of -3.9°C. Annual means and extremes of temperature are also lower at Buxton. In addition, temperatures generally decline with altitude so that those on the moors will on average be far lower. The pattern may be complicated by the temperature inversions common in the area. The prevailing wind is south-westerly, with other dominant winds from the west and

north-west. The area thus lies directly in the path of rain bearing westerly depressions. Consequently, rain days tend to be rather evenly spread throughout the year, with Buxton receiving some 123 cm of rain per year compared to 71 cm at Bidston and only 55 at Cambridge. The plateau in the Kinder-Bleaklow area receives some 160 cm per year, a result of orographic rainfall at this high altitude. In winter, snow lies for periods tending to average eight days in any winter month, with a mean of 38 days of snow per year (Bidston has 11). Frost is also far more frequent at Buxton. As low cloud, fog and mists are also common, the amount of sunshine recorded is low, with Buxton receiving only 3.3 hours per day, average, throughout the year, whilst Bidston and Cambridge receive 4.0 and 4.2. hours per day respectively.

In about the mid-eighteenth century, naturalists first linked the poor growth of some moorland vegetation and changes in the distribution of certain moorland plants to atmospheric pollution. Earlier records of atmospheric pollution are associated with roman lead smelters, from which copious amounts of sulphur dioxide were emitted. Later, this same chemical was emmited in vast quantities from the surrouding towns at the centre of the industrial revolution (Lee, Tallis and Woodin 1988). The moorland vegetation is particularly susceptible to atmospheric pollution for a number of reasons. The high altitude and position relative to the paths of rain bearing depressions ensures high rainfall bringing many hydrogen ions to acidify the ground. The thin soils and naturally acidic peat is a poor buffer for this acid. Many of the plants growing on the peatlands are adapted to receive nutrients from the atmosphere rather than the soil, thus making direct contact with the pollutants (Woodin 1988). Moorland areas are also particularly prone to occult deposition from clouds, mists and fogs and the concentration of pollutants in this type of precipitation may be up to ten times that found in rainfall. This sensitivity has led to the loss of practically all of the bog mosses, *Sphagnum* spp. and *Racomitrium lanuginosum* which even into the twentieth century covered large areas of the peatlands. Although deposition of sulphur has decreased in recent years, the concentration of nitrates being deposited is thought to be too high to allow the re-establishment of the mosses.

Figure 2 Solid geology of the S.Pennines.



Carboniferous millstone grit
Carboniferous coal series

Carboniferous limestone
Triassic sandstone and marls

THE VEGETATION

The vegetation of the S.Pennines may broadly be described in terms of five vegetation types, each associated with particular facets of topography or management.

On the plateaux, where the peat may average three-four metre in depth, the vegetation is dominated by the cottongrass *Eriophorum vaginatum*. This plant vegetates huge expanses of moorland and is particularly characteristic of the S.Pennine blanket bogs (Ratcliffe 1977). *E. angustifolium* occurs along the edges of pools or where the peat is eroded. Although heather *Calluna vulgaris* may also occur here, together with small patches of crowberry *Empetrum nigrum*, bilberry *Vaccinium myrtillus* and cloudberry *Rubur chamaemorus*, these are amongst the most species-poor bog floras in Britain. Extensive areas are also devoid of vegetation and are actively eroding. Several explanations have been advanced to account for these features. The present extent of peat appears to have been reached some 4000 years BP and the S.Pennine peats, being both deep and old may display severe erosion as part of a natural cycle. Certainly, they have been in existence long enough to have experienced many of the catastrophic events thought likely to have triggered erosion. The peats also contain abundant evidence of burning and there is no doubt that some moorland fires burned deeply into the peat allowing erosion to commence. Overgrazing may similarly have allowed erosion to commence after the peat was denuded of vegetation. Atmospheric pollution, particularly acid precipitation during occult deposition (see previous section) is thought likely to have been responsible for the loss of peat-forming sphagna mosses in the mid-eighteenth century. Once peat is exposed, erosion and oxidation are known to inhibit the development of the roots of potential plant colonists, and thus peat remains bare and continues to erode. Although there is agreement on the causes of erosion in some specific cases, there appears to be little agreement on whether it is part of a natural cycle or whether, in general terms, atmospheric pollution, over-grazing or burning are the more important factors in initiating erosion.

The vegetation of the more gentle moorland slopes is often dominated by heather *Calluna vulgaris*. The heather moors may be burned to provide nutritous young shoots for either grouse or sheep. Many other species, including crowberry, bilberry, cloudberry and cowberry *Vaccinium vitis-idea* may grow alongside the heather. The area of moor dominated by pure heather in the northern part of the Peak District appears to have declined by some 35% since 1913 (Anderson and Yalden 1981 and Philips, Yalden and Tallis 1981). These losses are thought to result from overgrazing and poor burning management.

Much of the heather moorland has been replaced by some form of acid grassland. Purple moor grass *Molinia caerulea* is often dominant on gentle, wetter slopes where it usually forms a species-poor, tussocky sward. Mat grass *Nardus stricta* forms smaller but similar tussocks and is the type which has probably

TABLE 2 - CLIMATIC TABLES FOR BUXTON, BIDSTON AND CAMBRIDGE

Station	Buxton	Bidston	Cambridge
Altitude	(307m)	(60m)	(12m)
Latitude	53° 16' N	53° 24' N	52° 12' N
Annual no. days with snow	38	11	-
Annual no. days with frost	111	79	112
Annual mean no. daily sunshine hours	3.3	4.0	4.2
Annual mean no. rain days	211	194	163
Annual mean rainfall (cm)	123	71	55
Annual mean temperature (°C)	7.8	9.4	9.4
January mean minimum temperature (°C)	- 9.4	- 3.9	- 6.7
July mean maximum temperature (°C)	25	25	28.9
Extreme minimum temperature (°C)	- 24	- 12.8	- 17.8

Data extracted from E.G. Bilham (1938) The Climate of the British Isles, McMillan & Co, London

spread most with heavy grazing, creating large areas of unpalatable 'whiteground'. Wavy hair grass *Deschampsia flexuosa* most often occurs on the steeper ground or shallow podzols, where it usually forms part of a relatively species-rich and tightly cropped sward.

At the moorland edge and along watercourses or other intrusions two other vegetation types are found. Cloughs, tors and gritstone edges, with their associated rock clitter are often dominated by bracken *Pteridium aquilinum* which may overlay almost any of the other vegetation types. Flushes dominated by the rushes *Juncus conglomeratus* and *J. acutifloris* may occur in very damp areas, often covering large areas where there is a marked change of slope such as at the moorland fringe. Such flushes also commonly occur elsewhere on sloping moors, wherever water is abundant at the surface.

More detailed information on the flora, vegetation, vegetational history and erosion of the moors can be found in Anderson and Shimwell (1981), Philips, Yalden and Tallis (1981) and Tallis (1964a, b, c, 1965 and 1973).

ADMINISTRATIVE BOUNDARIES AND LAND OWNERSHIP

The moors of the S.Pennines have long proved a barrier to east-west communications and it is therefore not surprising that even today their main axis functions as an administrative boundary. Figures 3 and 4 show the county boundaries in the region prior to and since 1974, respectively, when changes in local administration were made. Old boundaries are given in the older avifaunas and some modern county reports tend to retain the pre-1974 county boundaries as limits to the recording area. Five old counties (Lancashire, Yorkshire, Cheshire, Derbyshire and Staffordshire) and seven new counties (Lancashire, Greater Manchester, West Yorkshire, South Yorkshie, Derbyshire, Cheshire and Staffordshire) administer the moors of the S.Pennines. Certain planning and other matters also come under the remit of the Peak Park Joint Planning Board in the Peak District National Park and, in agricultural matters, of the Ministry of Agriculture in the North Peak Environmentally Sensitive Area (Figure 32).

As in many moorland areas, a small number of landowners own very large tracts of land. The Regional Water Companies and the National Trust are the largest of the public landowners. North West Water and Yorkshire Water own a very large proportion of the land whilst only a very small area is owned by Severn-Trent Water. Other public owners include the Peak Park Planning Board, Sheffield City Council and Bradford City Council. The remainder of the land is owned by a number of private individuals, consortiums and syndicates. The main owners are indicated in Figure 5. Much of the land is let for agricultural grazing or the rights to grazing, fishing and shooting may be leased to very large numbers of individuals or organisations. More detailed information concerning land ownership is lodged with NCC Regional Offices at Wakefield and at Bakewell.

The reader may find much valuable information on the environment, natural history, human history and socio-economics of the region in Edwards (1962) and Whiteley (1985).

Figure 3 The study area in relation to the pre-1974 counties of N.England

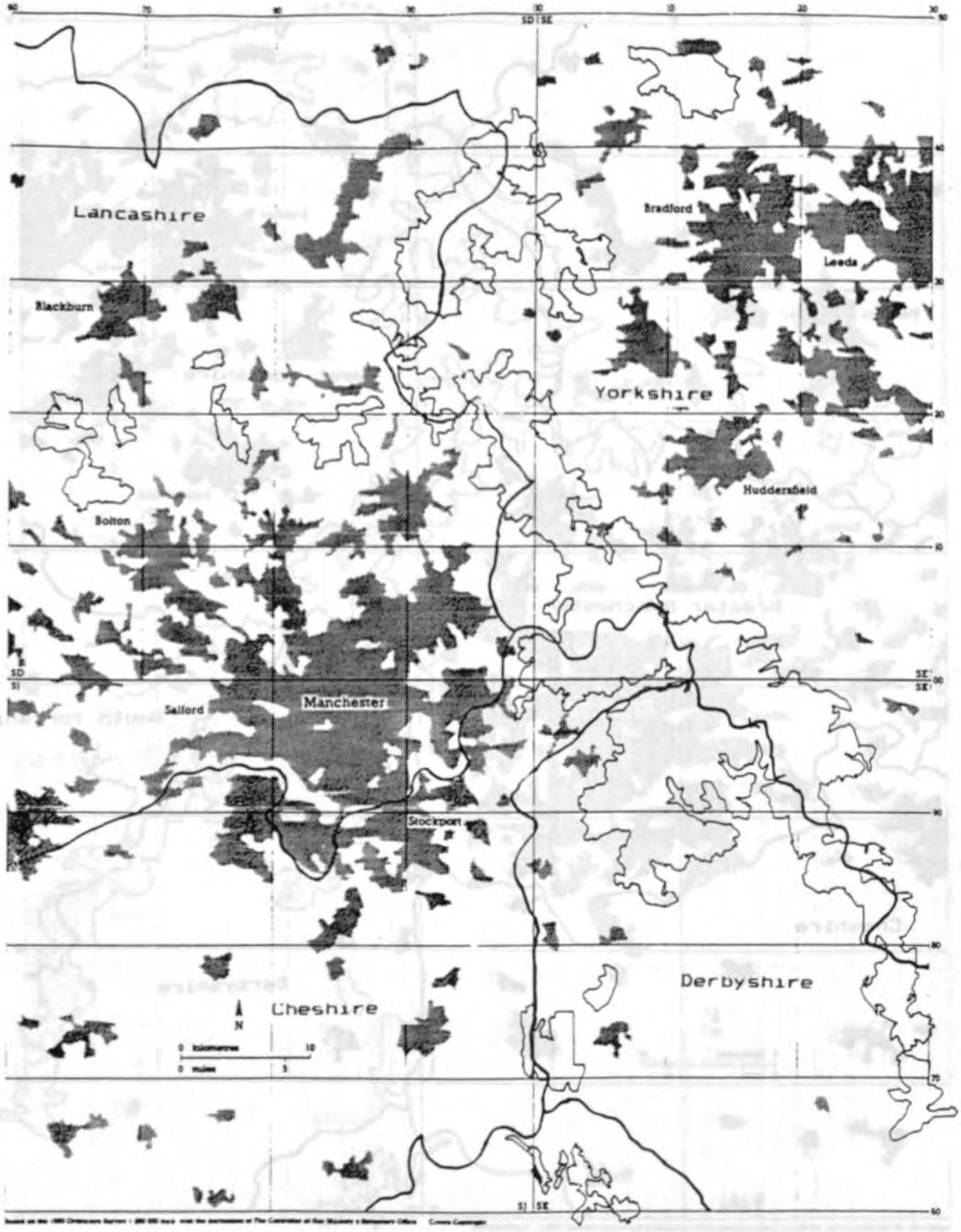


Figure 4 The study area in relation to the counties of N.England.

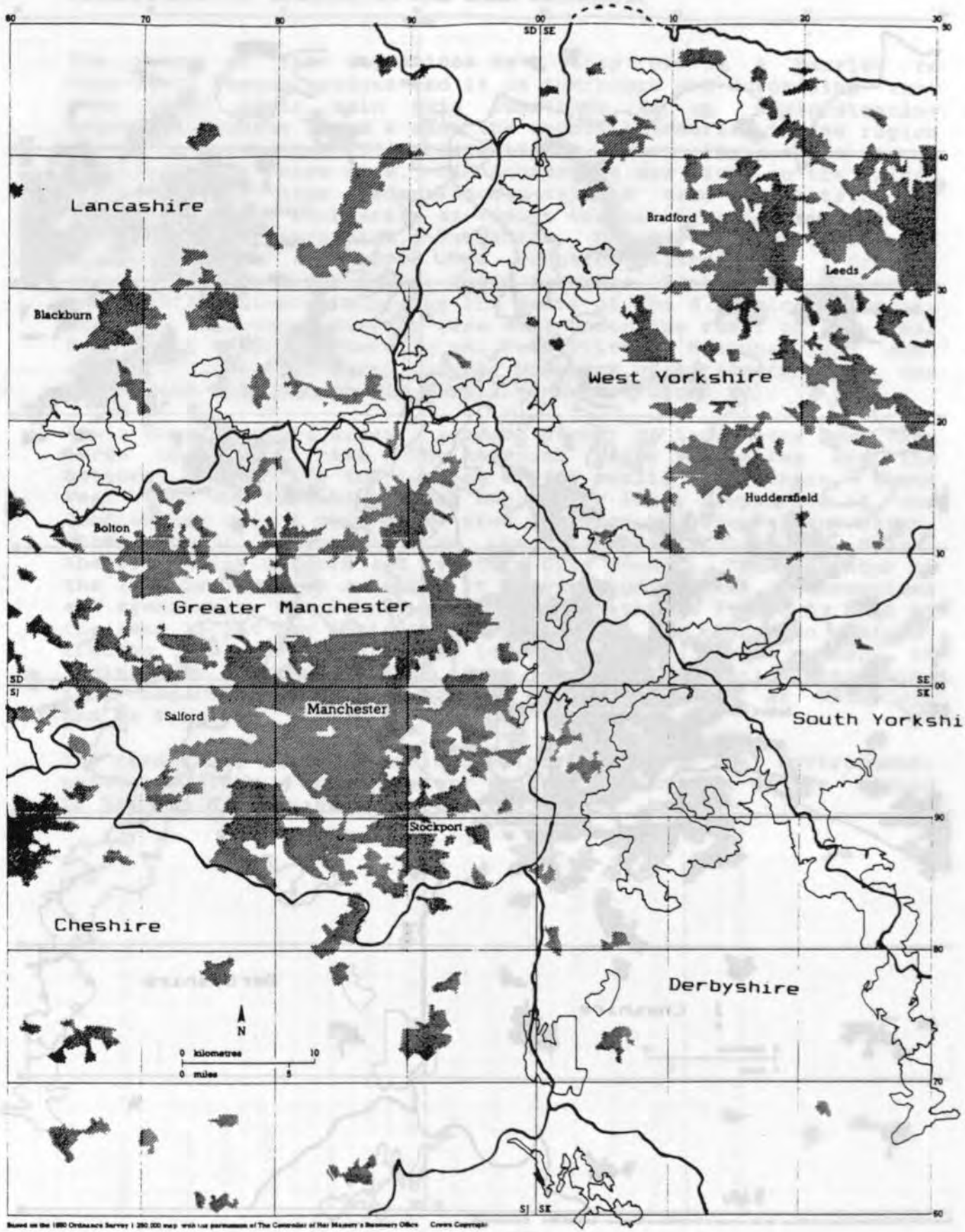


Figure 5 Land ownership in the S.Pennine moors
(see lable 3 for key)

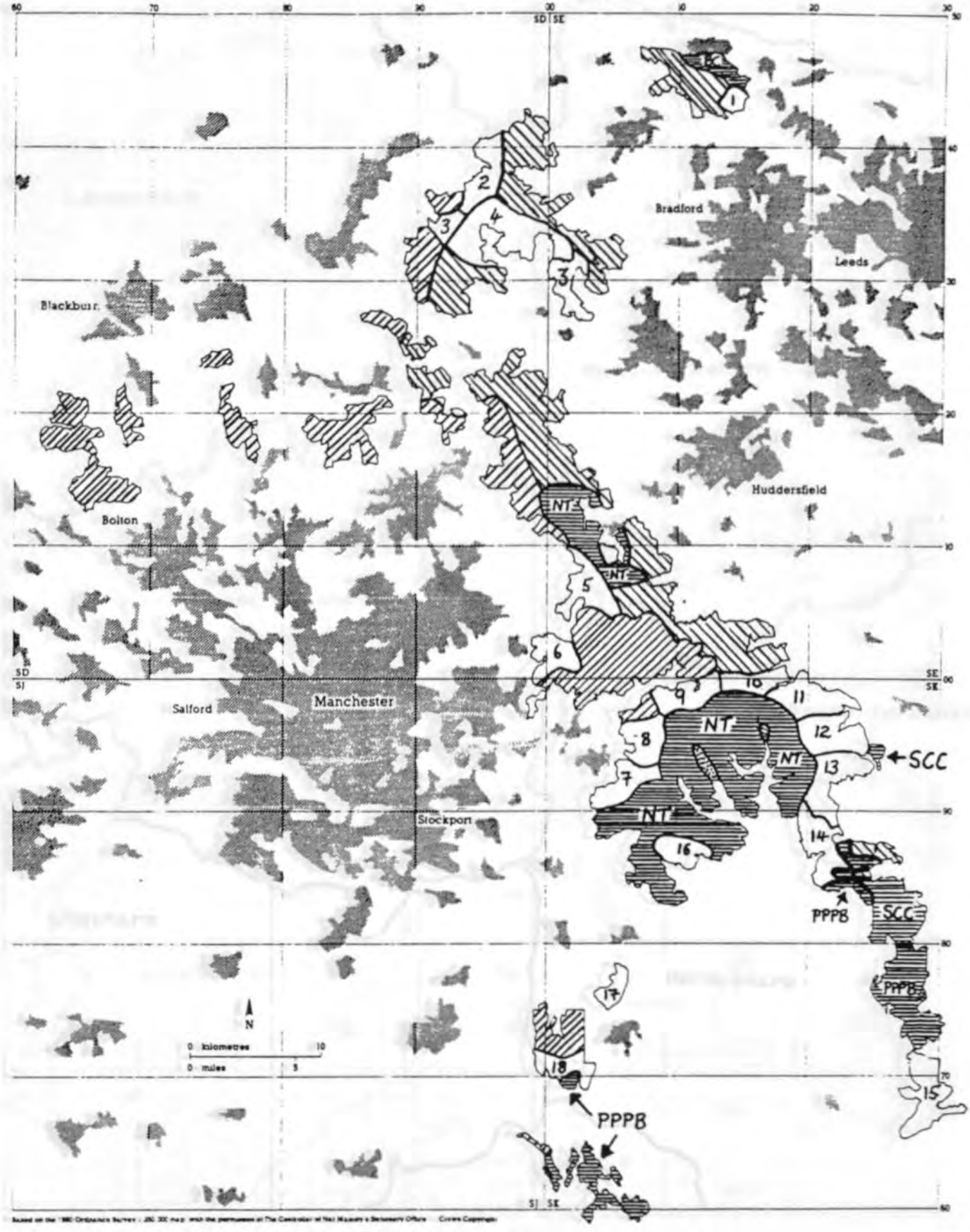
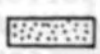
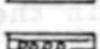
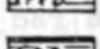


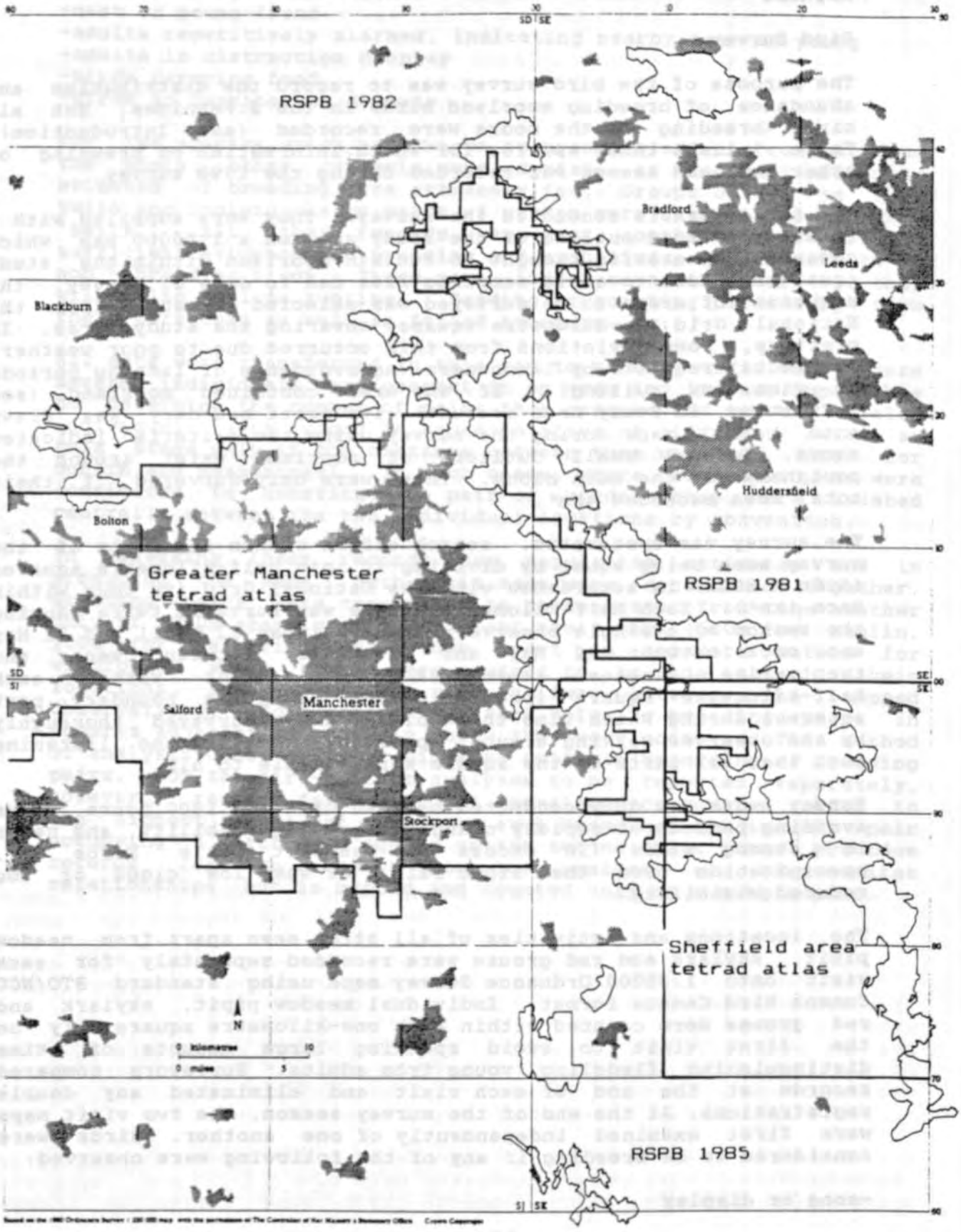
Table 3 A key to Figure 5.

Symbol	Landowner
	Public owners
	North West Water
	Yorkshire Water
	Severn Trent Water
	National Trust
	Peak Park Planning Board
	Sheffield City Council
	Bradford City Council
1-18	Private owners

PREVIOUS SURVEY IN THE S.PENNINES

The S.Pennines has long been a focus for the attention of ornithologists. Much detail of the birds of the area was included in one of the earliest accounts of British birds (Ray, 1678) and natives of the area included Henry Seebohm (1832-95) and F.C.R.Jourdain who supplied information on the area to contemporary writers. Many of their notes were included in The Handbook of British Birds 1938-41. Each county has been variously covered in county avifaunas: (Nelson 1907, and Mather 1986 on Yorkshire; Whitlock 1893 and Frost 1978 on Derbyshire; McAldowie 1893, Smith 1930-38 and Harrison *et al.* 1982 on Staffordshire; Coward 1910 and Hedley Bell 1962 on Cheshire; Mitchell 1884 and Oakes and Battersby 1939 on Lancashire) and all are served by annual ornithological reports. Perhaps the most valuable series of studies of the distribution and numbers of birds in the study area has been undertaken by Derek Yalden and co-workers in the Peak District National Park. His surveys have covered red grouse (Yalden 1972), golden plover and dunlin (Yalden 1974), common sandpiper (Holland, Robson and Yalden 1982), black grouse (Lovenbury, Waterhouse and Yalden 1978 and Yalden 1986) and the merlin (Newton, Robson and Yalden 1981). The short-eared owl was subject to survey in the Sheffield area in 1972 and 1973 (Herringshaw and Gosney 1974) whilst the dippers of Derbyshire were surveyed 1958-1968 by Shooter (1970). The moorland birds of some 128km^2 of the Kinder-Bleaklow plateau area of the Park were surveyed in 1981 by RSPB. A similar survey was also undertaken in the Forest of Tradwen in 1982 by both RSPB (1982) and Howarth and Thompson (1990). RSPB have also surveyed a large area of the north Staffordshire moorlands and associated hill farmland (Waterhouse 1985). Orford (1973) detailed the breeding distribution of twite throughout the study area. Three breeding atlases cover all or part of the study area: the NCC/BTO National breeding atlas (Sharrock 1976), detailing presence or absence of breeding birds in each ten-kilometre square, and the tetrad breeding atlases for the Sheffield area (Hornbuckle and Herringshaw 1985) and for Greater Manchester (Holland, Spence and Sutton 1984). The approximate areas covered by the RSPB surveys and the tetrad atlases are indicated in Figure 6.

Figure 6 The study area showing overlap with previous bird surveys.



METHODS

Bird Survey

The purpose of the bird survey was to record the distribution and abundance of breeding moorland birds in the S.Pennines. Not all birds breeding on the moors were recorded (see Introduction). Table 1 lists those species for which information on breeding or other moorland useage was recorded during the 1990 survey.

Ten field workers conducted the survey. They were supplied with a relatively crude outline of the study area on a 1:50000 map which covered all massifs thought to contain moorland within the study area. In order to avoid sampling bias due to date of survey, the sequence of areas to be surveyed was selected at random from the National Grid ten-kilometre squares covering the study area. In practice, some deviations from this occurred due to poor weather, or special requests by landowners (eg avoidance of lambing periods or when fox culling). If an area contained moorland (see definition in Study Area account), its exact boundary was drawn onto 1:25000 maps during the survey using the criteria indicated above. Several small outliers of moorland exist around the periphery of the main block. These were only surveyed if their total area exceeded 4km^2.

The survey was systematic, search effort within all parts of the survey area being equal by dividing it into half-kilometre squares (500m x 500m) in accordance with the National Grid (ie four within each 1km^2). Each half-kilometre square was surveyed twice during the season by a single observer, once between 12 April and 21 May and once between 22 May and 28 June. Between twenty and twenty-five minutes (mean 22.5) was spent within each half-kilometre square (proportionately less in boundary part squares) during which time the whole area was surveyed thoroughly by the observer walking around, pausing, scanning and listening such that all parts of the square were visible to him.

Survey work was only conducted between 0830 and 1800 hours, thus avoiding periods of rapidly changing bird detectability, and never in strong winds (in excess of Beaufort Scale Force 5), precipitation more than light rain, or when low cloud or fog reduced visibility.

The locations and activities of all birds seen apart from meadow pipit, skylark and red grouse were recorded separately for each visit onto 1:25000 Ordnance Survey maps using standard BTO/NCC Common Bird Census format. Individual meadow pipit, skylark and red grouse were counted within each one-kilometre square only on the first visit to avoid spending large amounts of time distinguishing fledgling young from adults. Surveyors compared records at the end of each visit and eliminated any double registrations. At the end of the survey season, the two visit maps were first examined independently of one another. Birds were considered to be breeding if any of the following were observed;

-song or display

-bird carrying nest material
-nest or young found
-adults repetitively alarmed, indicating nearby nest or young
-adults in distraction display
-birds carrying food
-birds in territorial dispute

For two species which were known to breed relatively commonly on the moors, other criteria were adopted, as records providing evidence of breeding were extremely few. Groups of one to four twite and individuals or pairs of cuckoo were regarded as breeding 'pairs'. All other records were not considered to provide sufficient evidence for breeding and such birds are referred to as non - breeding birds. These may, indeed be non-breeders but they will also include hunting, feeding or roosting birds away from their territory as well as failed breeders.

All data were transferred in this way to summary visit maps. Where several individuals were present in an area and it was impossible to determine the number of pairs they represented in the field, individuals were judged as representative of different pairs at this stage only if the distance between them was 500m (200m for dunlin and passerines). In such cases, where two individuals were considered to constitute a pair of birds, they were located centrally between the two individual locations by convention.

In assessing these records for population estimates and in producing the maps, both visit maps were considered together. Breeding pairs were considered to be separate from one-another only if 1000m apart on the different visit maps (500m for dunlin, 200m for passerines and 100m apart on separate waters for wildfowl). Where pairs were judged to be the same, their locations are marked on maps halfway between the mapped observations. Some records may thus refer to breeding pairs in squares adjacent to those in which they were observed. This method of analysis does, however, minimise multiple recording of breeding pairs. For the bird-habitat analyses to be reported separately, however, records for individual one-kilometre squares refer to the highest count of pairs for each breeding species. A pair occupying a different square on the second visit thus provides records for two squares for the analyses of bird-habitat relationships, but is mapped and counted only as a single pair.

THE ACCURACY OF SURVEY METHODS

The amount of effort expended in detecting and recording birds in each part of the study area was equal. The results for each part of the survey area are therefore directly comparable in terms of species composition and relative numbers and density.

However, perhaps one of the most important and certainly one of the most difficult aspects of any survey is determining the accuracy with which the presence or absence of a species from an area is determined and how accurately or consistently the number of breeding pairs is determined. Breeding birds are here defined as those with nests, eggs or young in the study area. Correctly determining the presence and absence of breeding birds is particularly important, as the end results plot the distribution of breeding birds. As non-breeding individuals may feed, roost or loaf in many areas where they do not breed, there is clearly great scope for inaccurately determining the breeding distribution of any species.

The approach adopted in assessing the accuracy of the survey method was to conduct survey on upland areas which were subject to much more intensive and independent study, often using colour-marked birds. The results from the two studies were then compared. The results of the intensive studies are currently the best available estimates of population size in the study areas.

The major problem in quantifying accuracy and error in this situation, however, is that very few fieldworkers conduct intensive studies of upland birds. The sample size for comparisons is thus minute. In addition, workers tend to specialise on one or a small number of bird species, usually the waders. The accuracy studies thus need to be spread over a number of years in order to obtain sufficient data and are thus continuing. They will be reported fully in a future publication.

Data were available for selected bird species from a number of areas in upland Britain:

Area 1. An area of high altitude (c900m) montane plateau in the Cairngorm range. The vegetation consisted of grass-covered blanket bog with areas of stony ground, bare peat and *Racomitrium* heath. Approximately 60 man-visits with a total duration of about 300 man-hours were made during the intensive study. Individual birds were colour-marked and repeated systematic ground survey was used to locate adults, nests and young. Total area: 4km^2.

Area 2. An area of boulder-strewn blanket bog with sparse *Calluna* cover at 200-500m overlying Lewisian gneiss in NW Sutherland. Approximately twenty-eight man days were spent searching for wader nests and broods in the area. Total area: 19.4km^2

Area 3. An area in Teesdale, N.England at 400-500m, consisting of unimproved rough upland grassland with much *Juncus* and improved, reseeded pasture. Both types of field were grazed by sheep.

Approximately 36 man-days were spent in locating adults, nests and young. The population was colour-marked during this process. The total area of approximately 1.5km² was divided into 15 fields and each was surveyed separately.

Area 4. An area similar to 3 (above) in terms of the vegetation mosaic but lying at 200-300m in E.Cumbria. Approximately 38 man-days were invested in searches for adults, nests and young during the intensive study. Captured birds were colour-marked. The total area of approximately 3km² was divided into 19 fields, each being separately surveyed.

Results

A comparison of the results from intensive studies and the survey methodology employed in the S.Pennines is currently possible for ten species of wader.

For golden plover only, a further comparison is made between the results of the present survey and those from a less-intensive, long-term study whose methods have been calibrated against an eighteen visit census. The study plot is adjacent to the road passing over the snake summit in Derbyshire and is described in Yalden and Yalden (1988).

Oystercatcher

Oystercatcher were recorded as breeding only in Area 3 by the intensive studies, and survey confirmed this situation. 5 pairs bred at this site and 3 were recorded by the survey. Oystercatcher were not found breeding in the S.Pennines.

Dotterel

This species bred only in area 1 and this was confirmed by the survey. However, of the 20 pairs present, only four (20%) were detected. This species does not breed in the S.Pennines but is regularly encountered during passage.

Golden plover

This species was seen in all areas but bred only in Areas 1 and 2. These findings were confirmed by the survey. Area 1 held 8 pairs and all eight were recorded during the survey (100% accuracy) and Area 2 held 11 pairs and 7 were recorded during the survey (63.6% accuracy). No breeding pairs were recorded in the remaining two areas.

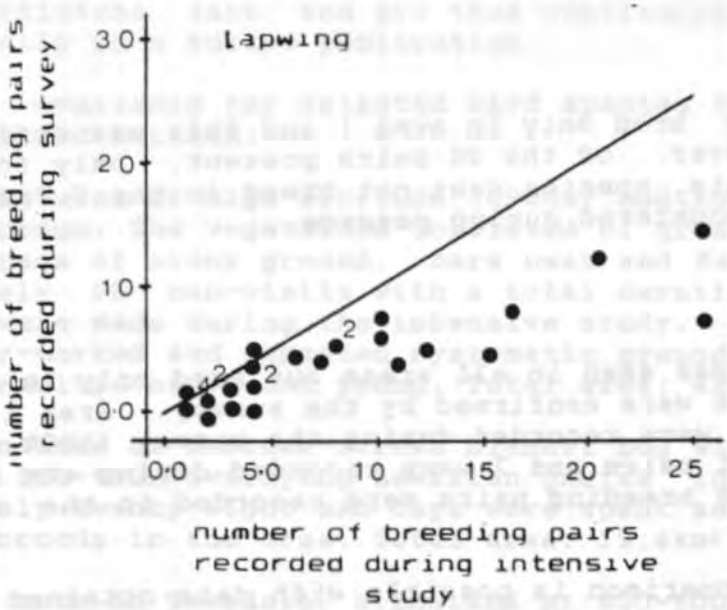
A further comparison is possible with data obtained during a 7.5 man-hour census on a study plot on the Snake summit, Derbyshire, part of a long-term study begun in 1972. Although the search

effort was less than that of the 1990 survey, its results have independently been related to a more intensive, eighteen visit census (Yalden and Yalden 1991). An estimated 27 pairs of golden plover were located during the 1990 visit to the census plot (D.W.Yalden, pers. comm.). The efficiency of a single visit has been estimated at an average of about 80% in the post-hatch period, and Yalden and Yalden (1991) suggest that a correction factor of 25% is applied to obtain an estimate of the true size of the population. The corrected estimate is thus 33.75 or 34 pairs. The 1990 survey recorded 33 pairs on the same plot, suggesting a very close agreement between the two survey methods.

Lapwing

Lapwing bred in Areas 3 and 4 and this was confirmed by the survey. A total of 214 pairs bred in these two areas, the survey recording 113 (52.8%) pairs. Presence/absence was correctly assessed in 28 of the 34 (82.4%) fields at the two sites. In two of the fields birds bred but were assessed by the survey as absent and in 4 fields birds were thought to have bred but intensive study suggested that they did not. There was found to be a highly significant correlation (Spearman Rank Correlation = 0.927, n=28 and $p<0.0001$, see plot 1) between the counts of the numbers of pairs breeding in a field as assessed by the survey and by the intensive studies. Plot 1 shows numbers estimated by both methods and a line showing the 1:1 relationship, suggests that the census underestimates the population size as assessed by the more intensive measures.

Plot 1. The number of breeding lapwing pairs recorded by intensive studies and the 1990 survey methods. (Sites with no breeding pairs omitted)



There was, however, no significant relationship between the error

(% error) of the survey estimate and the size of the population as measured by the intensive study (r = 0.049, n = 28, NS), suggesting that the underestimate was consistant. The average error (as measured by the intercept of a line modelling the relationship between % error and the size of the poulation measured by the intensive study) was 47.9%, suggesting an average accuracy of some (100-47.9%) 52%.

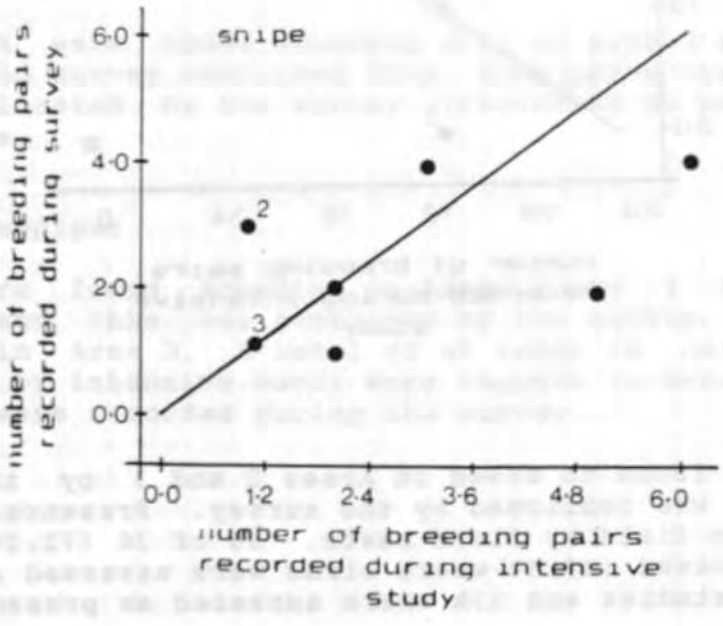
Dunlin

Dunlin were found to breed in areas 1 and 2 by the intensive studies and the survey confirmed this. Area 1 was found to hold 9 pairs by the intensive studies and also by the survey (100% accuracy), whilst area 2 held 10 pairs by the intensive study and 6 by the survey (60%). None of the 34 fields in the Areas 3 and 4 were found to hold breeding dunlin by either method.

Snipe

Snipe numbers were assessed by intensive studies in Areas 1,3 and 4 and were present in Areas 3 and 4. This was confirmed by the survey. They were found to breed in 10 of the 11 plots studied in areas 3 and 4 and were absent from area 1. This too was confirmed by the survey (100 % accuracy). A total of 23 pairs were recorded by the intensive studies and 22 by the survey (95.65%) but on a field by field basis the positive correlation between numbers estimated by the two methods was not statistically significant (Spearman's Rank Correlation = 0.507, n=10, NS). Plot 2 shows this relationship togeter with the 1:1 line.

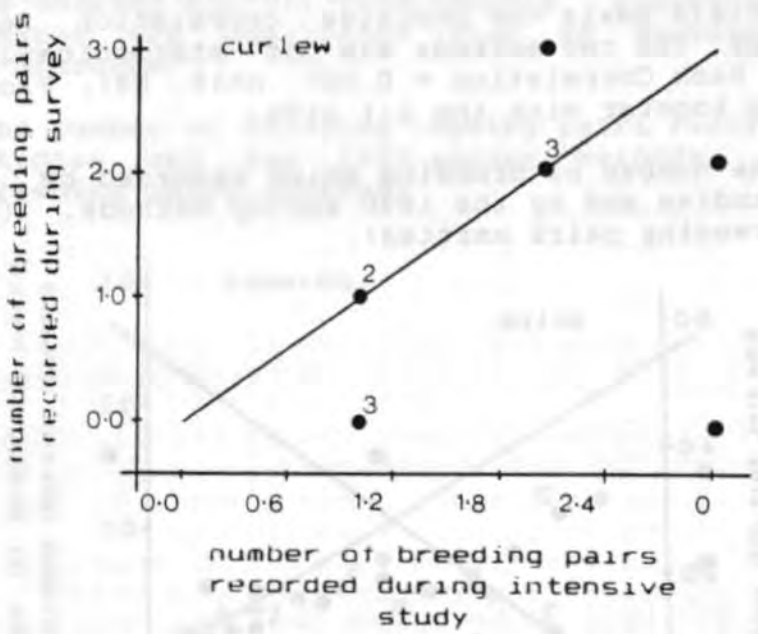
Plot 2. The number of breeding snipe recorded by the intensive studies and by the 1990 survey methods. (Sites with no breeding pairs omitted).



Curlew

Curlew were found to breed in Areas 3 and 4 by the intensive studies. This was confirmed by the survey. At one of the two areas, 13 pairs were recorded breeding by the intensive study and 9 pairs (69%) by the survey and at the other 6 pairs and 4 pairs (66%) were recorded by the these methods respectively. By combining the data from all fields at the two areas where birds were present and those where absent, an overall accuracy of 88.9% was found in determining presence/absence by the survey as compared to the findings of the intensive studies (presence correctly assessed on 7/11, 63.6% of plots: absence correctly assed on 25/25, 100% of plots). On four (11.1%) plots the birds were found to be absent by the survey but were found to be breeding by the intensive studies. These data demonstrate that the survey is effective, with more correct assessments being made than might be achieved by chance alone (X^2=19.75, $p<0.0001$). The positive correlation between counts assessed by both methods was found not to be statistically significant (Spearman's Rank Correlation = 0.503, n= 11, NS, Plot 3) but the % error was not related to the size of the population as assessed by the intensive studies (Spearman's Rank Correlation = -0.103, n = 11, NS).

Plot 3. The number of breeding curlew pairs recorded by the intensive studies and the 1990 survey methods. (Sites with no breeding pairs omitted)

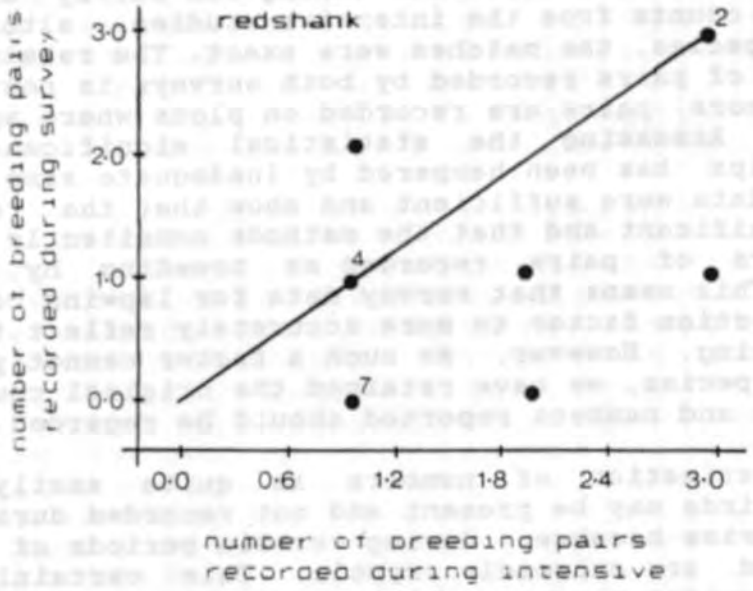


Redshank

Redshank were found to breed in Areas 2 and 3 by the intensive studies. This was confirmed by the survey. Presence/absence was determined on a field by field basis. 26 of 36 (72.2%) plots were correctly assessed (89.5% where birds were assessed as absent by the intensive studies and 53% where assessed as present). Eight of

the ten plots incorrectly assessed were so because breeding birds detected by the intensive studies were not recorded during the survey. Nine pairs were found at one site and 16 in the other by the intensive studies and 10 pairs (111%) and 8 pairs (50%), respectively at these sites by the survey. The relationship between the counts of both methods suggests that many redshank were not recorded during the survey. The positive relationship was not significant (Spearman's Rank Correlation = 0.504, n = 17, NS, Plot 4).

Plot 4. The number of redshank breeding pairs recorded by the intensive studies and the 1990 survey methods. (Sites with no breeding pairs omitted).



Greenshank

Greenshank were found breeding only in Area 2 by the intensive studies and survey confirmed this. Nine pairs bred in the area and 7 were located by the survey. Greenshank do not breed in the S.Pennines.

Common sandpiper

Birds were found breeding in Areas 2 and 3 by the intensive studies and this was confirmed by the survey. Birds were not counted in Area 3. A total of at least 14 pairs (14-25 pairs estimated by intensive work) were thought to breed in Area 2, and 13 pairs were recorded during the survey.

Summary

The presence or absence of each species of breeding wader in each of the four study areas was correctly determined by the survey in all cases. Where individual pairs were distributed across a number of fields, more detailed analysis was possible. Values for lapwing (82%), curlew (89%), redshank (73%) and oystercatcher (100%) show that even at this level, the survey method allows successful determination of presence and absence in a high percentage of cases. Success for the other species could not be judged at this level as the areas where they occurred were not subdivided into fields.

The number of birds recorded during the survey did not always match the counts from the intensive studies, although for some sites or species, the matches were exact. The relationship between the number of pairs recorded by both surveys is positive for each species: more pairs are recorded on plots where more pairs are breeding. Assessing the statistical significance of these relationships has been hampered by inadequate sample sizes. For lapwing, data were sufficient and show that the relationship is highly significant and that the methods consitently underestimate the numbers of pairs recorded as breeding by the intensive studies. This means that survey data for lapwing could be altered by a correction factor to more accurately reflect the number of birds breeding. However, as such a factor cannot yet be derived for other species, we have retained the original counts throughout this report and numbers reported should be regarded as minima.

The underestimation of numbers is quite easily understood. Firstly, birds may be present and not recorded during the survey. This may arise because, during certain periods of the breeding cycle, bird are extremely cryptic. This certainly applies to incubating golden plover, curlew and dunlin. Other species such as dotterel and dunlin may not flush from the nest even when the intruder is very close. Secondly, birds may be absent during survey because they are feeding or roosting elsewhere. Thirdly and perhaps most importantly, a frequently significant proportion of the nests of ground-nesting birds are predated and birds may not re-lay and desert the area. Survey visits after these dates will, of course, not detect these birds. Finally, bird detectibility varies greatly throughout the day. Population estimates in areas surveyed around midday may, for example, be underestimates as birds are least active at this time (see accounts in Halliday 1989 and Reed *et al.* 1985). A comparison of survey results with the numbers of known successful pairs on the intensively worked areas may clarify the relative importance of these factors.

Overestimation of numbers in any area may also be a problem, particularly where the size of the area is small. Several species, notably geenshank, golden plover and curlew will travel several hundred metres to mob intruders (surveyors) and if they were not seen entering the study area, might be counted as breeding in the study area when they did not. In some areas, lapwing will mob intruders en masse, and determining numbers in such circumstances can be extremely difficult, particularly where study areas are

small. As the S.Pennine study area and the areas worked each day were relatively very large, numbers were unlikely to have ever been overestimates.

The perceived detectability for each species is further discussed in the species accounts. No information is available with which to assess the accuracy of the survey methods in detecting passerines though comments on this are also provided in the relevant accounts in the results section.

RESULTS: INTRODUCTION

The main results of the survey concerning the distribution and abundance of each species recorded are presented in this section. Each species account contains, where available, the following information.

Firstly, comments on the characteristic behaviour of the species on its breeding grounds are given, especially where this has a great bearing on detectability of birds.

The number of individuals or pairs recorded is stated, together with a brief account of the distribution and abundance of the species within the study area. This account is supplemented by a figure showing the distribution of pairs or individuals (represented on each map by a single dot) throughout the entire study area. Maps containing the same information but at a much larger scale are provided at the end of the report (Maps 1-57).

The average density of birds in the study area and in 'suitable habitat' (defined as any whole or part one-kilometre square containing breeding birds of that species) is given and compared with similar data from elsewhere in Britain, where these are available. Data obtained from surveys which have used the same methods are presented in tabular form, and for each species are derived from the following Nature Conservancy Council reports: Morayshire (Shepherd et al. 1989), Angus (Shepherd and Brown 1989), Grampian (Brown and Shepherd 1990), Ayrshire (Brown and Shepherd 1989), N.Pennines (Harding, Shepherd and Brown 1990), S.Strathclyde and Dumfries and Galloway (McCarty, Shepherd and Brown 1990). Data for other areas have been obtained from surveys which have adopted different survey methods and are thus presented in the text, together with the source of the information. It should be noted here that caution should be exercised when comparing density data, particularly amongst surveys caried out using different techniques. The data are drawn from areas throughout Britain and are used to provide a clear context within which the S.Pennine breeding bird fauna can be viewed.

Finally, any points of particular note concerning the S.Pennine populations are highlighted. Historic to recent changes in the species status, distribution and abundance in the area are noted. Information for this has been gleaned from the comments made for relevant species in the numerous county or local area avifaunas.

A more detailed appraisal of long-term change is made for selected species but is presented in a later, separate section of the report. Similarly, little mention is made of the relationships between the birds and their habitat. A full analysis of data concerning this subject and its relevence to moorland management will be presented in a subsequent report.

SPECIES ACCOUNTS

Canada Goose

A total of nineteen pairs of this introduced species were found breeding during the survey (Figure 7 and Maps 34-41). Not surprisingly, they were all found in the vicinity of the upland reservoirs in the area. This species breeds in a great diversity of habitats throughout Britain and is infrequently encountered on the moorlands, though readily detected when present. The birds are fairly common residents of Derbyshire (Frost 1978) and the other counties. Whitlock (1893) referred to their exstensive introduction to many waters and noted that 'they wander a great deal' However, it was not until 1983 that evidence of the first successful upland breeding in the Sheffield area was found at Redmires Reservoir, South Yorkshire, (Hornbuckle and Herringshaw 1985). As the national population continues to expand and numbers breeding in the north-west of England increase, the number breeding on the moors is also likely to increase.

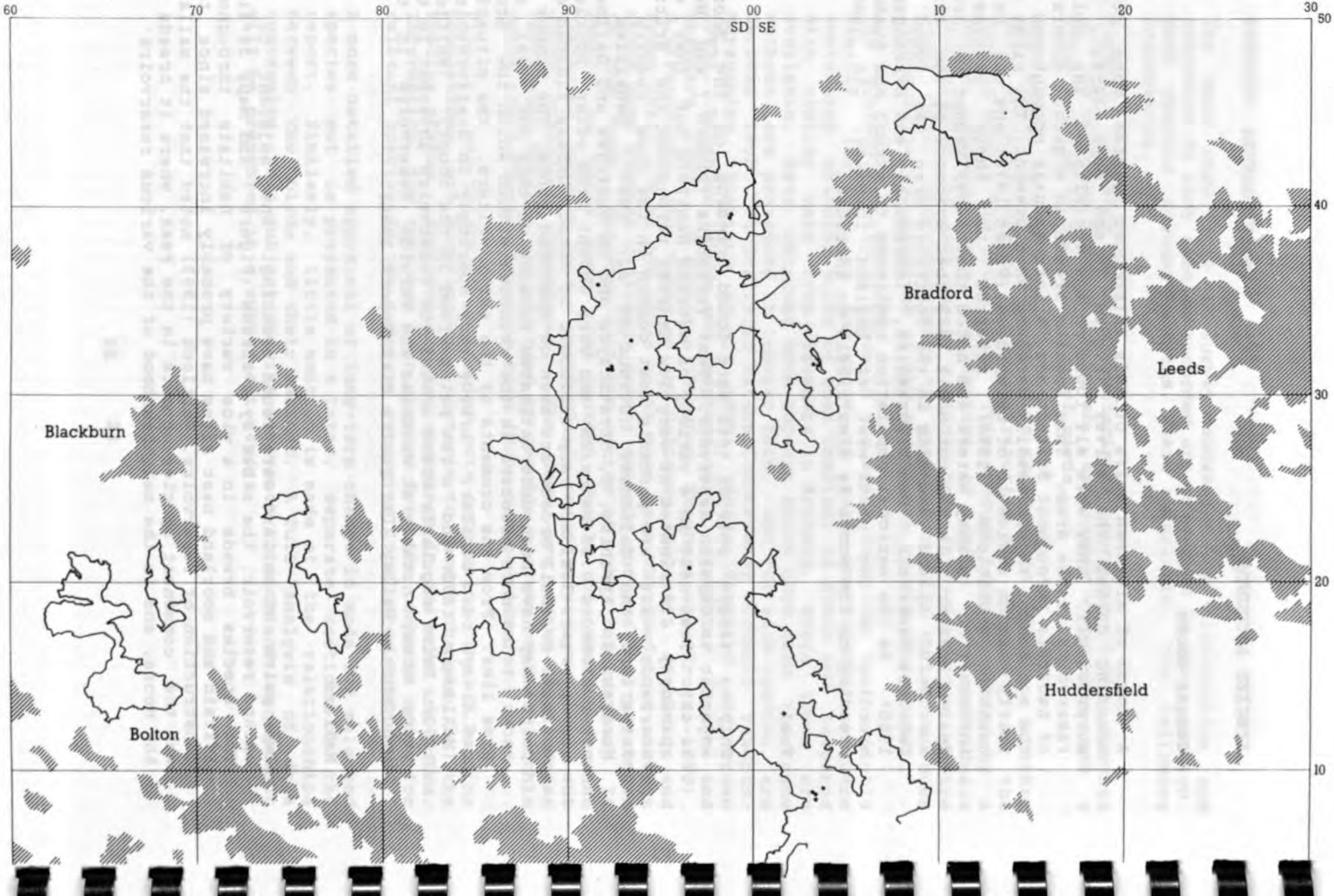
Teal

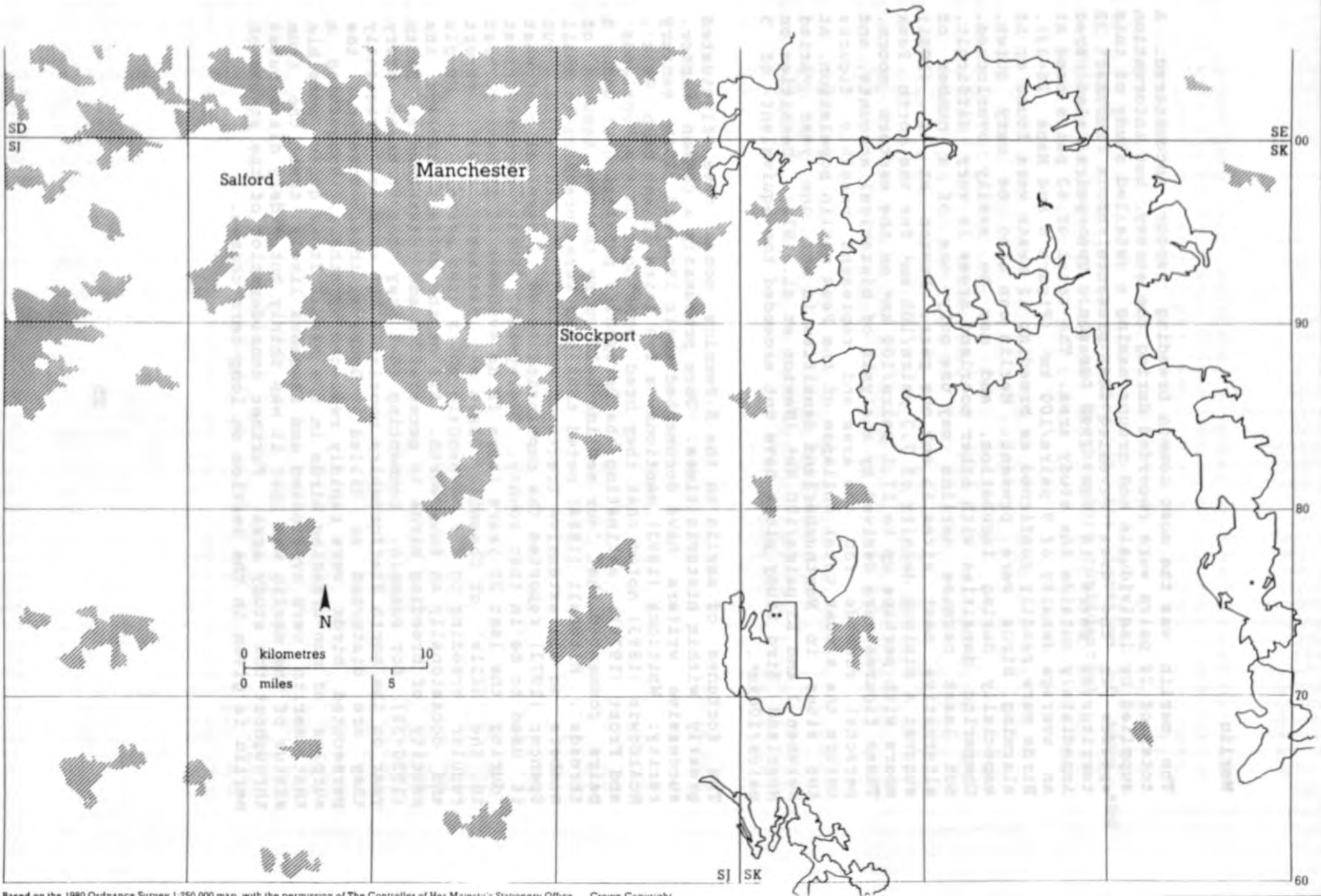
Only a single pair of teal were found breeding on the moors, adjacent to Cupwith Reservoir, West Yorkshire (Figure 7 and Maps 34-41). Teal nest in a variety of wetland habitats but they are sparingly distributed at very low density throughout the British moorlands, but are probably most common in the flow country of Sutherland and Caithness (Stroud *et al.* 1987). Densities in Morayshire, Ayrshire, S. Strathclyde and in Dumfries and Galloway never exceeded 0.04 pairs/km^2 and were absent from other moorland survey areas. Teal are very difficult to detect unless flushed off the nest or until broods are seen on moorland pools. The number of pairs may have been underestimated because of this but teal are known to be rare breeders in the counties within which the study area lies. From the comments of the early writers, the situation has always been similar: 'breeds very sparingly in Staffordshire' (McAldowie 1893) and 'a few pairs breed in the county' (Whitlock 1893). Pairs regularly breed around the reservoirs adjacent to the study area, notably at Woodhead and Torside Reservoirs in the Longdendale Valley (Derbyshire Bird Report 1990).

Mallard

Two pairs of mallard were found breeding, one adjacent to an upland reservoir, the other by a stream (Figure 7 and Maps 34-41). The species breeds in a wide variety of habitats throughout Britain and moorland nest sites have probably increased since the construction of reservoirs. Whitlock (1893) noted that the mallard was the 'commonest species of duck in the Peak, where it breeds on the moors, and in the neighbourhood of the various reservoirs'.

Figure 7. Distribution of breeding pairs of • Canada Goose, • Teal and · Mallard recorded in the South Pennines study area 1990





Merlin

The merlin was the most common breeding raptor encountered. A total of 28 pairs were recorded during the survey, but information supplied by individuals and groups making a detailed study of this species in the area revealed the presence of a further 32 territorial pairs in the 1990 season. Two pairs also bred immediately outside the study area. The total of 62 pairs bred at an average density of 9 pairs/100 km² (Figure 8 and Maps 26-33). Birds were readily confirmed as breeding if nests were found or if alarming birds were present. Merlin can also be very quiet, especially during incubation, and may be easily overlooked. Comparing densities with other moorland areas is very difficult, not least because merlins may use only one of a number of alternative nest sites in any one year. Newton et al. (1981) suggest a minimum density of 7.3 pairs/100 km² for the north Peak moors with perhaps up to 17.1 pairs/100 km² on the eastern moors. These figures were derived by analysis of historical accounts, and personal records for the area and represent possible figures before the almost total collapse of the Peak merlin population. At two sites in Northumberland densities in any one year varied between 3 and 13 pairs/100 km² (Newton et al. 1978). Densities on Moorland Bird Study plots have not exceeded the equivalent of 5 pairs/100km².

The fortunes of merlin on the S.Pennine moors have fluctuated greatly within historic times. Once presumably a common raptor, successive writers have documented their 19th and 20th century rarity: Whitlock (1893) mentions 'a few pairs in the high Peak', McAldowie (1893) noted that they bred 'sparingly on the moorlands' and Frost (1978), estimating the Derbyshire population at under 5 pairs commented that 'our merlins hold on by the most tenuous of threads'. Mitchell (1884) noted that they were 'breeding in small numbers on all extensive tracts of moorland' in Lancashire, but Spencer (1973) reported the population to be 'a mere relic of what it used to be'in that county. Hedley-bell (1962) reported that 'during the last 25 years there is no evidence of it having bred in the hills' of Cheshire. Oakes and Battersby (1939) report regular breeding on the Rossendale moors (two pairs), on Gorple and occasionally on Boulsworth. All of the writers ascribe the paucity of breeding birds to persecution and disturbance, Smith (1930-38) for example, commenting that they 'try to breed every year on the north Staffordshire moorlands but only too frequently they are disturbed or killed'. Despite this, however, the persecuted birds were rapidly replaced by others, suggesting a surplus of non-breeding birds in the area. It is quite possible that merlin were overlooked and it seems likely that the true status of the merlin was that it was thinly but widely distributed throughout the study area. Further consideration of the status of merlin is given in the section on long-term change.

Figure 8 contains information on the location of rare and vulnerable breeding birds and is therefore confidential.

Peregrine

The territories of five pairs of peregrine were found during the survey and a further six pairs holding territory at the edge of or immediately beyond the study area were located by local raptor study groups (Figure 8 and Maps 26-33). All but one were situated on crags near to the edge of the moorlands. The birds are readily detected by their persistent alarming when the observer nears the nest. The bird is only usually found on the moors when crags, cliffs or quarries are surveyed and hence densities recorded by moorland bird surveys rarely exceed 1 pair/100km^2

The peregrine remains a rare breeding bird throughout the area, and has been so for at least the last hundred years. Neither Whitlock (1893) nor McAldowie (1893) or Smith (1930-39) could give any evidence of breeding in Derbyshire and Staffordshire respectively but considered it a former breeder, and Frost (1978) found none for the former county until 1919. Pairs undoubtedly attempted to breed but each year were shot or the eggs robbed and it seems likely that the peregrine was eliminated during the early ninteenth century. Although the area abounds in suitable nesting habitat, there has been a painfully slow start to a recovery of numbers during the 1980's as the birds are still persecuted and very many of the otherwise suitable crags are now the haunt of rock-climbers and ramblers. The present population is likely to be well below that possible.

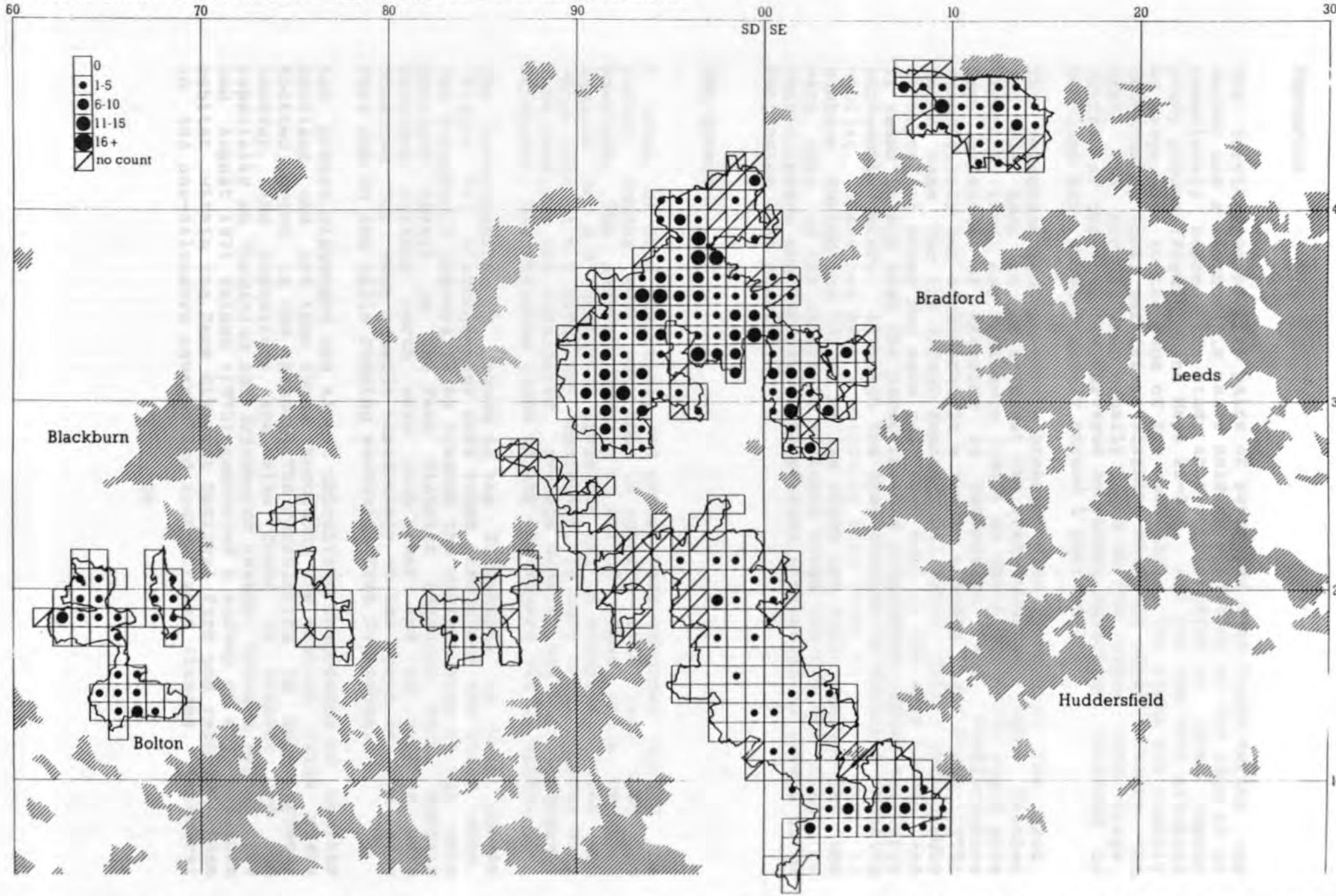
Red grouse

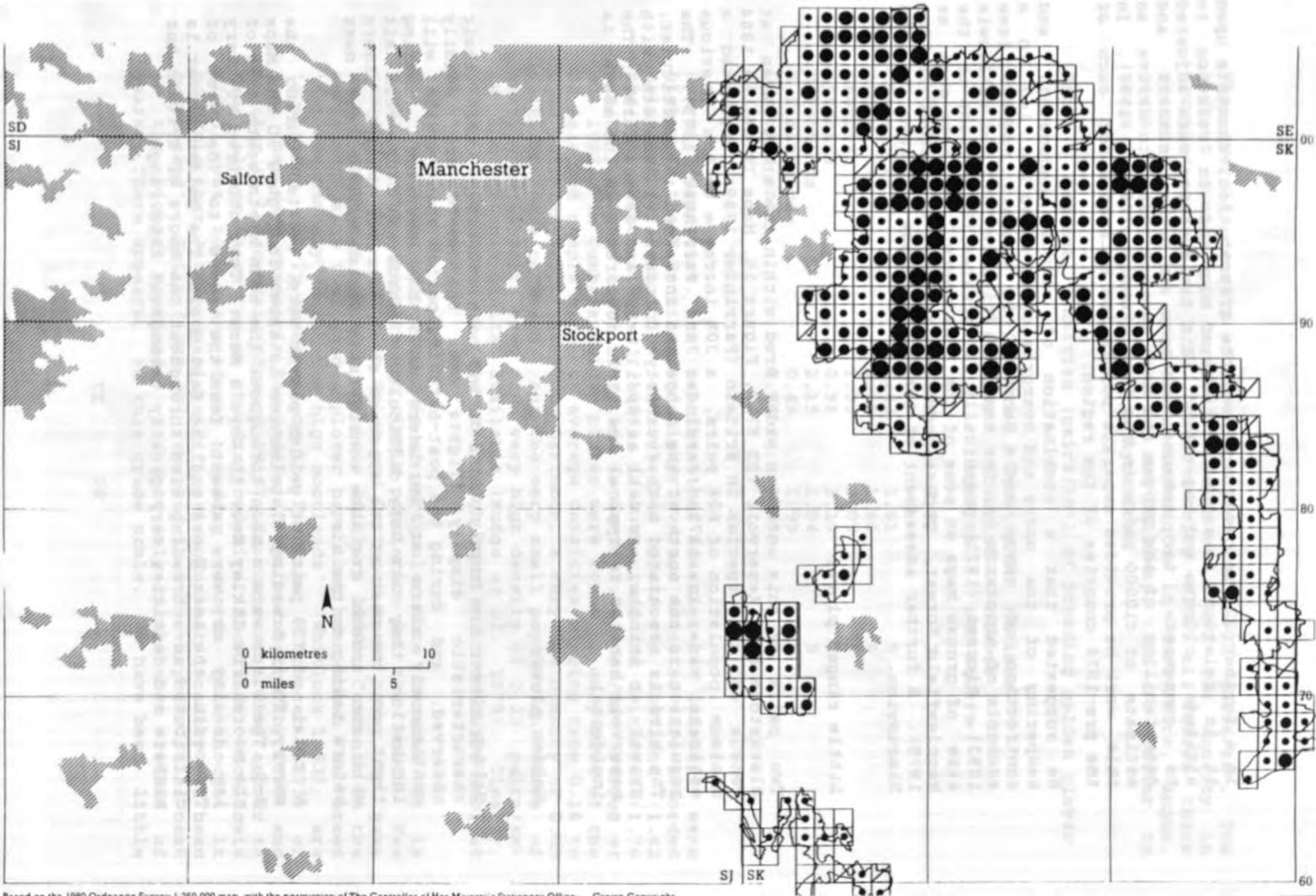
A total of 3901 individual red grouse were recorded during the survey. Counts were not made in squares with less than 10% moorland. The average density in all of these whole or part squares was 4.5 (median=3) birds/km^2 but in occupied squares the value rose to 6.1 birds/km^2 (median=5). If only those squares with 100% moorland are considered, average density was 6.4 (median=5) birds/km^2. The maximium count in any one square was 27 birds.

The distribution of grouse in the S.Pennines is very uneven (Figure 9). Although they were found throughout the study area, the stronghold appears to be towards the western side of the main moorland massif in the Peak District National Park. numbers recorded further north were much lower and no records were obtained for many squares immediately to the north of the Peak Park and on the hills running westwards from Todmorden.

Red grouse elsewhere are almost ubiquitous components of heather moorland and are thus found throughout the British Isles where heather grows in the uplands. The correlation is not perfect, however, and popuations are also found on blanket bog and especially on *Vaccinium* and *Eriophorum* heaths. Between August 1969 and August 1971 Yalden (1972) conducted a survey of all suitable habitat within the Peak District National Park and recorded them in 503 one-kilometre squares and found traces (faeces, feathers)

Figure 9. Numbers of Red Grouse recorded within each 1km-square in the South Pennines study area 1990





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in a further 22. He gives a map of the distribution, comments upon it in relation to separate tracts of moor and in relation to altitude, climate and vegetation. His field counts were adjusted to compensate for seasonal changes in the numbers and detectability of the grouse and were again adjusted to derive an estimate of c10000 pairs in the Peak District (Yalden 1979). In this work he provides separate population estimates for each of the pre-1974 counties of the region.

He suggested that a combination of reduced management and keepering of the moors and overgrazing by sheep had led to a contraction of range and a decrease in overall numbers (see accounts of abundance in, for example, Whitlock 1893 and McAldowie 1893). Picozzi (1971) graphically illustrates the decline in the size of grouse bags on some of the Peak moors. In areas such as Macclesfield Forest, grouse moor had been lost altogether (Yalden 1979). A further assessment of long-term change is given in the Discussion.

Little ringed plover

Two pairs of this uncommon wader bred within the study area at Blackstone Edge Reservoir (SD 9718, Figure 16, Maps 18-25). A 1984 census of this species in Britain (Parrinder 1989) suggested a minimum population of 608 pairs, a 30% increase on the previous estimate made in 1973 (Parrinder and Parrinder 1975). The population in the north of the range had increased in particular. The bird is associated with a variety of freshwater habitats with gravel or shingle, as well as spoil heaps and sewage farms. The reservoir habitat is typical and their occurrence on the moors is incidental.

Golden plover

Golden plover are highly vocal during both courtship, when their characteristic display flights over the moors are readily observed, and during the post-hatching period when adults will continuously alarm at intruders into the territory. During incubation they are very difficult to census as many will sit tight on the nest at the approach of an intruder whilst others will run unseen for some considerable distance from the nest before taking to the air.

A total of 736 pairs of golden plover were located during the survey. Their breeding distribution is shown in Figure 10 and Maps 2-9. The birds were common throughout the main north-south axis of the moors from Ilkley Moor to Goyt's Moss. They occurred at very low density or were absent from the moors to the west of Todmorden, the Leek Moors and the East Moors. The golden plover is distributed as a breeding bird throughout the moors of Britain but numbers and densities vary greatly throughout this range.

The overall density of breeding birds was 1.02 pairs/km². The highest number per square kilometre was 7 and the density in occupied squares was 2.22. These density values all exceed those recorded using the same census techniques in Morayshire, Angus, south Strathclyde and Dumfries and Galloway, and are similar to those found in Grampian and in Ayrshire.

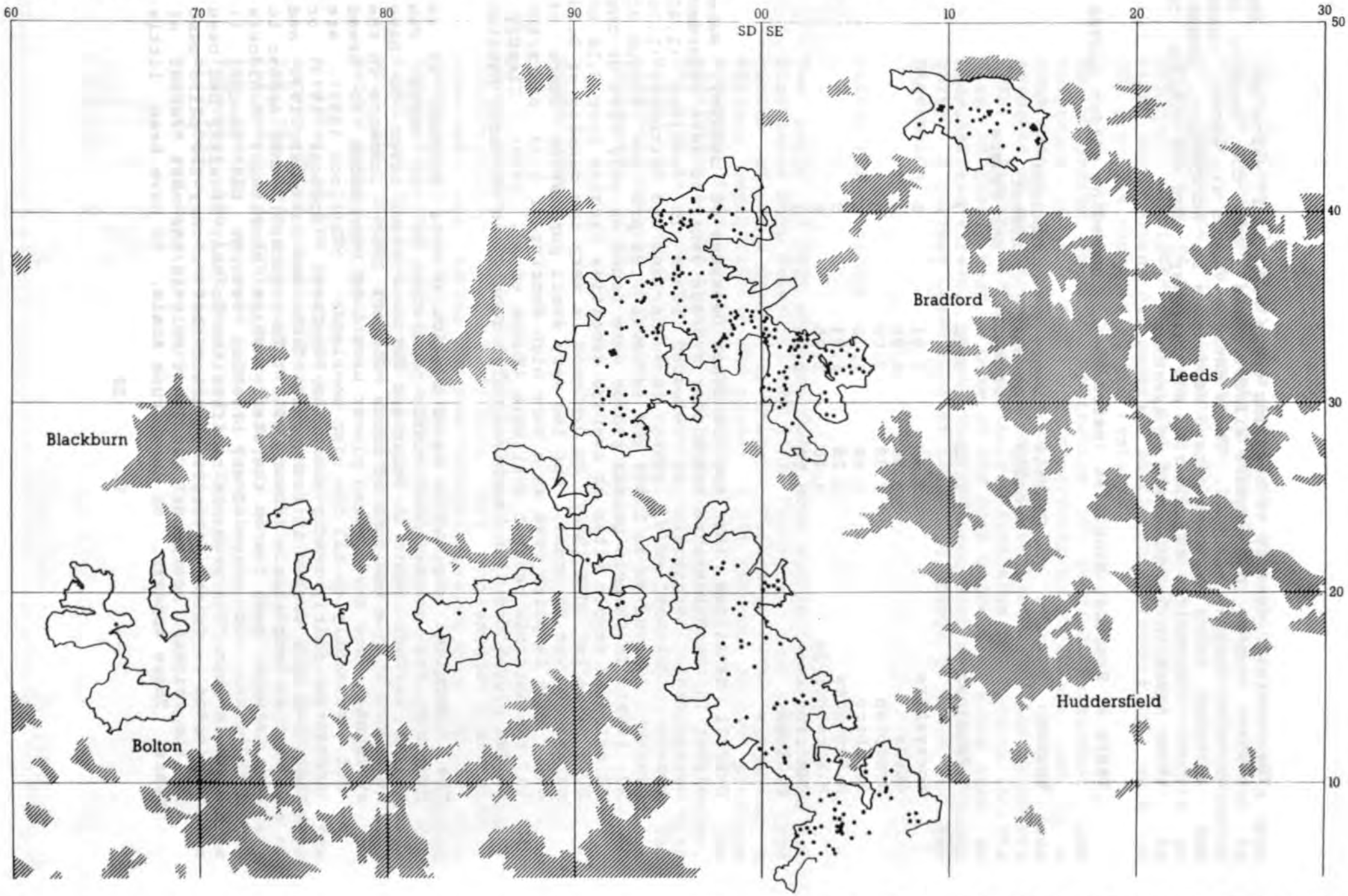
Table 4 Regional densities (pairs/km²) of breeding golden plover

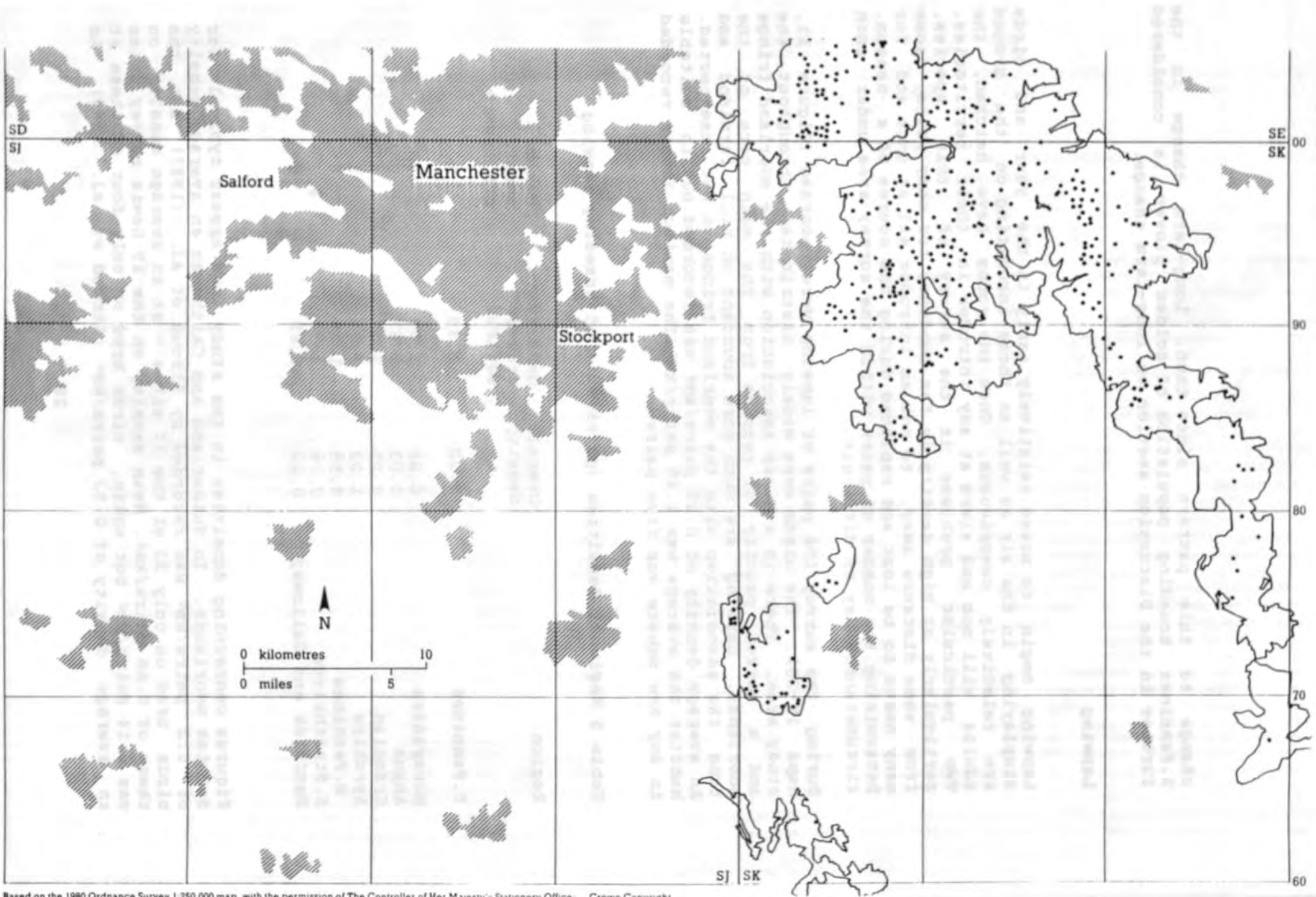
Region	Overall density	Density in occupied squares	Maximum number per square
S.Pennines	**1.02**	**2.22**	**7**
Morayshire	0.43	1.61	5
Angus	0.41	1.86	4
Grampian	1.38	2.09	5
Ayrshire	0.98	2.10	7
N.Pennines	2.15	1.94	5
S.Strathclyde	0.46	1.95	6
Dumfries and Galloway	0.09	1.25	3

Overall densities, but not the other measures of density, were higher in the N.Pennines and higher average densites were recorded using other techniques on selected plots in Shetland (1.42 prs/km², Rothwell *et al.* 1988), in Sutherland and Caithness (1.76 prs/km², Stroud *et al.*1987) and in Lewis 1.96 prs /km² (Stroud *et al.* 1988). In Cumbria golden plover were found on only five of the 32 selected sample sites at average densities ranging from 0.16 to 0.88 pairs/km² (NCC 1986). On Dartmoor, a very low density of 0.03 pairs/km² was recorded, but the very small population there of only some 14 pairs bred at a very high density of 2.33 pairs/km² in the suitable habitat available (Mudge *et al.* 1979). Clearly, golden plover breed at relatively high density in suitable habitat in the S.Pennines.

The S.Pennines population is of particular note because it is probably the southernmost viable population in the world. Few remain further south in Wales and Dartmoor seems never to have held more than a few tens of birds (Sitters 1989). Comments in the avifaunas show that golden plover have long been known to breed 'not uncommonly on all the high moorlands' (Whitlock 1893), are 'scattered fairly evenly along the Pennines' (Spencer 1973) or that they were common in Rossendale (Oakes and Battersby 1939 and regular in Longdendale (Coward 1910). In contrast, they appear to have always been few on the Staffordshire moorlands: McAldowie (1893) was not aware of any breeding records but thought it possible that 'its probable nidification in that locality had been overlooked'. Smith (1930-38) remarked that 'a very few pairs nest on the highest moorlands' and that only in the most recent of years. There appears, on this crude scale, to have been little

Figure 10. Distribution of breeding pairs of Golden Plover recorded in the South Pennines area 1990





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change to this pattern since then. Long-term change in the S.Pennines breeding population of golden plover is considered further in the Discussion section on long-term change.

Lapwing

Lapwing begin to breed relatively early in the year and birds displaying in the air as well as those incubating on the ground are relatively conspicuous. Once the young have hatched, the adults will mob and alarm at any intruder in their territories. Two particular problems in the survey of this species, particularly at high density is the tendency for many pairs, some from some distance away, to mob an intruder all at once and for many nests to be lost and replaced during the course of a season. Determining the number of pairs within the survey area under such circumstances may be difficult.

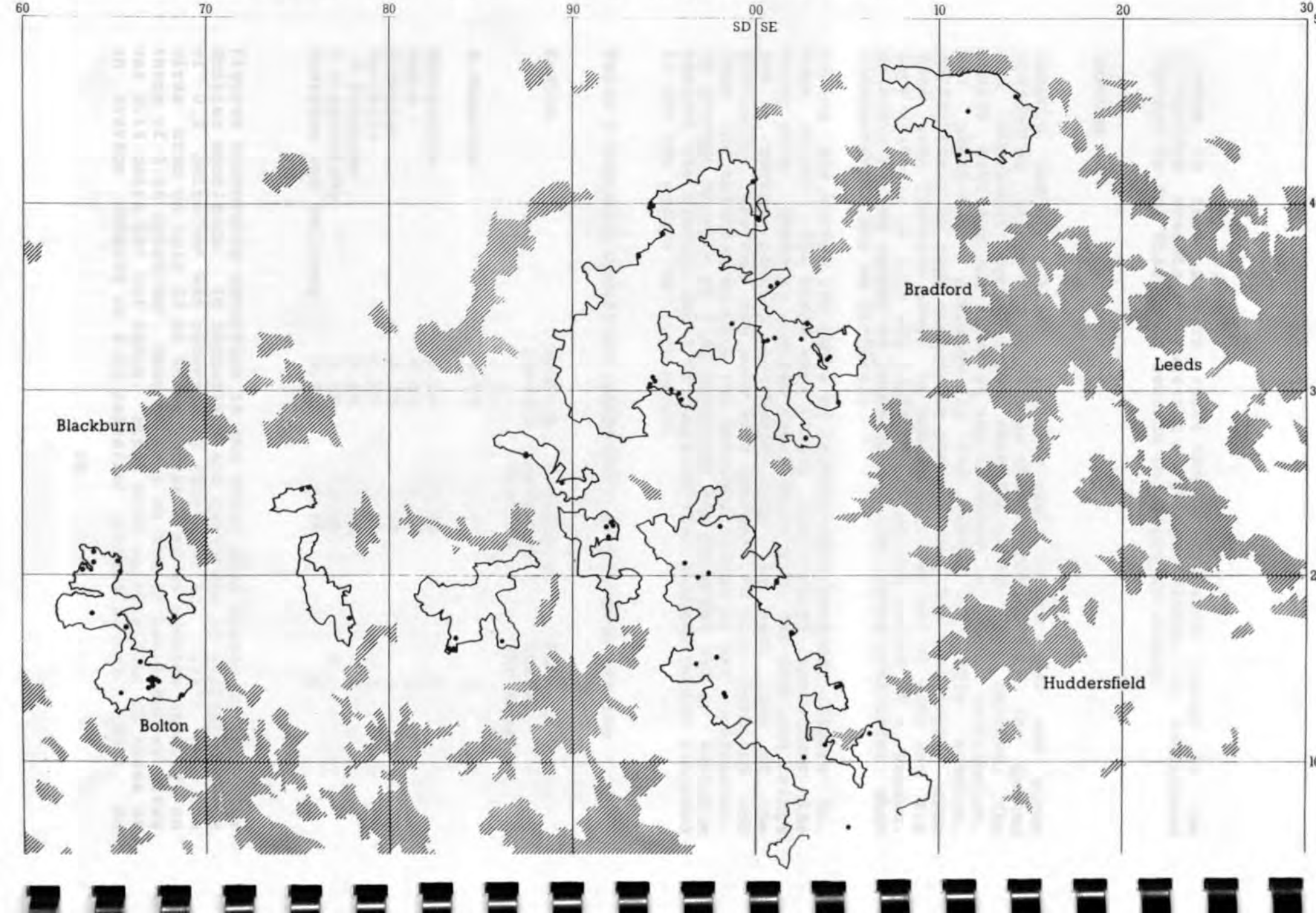
During the survey 156 pairs of lapwing were recorded (Figure 11, Maps 18-25). The birds were widely distributed throughout the study area. There is a clear association with the moorland fringe and a marked paucity of records from the main core of the moorlands. Lapwing are much more abundant on hill farmland and thus the association with the moorland fringe is not unexpected. An average density of 0.22 pairs/km² was recorded but in suitable habitat the average was 1.85 pairs/km².The maximum number recorded in any one square was five pairs.

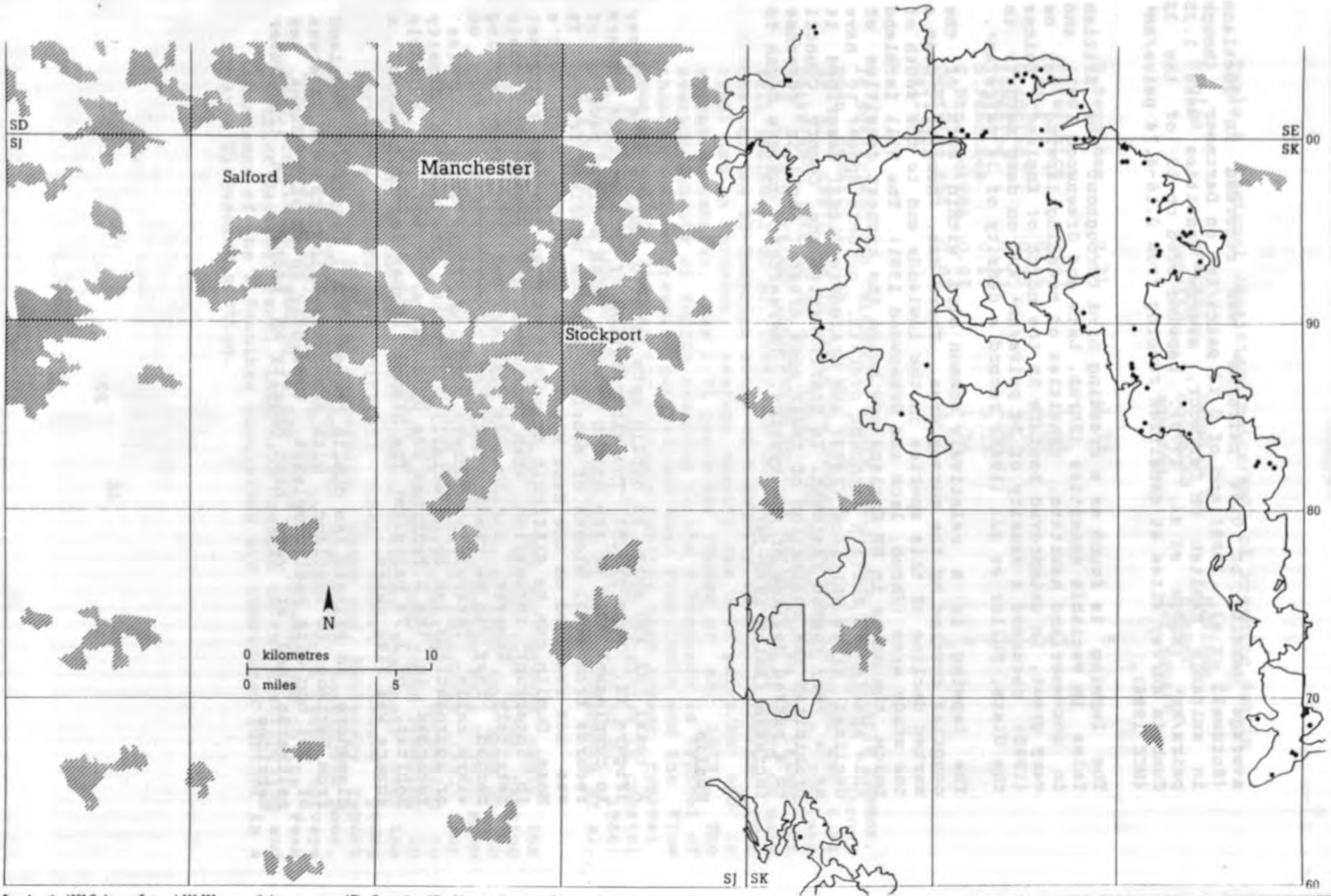
Table 5 Regional densities (pairs/km²) of breeding lapwing

Region	Overall density	Density in occupied squares	Maximum number per square
S.Pennines	**0.22**	**1.85**	**5**
Morayshire	0.26	2.99	9
Angus	0.03	1.67	1
Grampian	0.25	2.47	3
Ayrshire	1.03	3.54	8
N.Pennines	0.55	1.88	4
S.Strathclyde	0.76	3.58	8
Dumfries and Galloway	0.22	1.85	6

Figures concerning densities in the study area appear typical for British moorlands. In Sutherland and Caithness an average density of 0.2 pairs/km² was recorded by Stroud *et al.* (1987) but the birds bred on only 23 of the 77 sites - at an average density on these of 0.66 pairs/km². Mean density on the 19 Lewis survey sites was 0.14 pairs/km² but again, birds bred on only four of these at an average density of 0.53 pairs/km² (Stroud *et al.* 1988). An

Figure 11. Distribution of breeding pairs of Lapwing recorded in the South Pennines study area 1990

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average density of 0.64 pairs/km² was recorded in Shetland (Rothwell *et al.* 1988) and of 0.12 pairs/km² on Dartmoor, though in suitable habitat on Dartmoor, averge densities were 1.35 pairs/km² (Mudge *et al.* 1979). Lapwing bred on 13 of the 32 Cumbria survey sites at densities ranging from 0.16-4.74 pairs/km² (NCC 1986).

The lapwing is found as a breeding bird throughout the British Isles in variable densities (Shrub, Lack and Greenwood 1991) and in non-moorland habitats, densities of breeding lapwing may be very great. In unimproved pasture in the north of England, Baines (1988) recorded a density of 54 pairs/km² and on damp machair in the Uists, Fuller *et al.* (1986) record a density of 34 pairs/km².

The lapwing is a relatively common bird within each of the counties covered by the survey area. There has, however, been a marked decline of this species in the lowlands and to the south of the study area (Shrub, lack and Greenwood 1991). The hill farmland below the moors in NW England now holds the highest densities of this species in Britain although overall, numbers appear to have declined since Whitlock (1893) and McAldowie (1893) described it as a very common resident. In Staffordshire the County Council prohibited the collection of their eggs after 7 April in response to a marked decline of the species. Thereafter, numbers began to increase (Smith 1930-39).

Dunlin

A total of 150 pairs of dunlin were located during the survey (Figure 12, Maps 18-25). The distribution of this species appears to complement that of the golden plover, with a clear paucity of records from small blocks of moorland and the moorland fringe. It was not recorded on the East Moors, the Leek Moors or on Goyt's Moss. Dunlin can be difficult to survey as they are very reluctant to interrupt incubation when intruders are present on their territory. However, during the display and the post-hatching period, they can be readily detected by characteristic song or alarm calls. Determining numbers breeding within dense 'colonies' or aggregations can be especially difficult. The average density recorded in the S.Pennines was 0.21 pairs/km² and, in suitable habitat, of 1.79 pairs/km² The highest number recorded within a square was five pairs.

Elsewhere in Britain the dunlin breeds on all suitable moorland from Dartmoor to Shetland, with densities being greatest in areas of wet bog with pool complexes, sparingly on coastal dunes and saltmarsh and at very high density on machair in the Outer Hebrides.

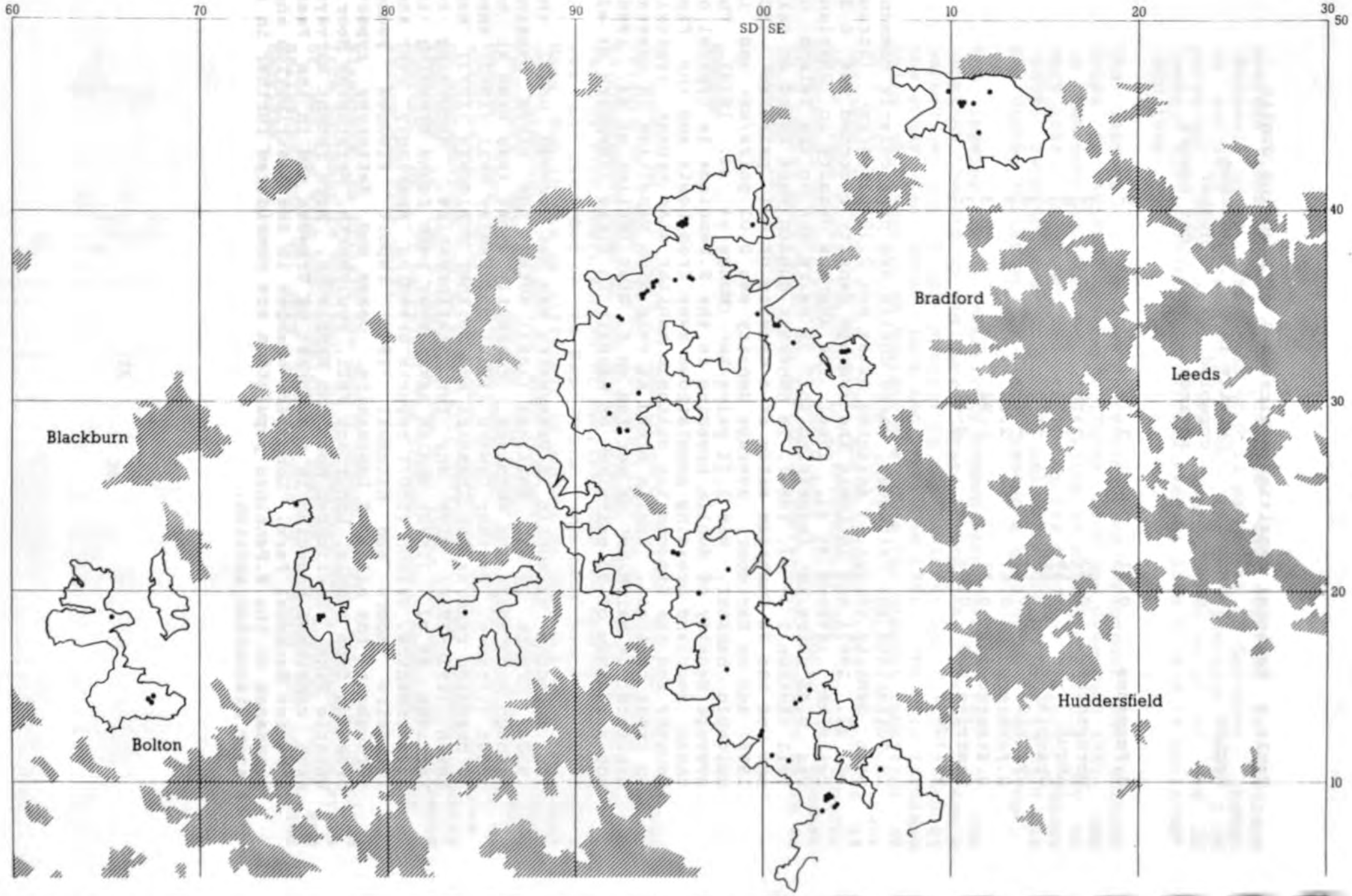
Table 6 Regional densities (pairs/km²) of breeding dunlin

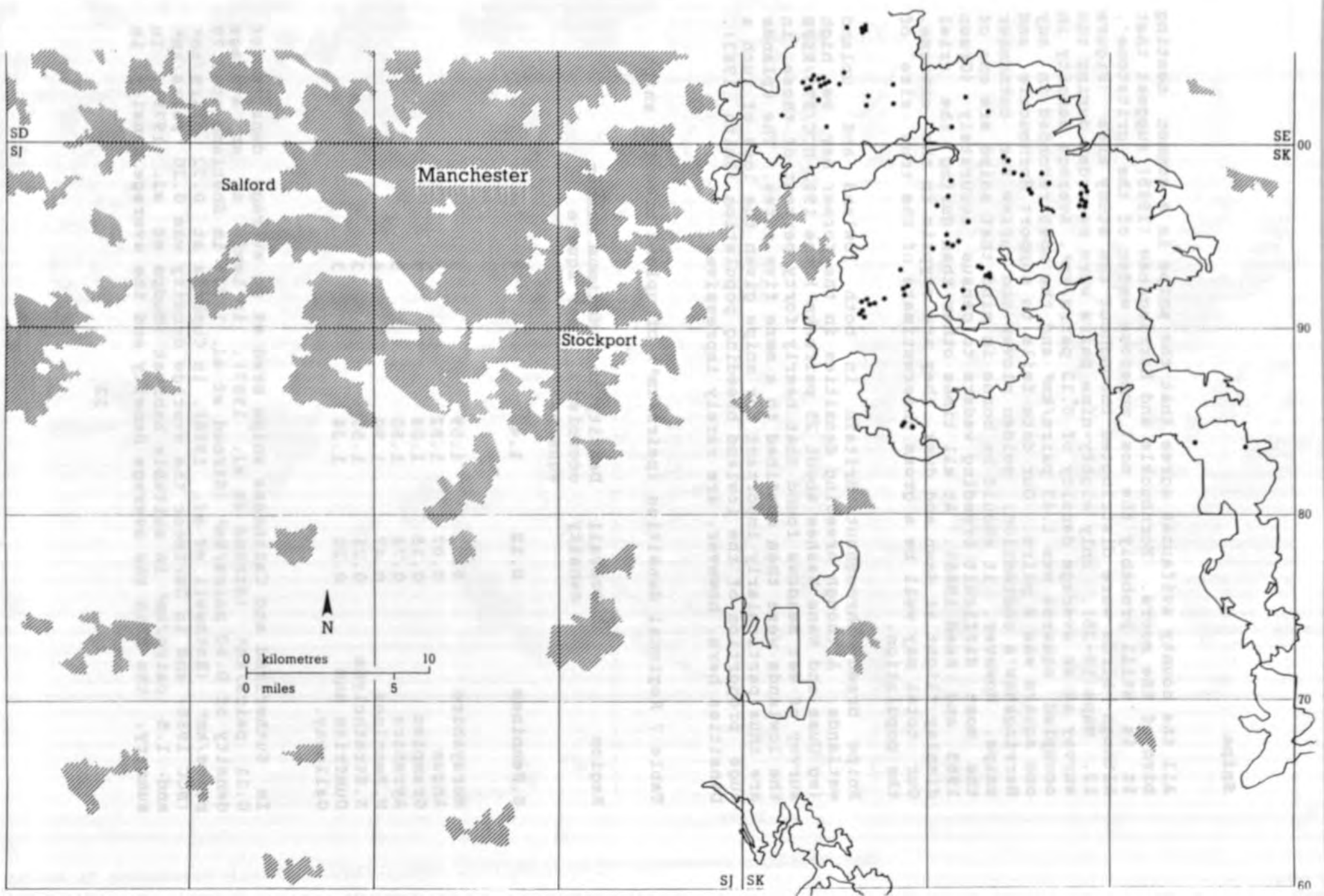
Region	Overall density	Density in occupied squares	Maximum number per square
S.Pennines	0.21	1.79	5
Morayshire	0.03	1.38	2
Angus	0.16	3.69	6
Grampian	0.55	1.72	7
Ayrshire	0.13	1.80	4
N.Pennines	0.67	2.18	7
S.Strathclyde	0.07	1.94	3
Dumfries and Galloway	0.03	3.16	3

In Sutherland and Caithness, where dunlin are particularly common, mean density across 77 selected sites was 2.39 pairs/km² (Stroud *et al.* 1987) and in Lewis the average density recorded was 6.24 pairs/km² (Stroud *et al.* 1988). The average density in Shetland was 0.48 pairs/km² increasing to 2.39 pairs/km² on the island of Yell (Rothwell *et al.* 1988). In contrast dunlin were found on only one of the 32 Cumbrian sites at a density of 0.1 pairs/km² (NCC 1986) and on Dartmoor, average density was 0.03 pairs/km² and in suitable habitat, was 1.71 pairs/km² (Mudge *et al.* 1979). The average density of dunlin breeding in the S.Pennines is typical of those moorland breeding populations away from Lewis and the Flow Country and the figures for suitable habitat also appear typical. In great contrast, dunlin breed at very high densities in coastal habitats: 66 pairs/km² on wet fen on S. Uist (Fuller *et al.* 1986) and a maximum of 90 pairs/km² on machair in Tiree (Shepherd *et al.* 1988).

The breeding of dunlin in Derbyshire was not proved until the 1930's (Frost 1978). Whitlock (1893) noted the birds passing through Derbyshire and surmised, correctly, that they bred at no great distance. Neither Coward (1910) nor Hedley Bell (1962) knew of breeding records for Cheshire and neither McAldowie (1893) nor Smith (1930-1938) give any for Staffordshire. According to Harrison *et al.* (1982) dunlin have never been found breeding in Staffordshire. Nelson (1907) reports breeding 'sparingly' over the Yorkshire moors and Mitchell (1884) report fledged young throughout the hills of Lancashire. Oakes and Battersby report breeding from Pendle, Longridge Fell, Boulsworth, Worsthorne Moor, Whittle Pike, Haslingden Moor and Hambledon. More recent surveys have confirmed breeding in the Forest of Trawden and in the Peak District National Park. Long-term changes in the distribution and abundance of the S.Pennines population are considered further in a later Discussion section.

Figure 12. Distribution of breeding pairs of Dunlin recorded in the South Pennines study area 1990

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Snipe

All the county avifaunas agree that the snipe is a common nesting bird of the moors. Hornbuckle and Herringshaw (1985) suggest that it is 'still probably the most numerous wader of the gritstone'. Althugh birds were distributed throughout the study area (Figure 13, Maps 18-25), only eighty-nine pairs were recorded during the survey at an average density of 0.12 pairs/km². Average density in occupied squares was 1.43 pairs/km² and the most recorded in any one square was 4 pairs. Our data fails to support Hornbuckle and Herringshaw's contention; golden plover and curlew far outnumber snipe. However, it should be borne in mind that snipe are one of the most difficult breeding waders to census accurately (Green 1985 and Reed 1986). At all times other than during the ariel display flight at dawn and dusk, they are cryptic in the extreme. Our total may well be a gross underestimate of the true size of the population.

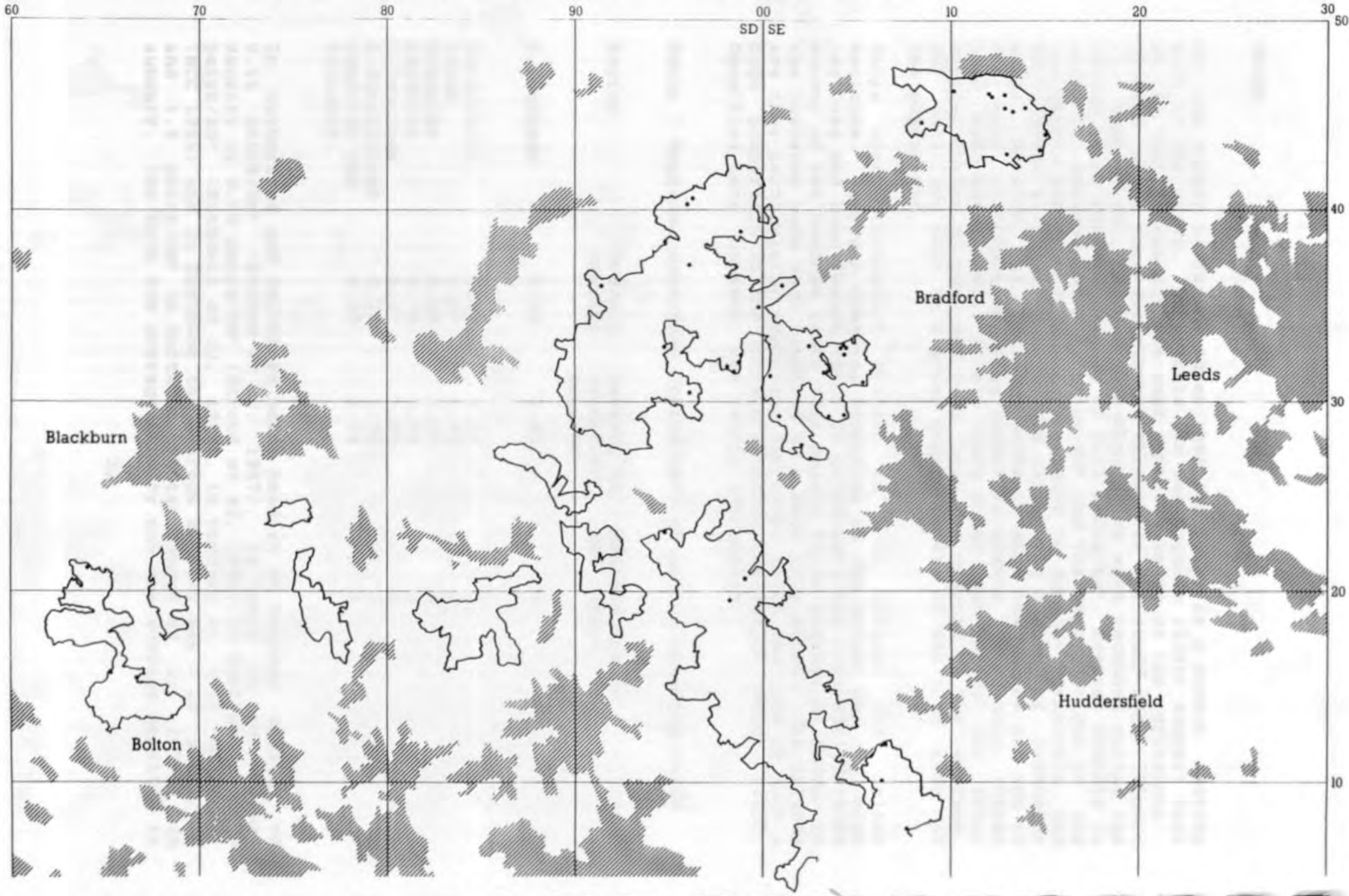
Snipe breed throughout Britain in both lowland and upland wetlands. Although breeding densities in the former may be high (eg Ouse and Nene Washes about 25 pairs/km²) the 1982 NCC/BTO/RSPB survey of wet meadows found that nearly forty percent of those in the lowlands were then confined to a mere five sites. The uplands are thus particularly important for snipe given the loss of such a huge proportion of the lowland breeding population (Smith 1983). Densities here, however, are rarely impressive.

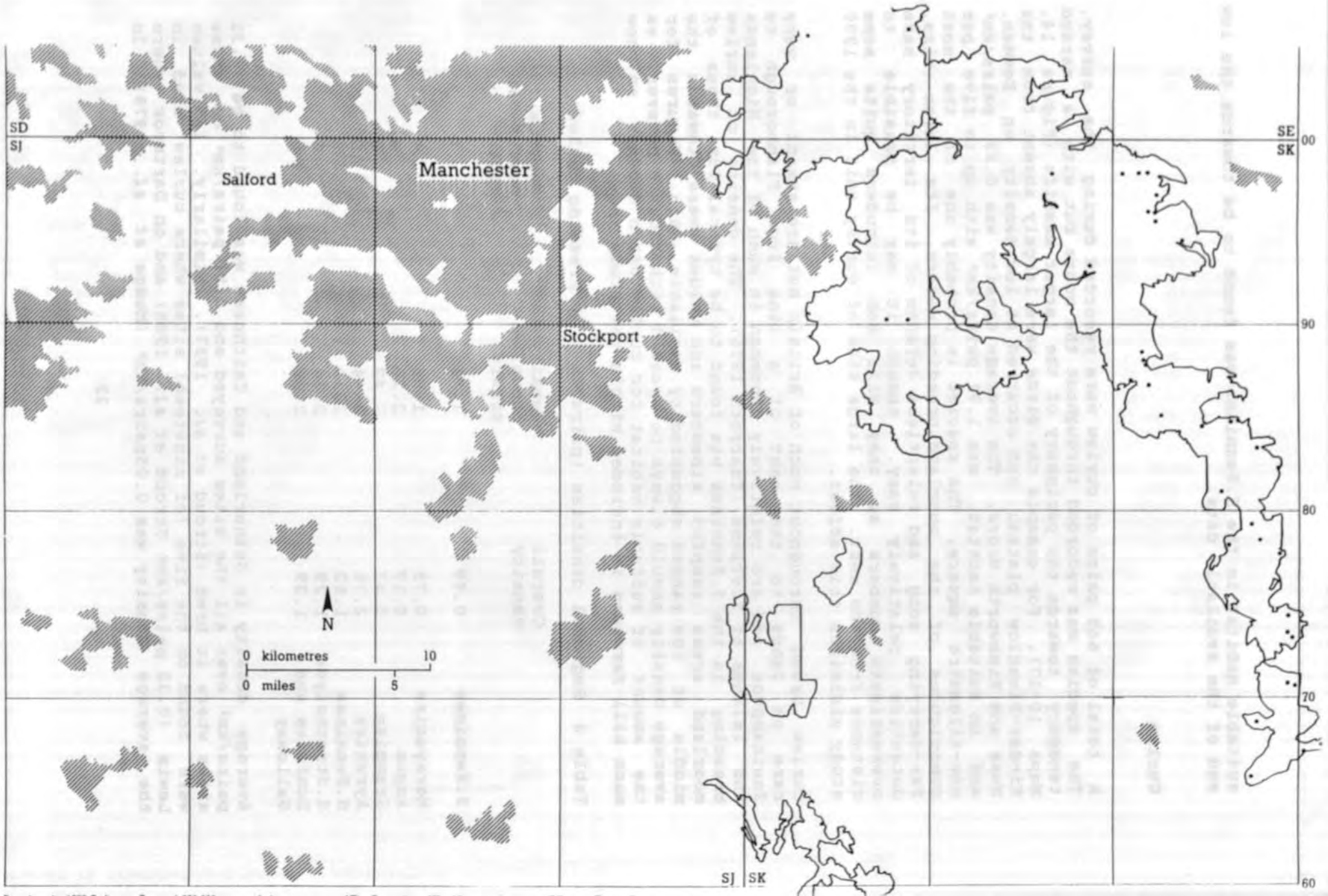
Table 7 Regional densities (pairs/km²) of upland breeding snipe

Region	Overall density	Density in occupied squares	Maximum number per square
S.Pennines	**0.12**	**1.43**	**4**
Morayshire	0.22	1.59	3
Angus	0.07	1.82	3
Grampian	0.15	1.08	2
Ayrshire	0.74	1.60	5
N.Pennines	0.47	1.90	4
S.Strathclyde	0.21	1.51	3
Dumfries and Galloway.	0.20	1.34	3

In Sutherland and Caithness snipe bred at an average density of 0.11 pairs/km² (Stroud *et al.* 1987), in Lewis at an average density of 0.60 pairs/km² (Stroud *et al.* 1988) in Shetland at 0.79 pairs/km² (Rothwell *et al.* 1988), in Cumbria at 0.32 pairs/km² (NCC 1986) and in Dartmoor the average density was 0.20 pairs/km² and 1.5 pairs/km² in suitable habitat (Mudge *et al.* 1979). In summary, the both the average density and the average density in

Figure 13. Distribution of breeding pairs of Snipe recorded in the South Pennines study area 1990

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suitable habitat in the S.Pennines was found to be towards the low end of the available data.

Curlew

A total of 645 pairs of curlew were recorded during the survey. The species was recorded throughout the moors but with a marked tendency towards the periphery of the larger massifs (Figure 14, Maps 10-17). For example the birds were largely absent from the Kinder-Bleaklow plateau and occurred at low density on Howden, Moss and Rishworth Moors. The average density was 0.89 pairs/km² and in suitable habitat, was 1.91 pairs/km² with up to five per one-kilometre square. The species is probably one of the most conspicuous of the moorland breeding waders. Its large size, far-carrying song and relentless defence of its territory make detection relatively easy, though it may be possible to overestimate numbers as they will mob intruders quite some distance from the nest. The large size of survey unit in the 1990 study minimises this effect.

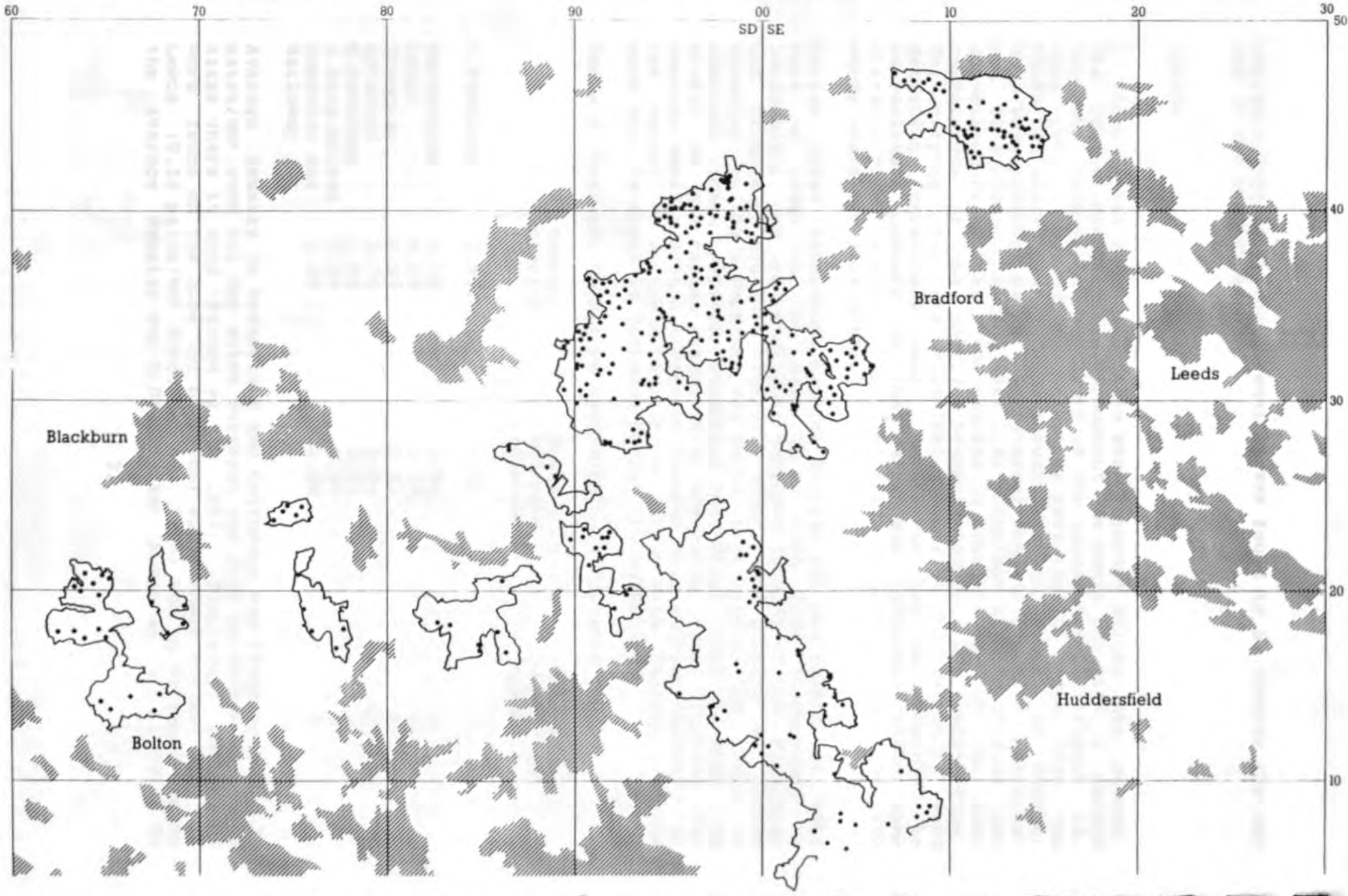
Curlew breed throughout much of Britain but are absent or very rare on lands to the east of a line from Flamborough to Southampton and are relatively uncommon in much of the Highlands and Islands of Scotland (Sharrock 1976). The density of curlew breeding in the S.Pennines was found to be typical for those of moorland areas sampled elsewhere and values were towards the middle of the ranges suggested by available data. Figures for average density should always be treated with caution however, as the amount of suitable habitat for curlew often depends on how much hill farmland is included within the study area.

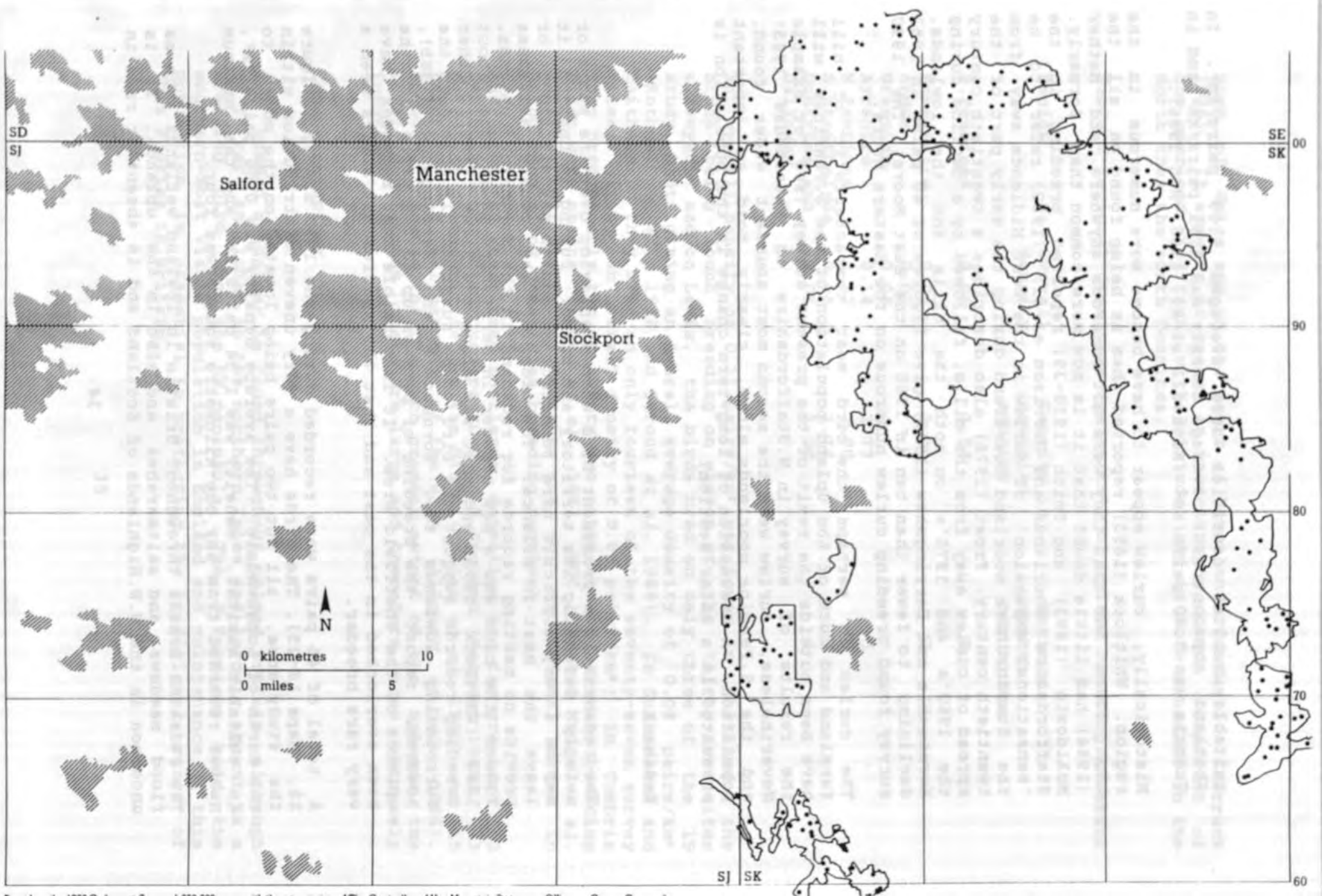
Table 8 Regional densities (pairs/km²) of breeding curlew

	Overall density	Density in occupied squares	Maximum number per square
S.Pennines	**0.89**	**1.91**	**5**
Morayshire	0.75	1.96	4
Angus	0.19	2.25	4
Grampian	0.47	2.42	6
Ayrshire	2.76	3.44	10
N.Pennines	1.62	2.32	5
S.Strathclyde	1.29	2.54	8
Dumfries and Galloway	1.29	2.08	5

Average density in Sutherland and Caithness was found to be 0.31 pairs/km² over all the sites surveyed and 0.51 pairs/km² on those sites where it bred (Stroud *et al.* 1987). Similarly, low values were found on the five (of nineteen) sites where curlew bred in Lewis (0.33 pairs/km² Stroud *et al.* 1988) and on Dartmoor where the average density was 0.05pairs/km² (Mudge *et al.* 1979). In

Figure 14. Distribution of breeding pairs of Curlew recorded in the South Pennines study area 1990

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suitable habitat densities here averaged 1.09 pairs/km². In Shetland, by contrast, average density was 1.91 pairs/km² and in Cumbria was 0.80 pairs/km² (Rothwell *et al.* 1988; NCC 1986).

Historically, curlew appear to have become more numerous in the region. Whitlock (1893) reported them as being found on all the high moors but that they were not numerous anywhere and Mather (1984) had little doubt that it is now more common than formerly. McAldowie (1893) and Smith (1930-39) reported breeding in the Staffordshire moorlands and Harrison *et al.* (1982) refer to he 'sensational expansion' of curlew in the West Midlands away from the Staffordhire moorland heartland during the early part of the twentieth century. Frost (1978) also describes a twentieth century spread of curlew away from the hills, followed by a decline during the 1960's and 1970's on both the hills and the lowlands. Hornbuckle and Herringshaw (1985) give figures of 40 pairs in 1953 declining to fewer than ten in 1985 on the East Moors. The 1990 survey found breeding curlew numerous on the Eastern Moors.

The curlew is perhaps the bird most characteristic of hill farmland and much of the upland population of the S.Pennines will have been outside the remit of the present survey (see for example the results of survey in N.Staffordshire in Waterhouse 1985) Nevertheless, curlew were the second most abundant wader found, and the S.Pennine moorlands alone, clearly hold an important population. A discussion of long-term change in the population is presented in a later section.

Redshank

The redshank is a prominent bird when displaying over the moors or noisily defending its territory and brood. During incubation it may be a very difficult bird to detect as adults may sit tight or leave the nest in silence. The older of the county avifaunas provide no nesting records for redshank in the S.Pennine uplands. Indeed the bird was a new breeder in Derbyshire as late as about 1880 (Whitlock 1893) and that was along the River Trent. Other breeding records suggest the bird to be surprisingly scarce in the surrounding lowlands too. Hornbuckle and Herringshaw (1985), however, report the breeding of perhaps up to ten pairs in the uplands of the Sheffield area. It is possible that redshank have been overlooked in the past and that the species has always been a very rare breeder.

A total of 46 pairs were recorded during the 1990 survey (Figure 15, Maps 18-25). The birds have a very uneven distribution within the study area, all but two pairs being located on the moors to the north of Longdendale. The average density was 0.06 pairs/km². In suitable habitat, density was 1.54 pairs/km² and the maximum number recorded from any one-kilometre square was four.

The redshank breeds throughout Briatin in lowland wetlands such as flood meadows and saltmarshes and also in the uplands. It is uncommon in the N.W.Highlands of Scotland and is absent or rare in

much of Wales and on the moors of Devon and Cornwall (Sharrock 1976). It appears to become an increasingly common component of the moorland bird fauna with latitude, and is more abundant in the north than the south Pennines.

Table 9 Regional densities (pairs/km²) of upland breeding redshank

Region	Overall density	Density in occupied squares	Maximum number per square
S.Pennines	**0.06**	**1.54**	**4**
Morayshire	0.03	1.56	2
Angus	0.00	-	-
Grampian	0.00	-	-
Ayrshire	0.14	1.77	5
N.Pennines	0.22	2.00	5
S.Strathclyde	0.06	1.74	2
Dumfries and Galloway	0.01	1.20	4

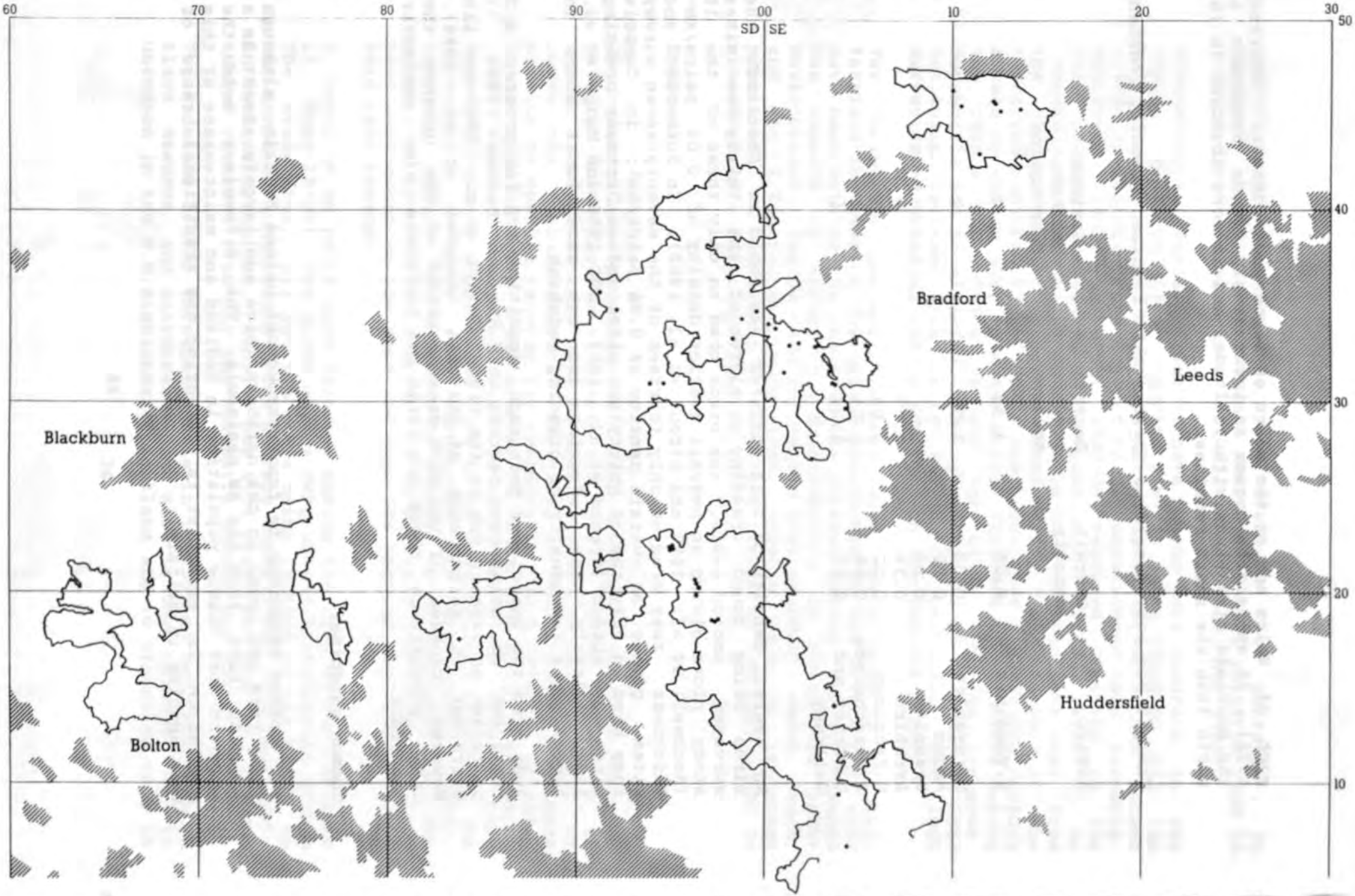
An overall density of 0.11 pairs/km² was found in Shetland, the birds being found breeding on eleven of the thirty-two sites surveyed, and on Lewis, the birds bred on only three of the 19 study plots giving an overall average density of 0.08 pairs/km² (Rothwell *et al.* 1988 and Stroud *et al.* 1988). In Sutherland and Caithness, they bred on only fourteen of the seventy-seven survey sites, giving an overall density of 0.06 pairs/km²; in Cumbria they bred on only two of thirty-two sites and on Dartmoor breeding birds were absent (Stroud *et al.* 1987, NCC 1986 and Mudge *et al.* 1979). Clearly, the S.Pennines are not exceptional moors in harbouring a low density of breeding redshank.

Away from the unenclosed moorlands, densities are far greater: 6.2 pairs/km² on unimproved pasture in N.England (Baines 1988), 73 pairs/km² on machair fen in the Uists (Fuller *et al.* 1986) and 115 pairs/km² in saltmarshes of the wash (Allport *et al.* 1986). However, because of the much greater extent of the uplands the total populations there are large and therefore also extremely important.

Common sandpiper

The common sandpiper is found throughout upland Britain although it is rare and local in the northern Isles and largely absent as a breeding bird from the SW peninsula. The S.Pennines hold the southern-most viable population in England and maintenance of this population is essential in protecting the traditional range of this species in Britain.

Figure 15. Distribution of breeding pairs of Redshank recorded in the South Pennines study area 1990



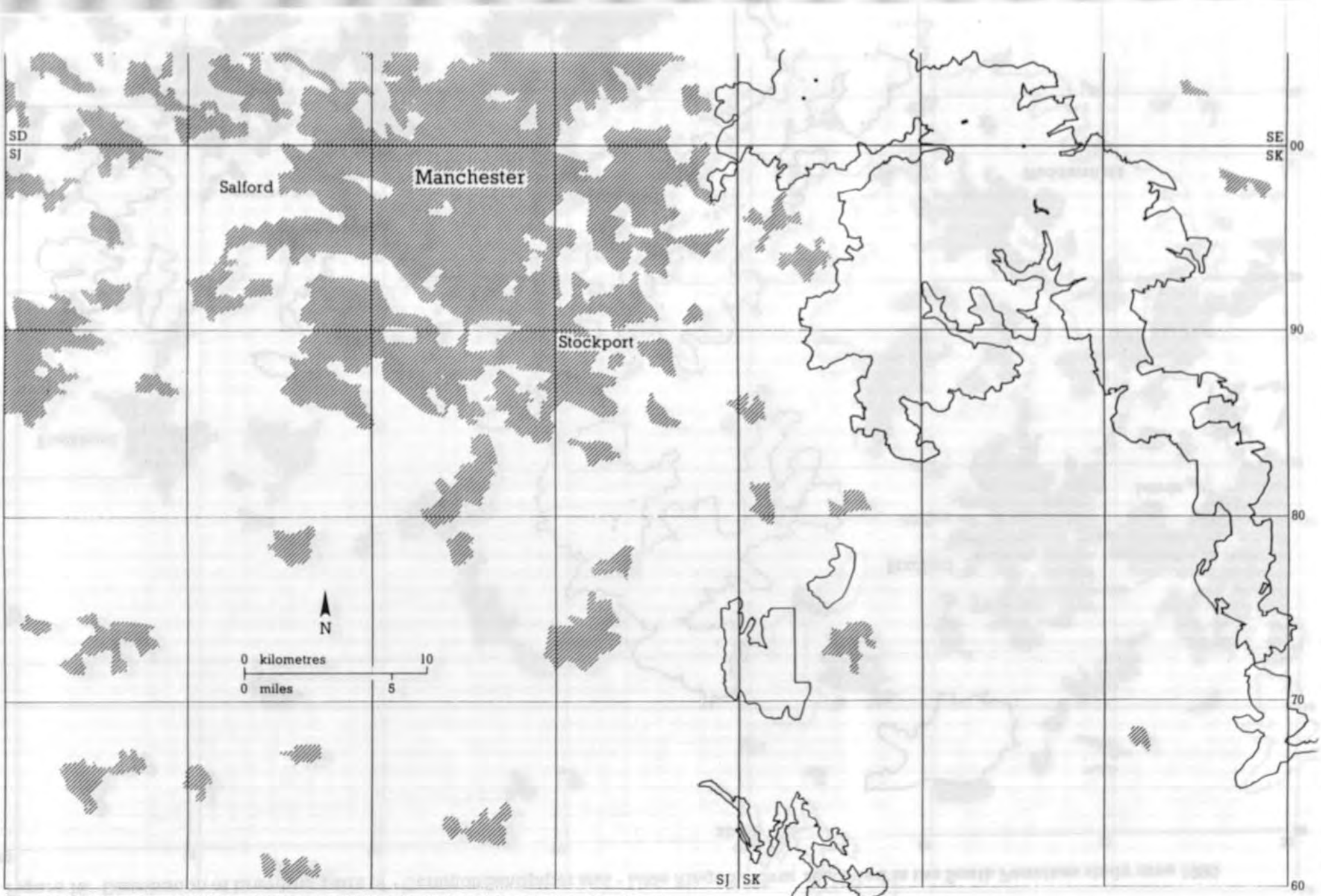
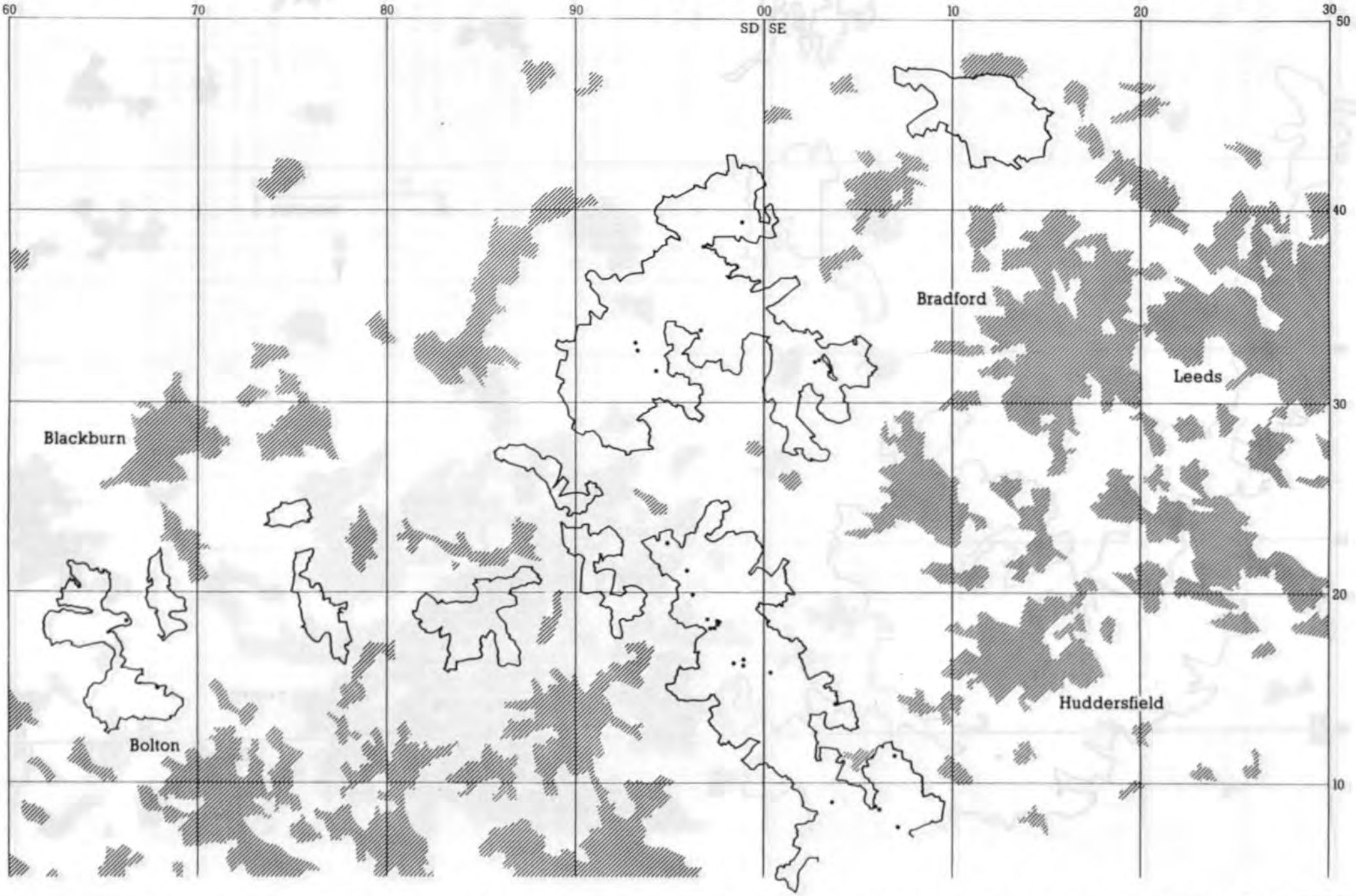
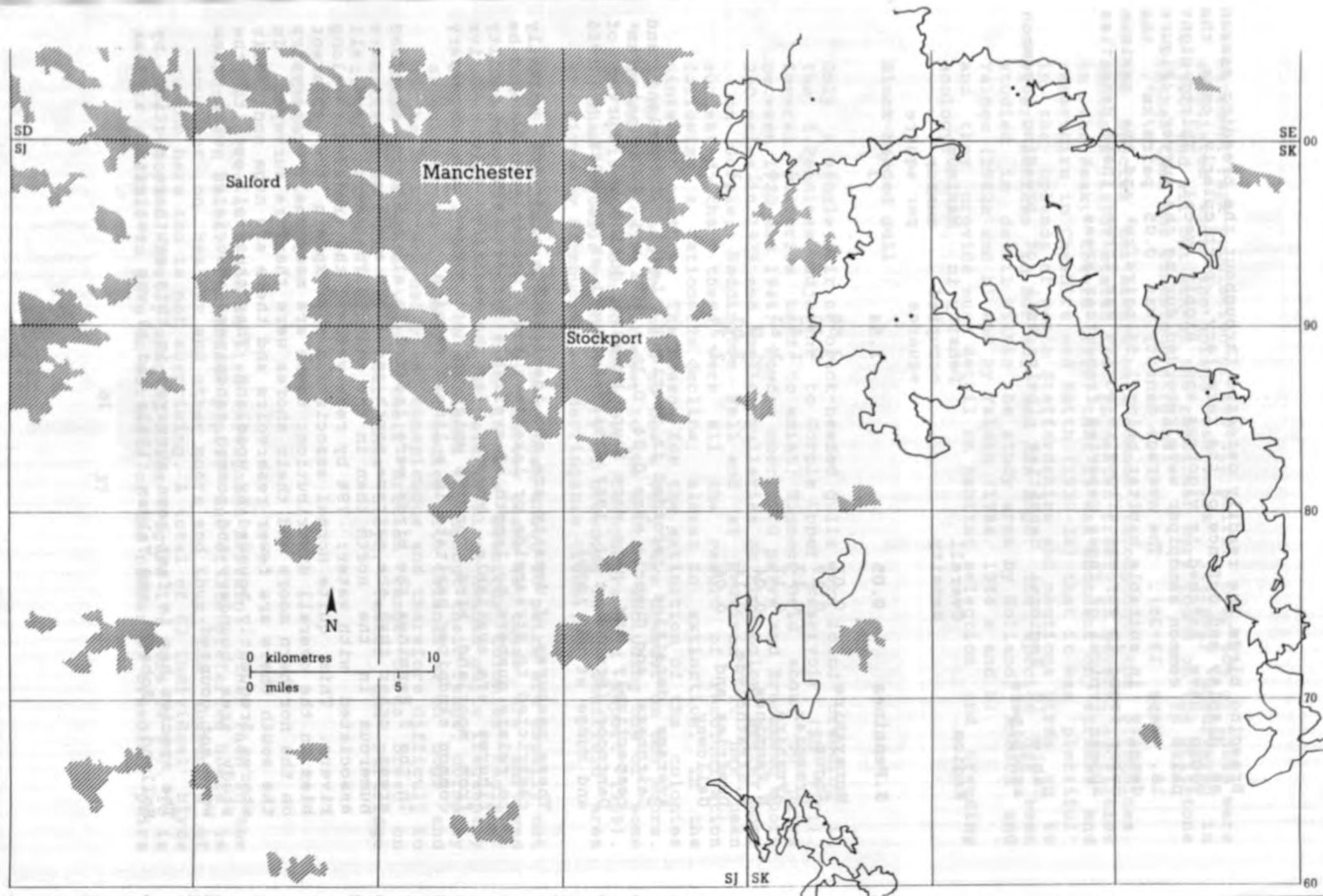


Figure 16. Distribution of breeding pairs of • Common Sandpiper and • Little Ringed Plover recorded in the South Pennines study area 1990

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Breeding birds are readily detected throughout the breeding season as display and defence of the territory, particularly once the young have hatched is vigorous and highly vocal. Thirty-eight pairs of common sandpiper were recorded during the survey (Figure 16, Maps 18-25). The average density was 0.05 pairs/km², the density in suitable habitat being 1.54 pairs/km² and the maximum nuber found in any one-kilometre square was three. These densities appear typical of those reported from other areas.

Table 10 Regional densities (pairs/km²) of breeding common sandpipers

Region	Overall density	Density in occupied squares	Maximum number per square
S.Pennines	**0.05**	**1.54**	**3**
Morayshire	0.01	2.50	1
Angus	0.19	1.32	2
Grampian	0.13	1.47	2
Ayrshire	0.17	1.63	4
N.Pennines	0.04	1.0	1
S.Strathclyde	0.14	2.03	3
Dumfries and Galloway	0.06	2.36	3

Average densities recorded in Shetland, Lewis, Sutherland and Caithness and Cumbria were 0.04, 0.38, 0.21 and 0.04 pairs/km² respectively and none were found breeding during the survey of Dartmoor (Stroud *et al.* 1987, 1988, Rothwell *et al.* 1988, NCC 1986 and Mudge *et al.* 1979).

These measures of density are not ideal as the birds are normally restricted to streamside or lakeshore and a better method would be to relate numbers to length of available habitat. Few such density figures are available, however, as the majority of data derive from moorland bird surveys which do not survey the necessary common sandpiper habitats in a linear fashion.

In the S.Pennines the birds were located in all the main moorland areas other than the extreme north and south and they were more numerous in the north than in the south. The birds were all associated with water; 79% by reservoirs, the remainder along rivers. This quite normal association may explain the apparent bias in the overall distribution: there are many small reservoirs on the northern moors and their shores were therfore surveyed. In the south there are fewer reservoirs and these are huge and their shores frequently bounded by woodland. They thus fell outwith the study area boundary and common sandpipers associated with them were not counted.

The species has in fact been surveyed in this southern section by Holland, Robson and Yalden (1982a and b) who estimated a Peak

National Park population of 190-210 pairs. Over 60% of these were associated with the upland reservoirs (largely unsurveyed in 1990) and all but six of the remainder were found on the gritstone rather than the limestone streams.

The species has always been common throughout the S.Pennines. Whitlock (1893) stated that it nested freely in several localities in the Peak, Coward (1910) that it was abundant on streams and reservoirs in Cheshire and Smith (1930-38) that it was 'plentiful' in the uplands of north Staffordshire and mentions birds up to river sources on Morridge and Axe Edge. The species has been studied in detail within the study area by Holland, Robson and Yalden (1982a and b) and by Yalden (1984, 1986 a and b) and they provide much detail on habitat selection and breeding ecology.

Black-headed gull

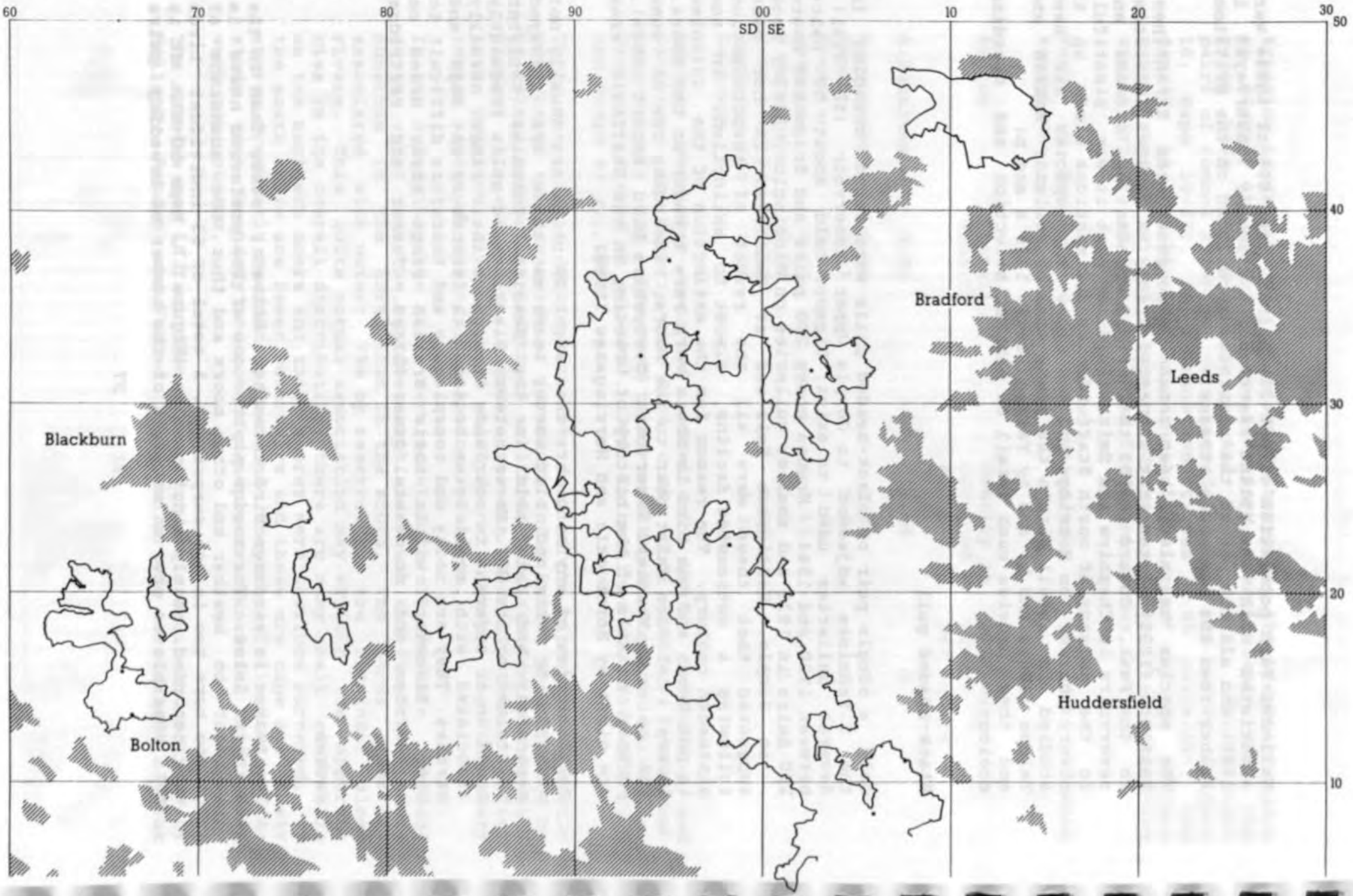
Only a single pair of black-headed gulls were found breeding in the S.Pennines adjacent to Gorple Upper Reservoir (SD 9131). Several gulleries used to exist; Bigmoor held about 50 pairs between 1920 and 1944, Howden moors 200 pairs and Broomhead moors 250 pairs in 1938 and smaller gulleries on Ringinglow, Beeley moor , on Gorple, Waddington Fell and at Redmires. It has been suggested that these were all the result of recolonisation following a nationwide decline, almost to extinction, in the ninteenth century. The reason for the extinction of the colonies is not known and the bird is now a very rare breeder on the moors. Several colonies exist near to the moors, including one of some 150 pairs on Woodhead Reservoirs (Derbyshire Bird Report 1989). Further details of the history of breeding in the Sheffield area are given by Hornbuckle and Herringshaw (1985).

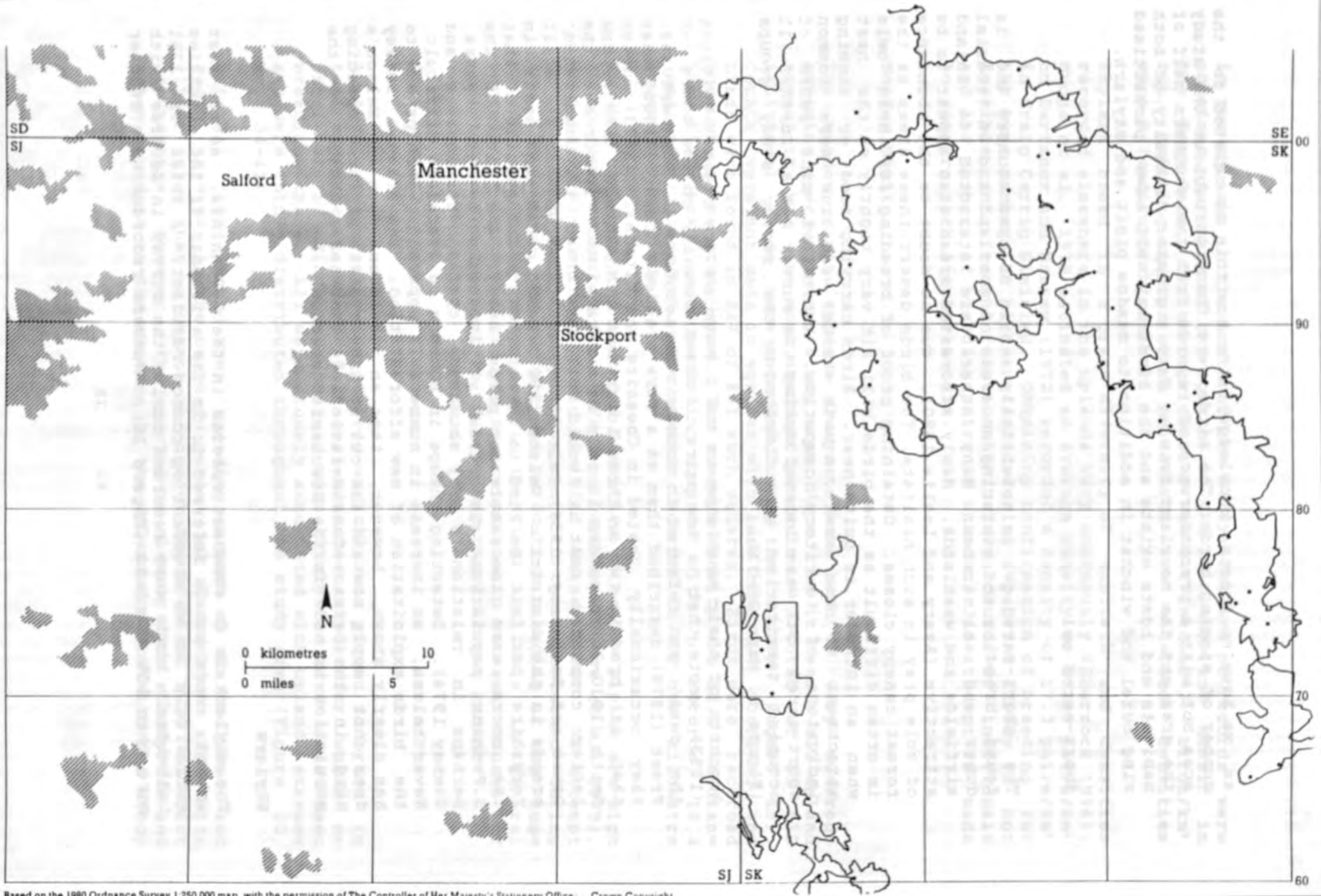
Gull colonies of anything more than about 20 pairs are usually not surveyed by moorland bird survey teams as these are surveyed separately and data held in the Seabirds Colonies Register maintained by the NCC. Nevertheless, black-headed gulls frequently breed on or adjacent to moorlands throughout their range, normally associated with small water bodies with islands or on bogs and marshes. They are noisy and conspicuous and therefore difficult to miss. Elsewhere within their British range birds breed on saltmarshes and on coastal dunes (Lloyd, Tasker and Partridge 1991).

Cuckoo

The cuckoo is a common bird throughout Britain, other than in the Northern Isles. The meadow pipit, one of its preferred hosts is abundant on heather and other moors and thus the abundance of cuckoo here too is not surprising. A total of 63 individual birds were recorded, mostly singing males (Figure 17, Maps 50-57). It is not possible to give an estimate of the number of breeding pairs

Figure 17. Distribution of breeding pairs of Cuckoo recorded in the South Pennines study area 1990





as we have no precise knowledge as to how this is related to the number of singing birds. The birds were found throughout the study area but with a preponderance of records from the southern half of the area and the moorland fringe. Here a greater diversity of both habitats and hosts exists and the birds may well have parasitised ring ouzel and winchat in addition to meadow pipit and skylark.

Short-eared owl

The short-eared owl is essentially a bird of open country and is found breeding and wintering on areas of moorland and on coastal dunes and saltmarshes. Many others are attracted to inland airfields and washlands. Newly afforested areas also appear to be attractive (Avery and Leslie 1990), due no doubt to the abundance of vole prey in such habitats. The birds desert these areas as the forest canopy closes. Obtaining proof of breeding for these owls is often difficult as the birds will sit very tightly on the nest when an intruder is quite near. Birds carrying food or showing attachment to the area on both visits were the more common indicators of territory occupation. A total of nine pairs of short-eared owl were located during the survey but a further 11 occupied territories were located by the raptor study groups (Figure 8, Maps 26-33).

Accounts of their abundance in the S.Pennines are bleak. Whitlock (1893) wrote that 'a few pairs... breed annually on the moors of the peak' and referred to constant persecution of the species. Frost (1979) described them as a rare breeder, Coward (1910) that they occasionally nested in Cheshire and Mitchell (1893) noted that it bred in two or three localities. McAldowie (1893) and Smith (1930-38) recorded it only as a rare winter visitor but the latter commented that it 'would doubtless breed if unmolested' Oakes and Battersby (1939) felt it 'questionable whether it still breeds in the district'. Nelson (1907) noted occasional nests in Yorkshire but felt the bird to be more common and suggested that the moors were too remote for proper study. The size of the S.Pennine population also greatly fluctuates between years, perhaps in relation to prey abundance cycles (Herringshaw and Gosney 1974). Detecting change in numbers is therefore difficult. Nevertheless, an increase in numbers is apparant, perhaps due to the birds exploitation of new afforestation. The present survey has clearly shown, however, that an assessment such as Nelson's does not apply now and the owl is indeed still a rare breeding bird in the area. Consideration of long-term change in the population is made in the Discussion section.

Skylark

The skylark is an abundant species in the S.Pennines, as in most upland areas and is referred to in the avifaunas of the counties exclusively as an abundant or common resident. A total of 3781 individual birds were recorded during the survey in squares with more than 10% moorland (Figure 18). Numbers recorded were greater

in the squares in the north of the study area and no records were obtained for many of the squares in the main moorland massif in the Peak Park. The average density was 4.4 (median=2) birds/km². but, omitting squares where no records were obtained, densities were 6 (median=4) birds/km².

Skylark breed in a great diversity of habitats and densities recorded elsewhere in the uplands vary enormously (Sharrock 1976). Mudge *et al.* 1979 estimated an average density of 47.8 pairs/km² on Dartmoor and Massey (1972) recorded a density of 17.3 pairs/km² in Craig Cerrig Gleisiad. Obtaining confirmation of breeding for the huge numbers of birds recorded during a general survey is not feasible and, as the relationship between counts of individuals and the numbers of breeding pairs is unknown, no attempt is made to compare such figures herein.

Meadow pipit

The meadow pipit appears always to have been a very numerous breeding species in the study area. Here, as in nearly all upland areas it was the most abundant passerine. A total of 15 612 individual birds were recorded during the survey (Figure 19). Counts were not made in squares with less than 10% moorland and birds were found in 847 of 861 such squares. Birds were recorded throughout the study area. The average density was 18.1 (median= 16) birds/km² and, excluding squares with no records, 18.4 (median=16) birds/km². The maximum recorded in any one kilometre square was 84 birds.

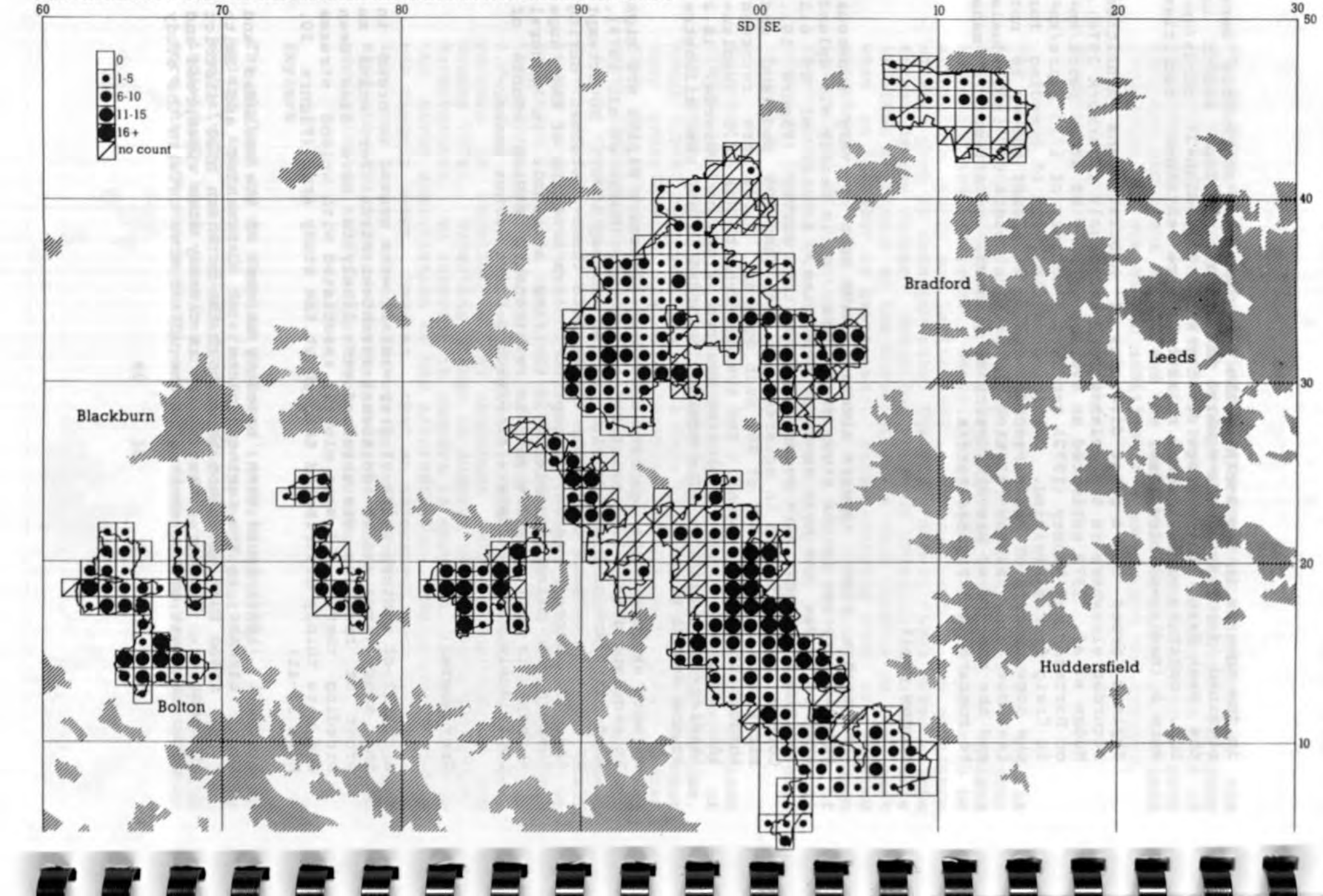
As with skylarks, the recorded densities of meadow pipits are high in moorland areas: 53.8 pairs/km² on Dartmoor (Mudge *et al.* 1979), 42.6 pairs/km² on Craig Cerrig Gleisiad (Massey 1972). No attempt is made to compare these such values with those obtained during the 1990 survey, as any attempt to confirm breeding of the huge numbers of pairs encountered in the time available in general surveys is not possible and the relationship between counts of individuals and the numbers of breeding pairs is not known.

Grey wagtail

A total of sixteen pairs of grey wagtail were proved to breed in the study area and an additional seventeen birds for which no proof of breeding was obtained were likely to have also been breeding there. All were closely associated with upland streams and were thinly distributed throughout the study area (Figure 20, Maps 34-41).

Mitchell (1884) found them 'breeding on most of the secluded and rocky streams in the northern parts' of Lancashire and Smith (1962) noted them as common throughout the northern hill district of Cheshire. However, the species is clearly also widespread and often abundant on the streams in the upland area outwith the study

Figure 18. Numbers of Skylarks recorded within each 1km-square in the South Pennines study area 1990



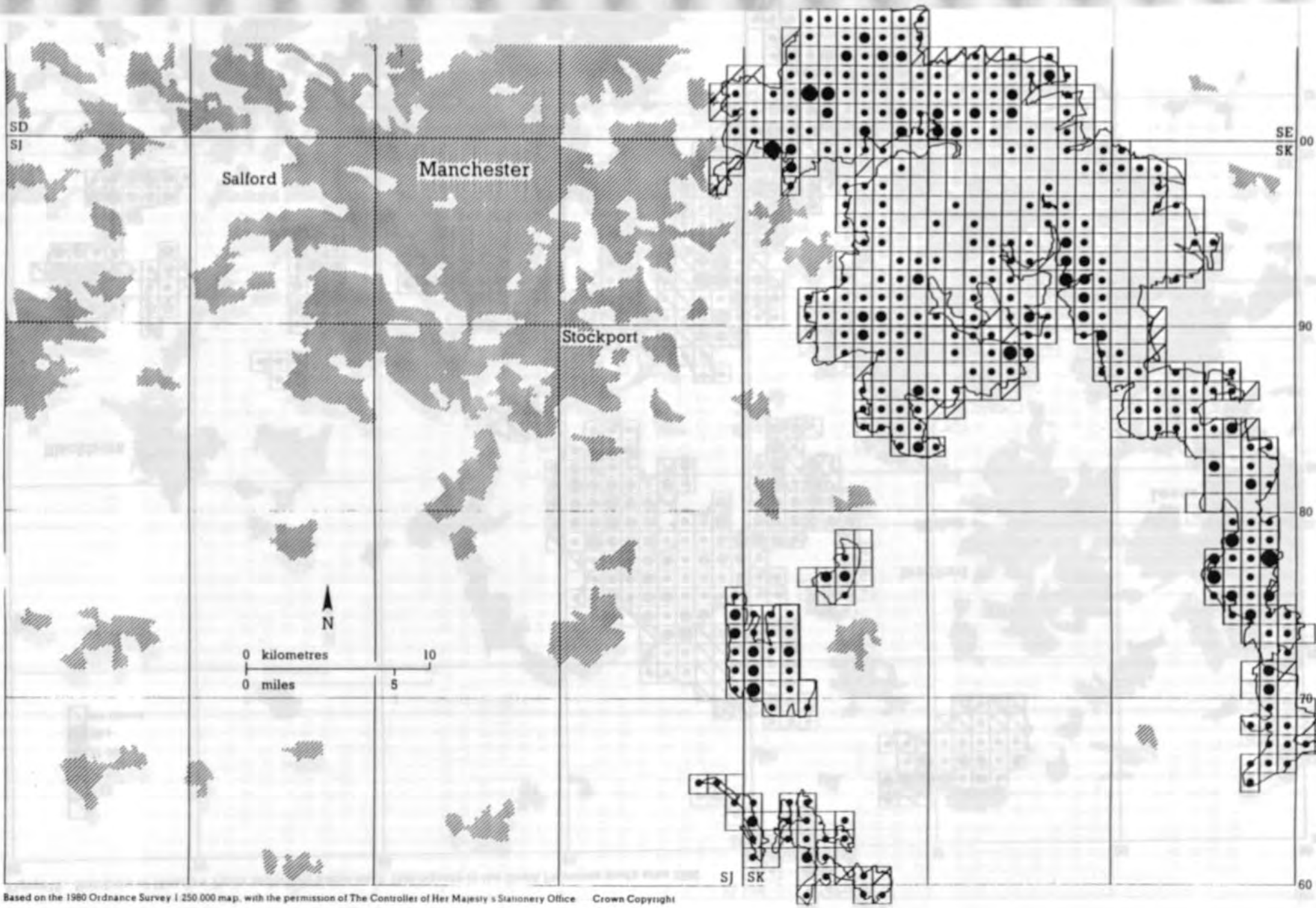
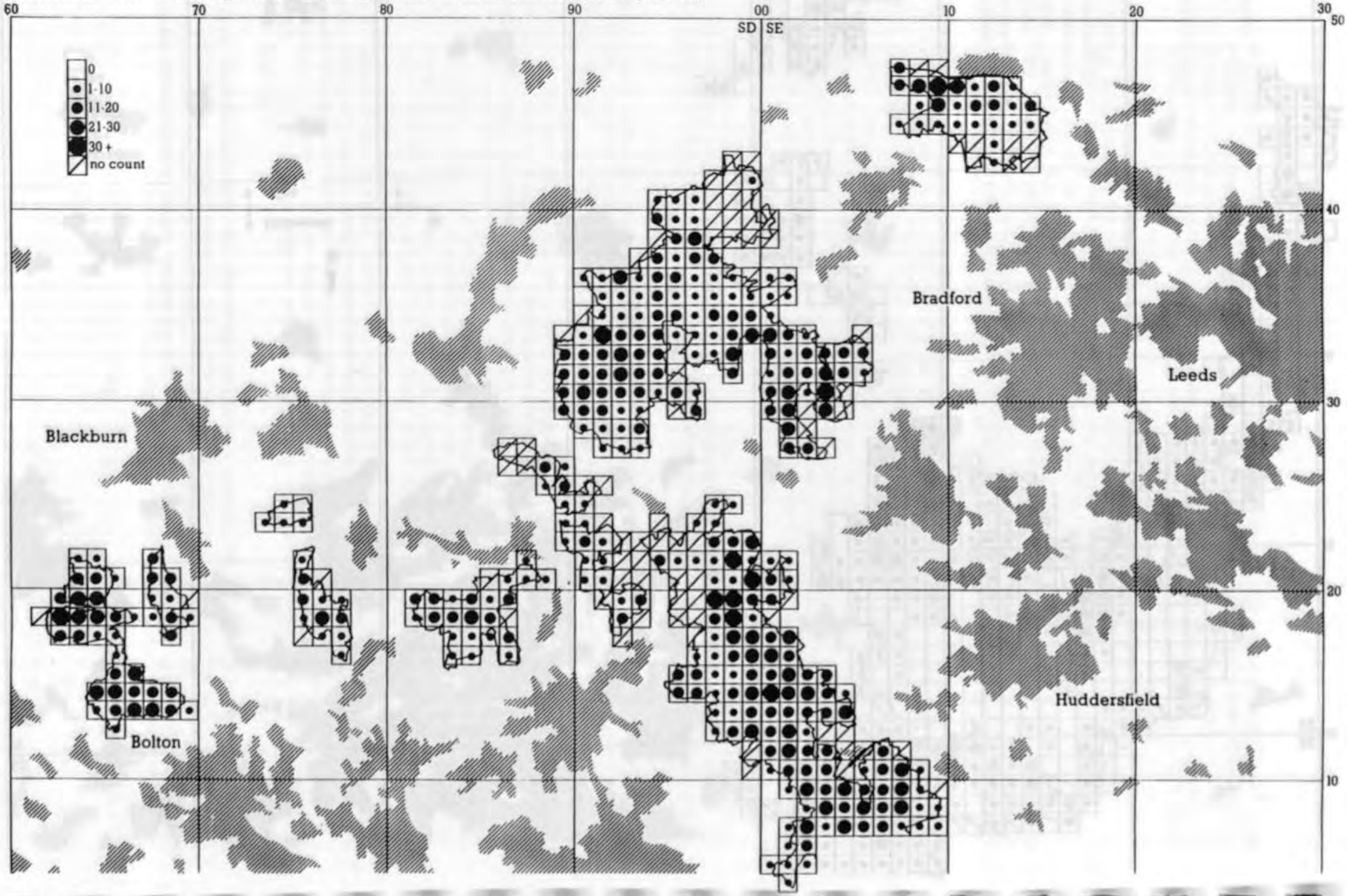
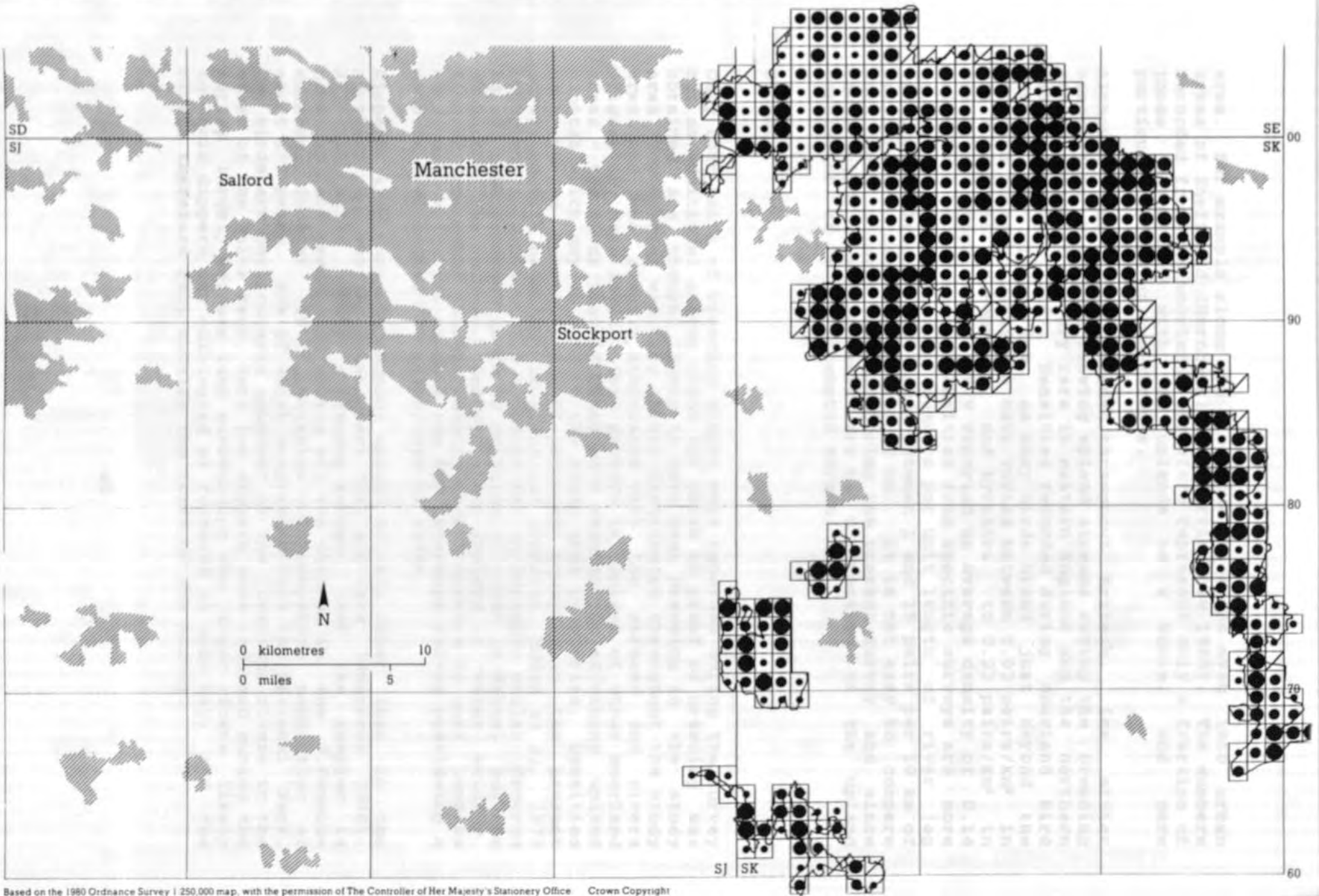


Figure 19. Numbers of Meadow Pipits recorded within each 1km-square in the South Pennines study area 1990





area, for example along the limestone dales and even into urban areas of Sheffield (Hornbuckle and Herringshaw 1985). The numbers recorded from the moorlands therefore represent only a fraction of those associated with the uplands as a whole, and more particularly, the upland streams.

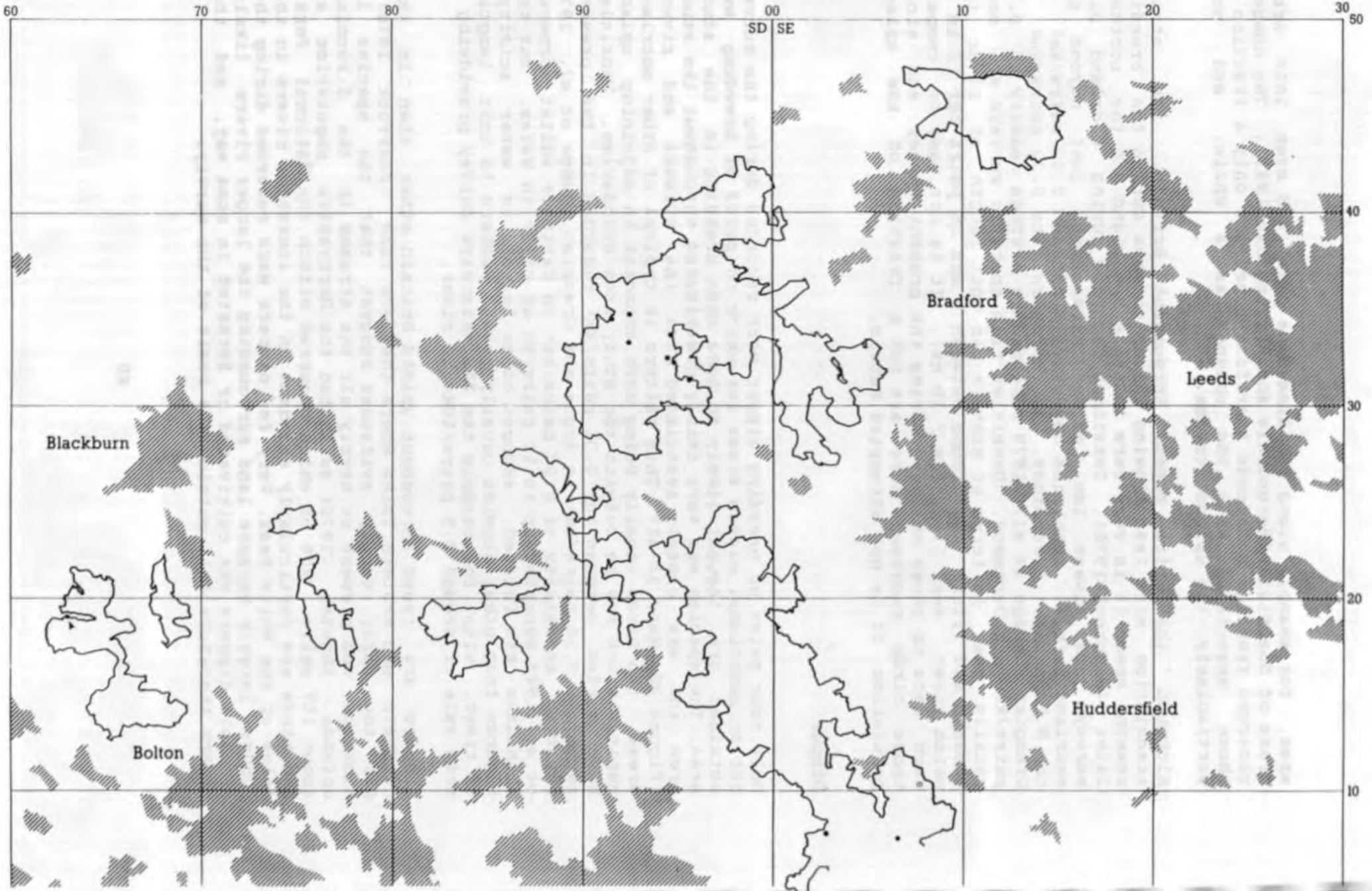
Although the bird breeds throughout Britain, its strict association with fast flowing upland streams during the breeding season means it is very rare in eastern England and the northern Isles (Sharrock 1976). Densities recorded during moorland bird surveys are always low, as many birds breed just beyond the moorland fringe. Densities have varied between 0.02 pairs/km^2 in the N.Pennines, S.Pennines, and Ayrshire, to 0.22 pairs/km^2 in Grampian. Mudge *et al.* 1979 reported an average density of 0.14 pairs/km^2 on Dartmoor. Densities from specific surveys are more usually cast in terms of numbers per unit length of river (eg Ormerod and Tyler, 1987 found between 1 and 15 pairs per 10 km of welsh river, mean 3.8 pairs / 10 km). It is not easy to compare such data to those colected during the present survey and since those birds recorded here are but a fraction of the upland population, it is not attempted herein.

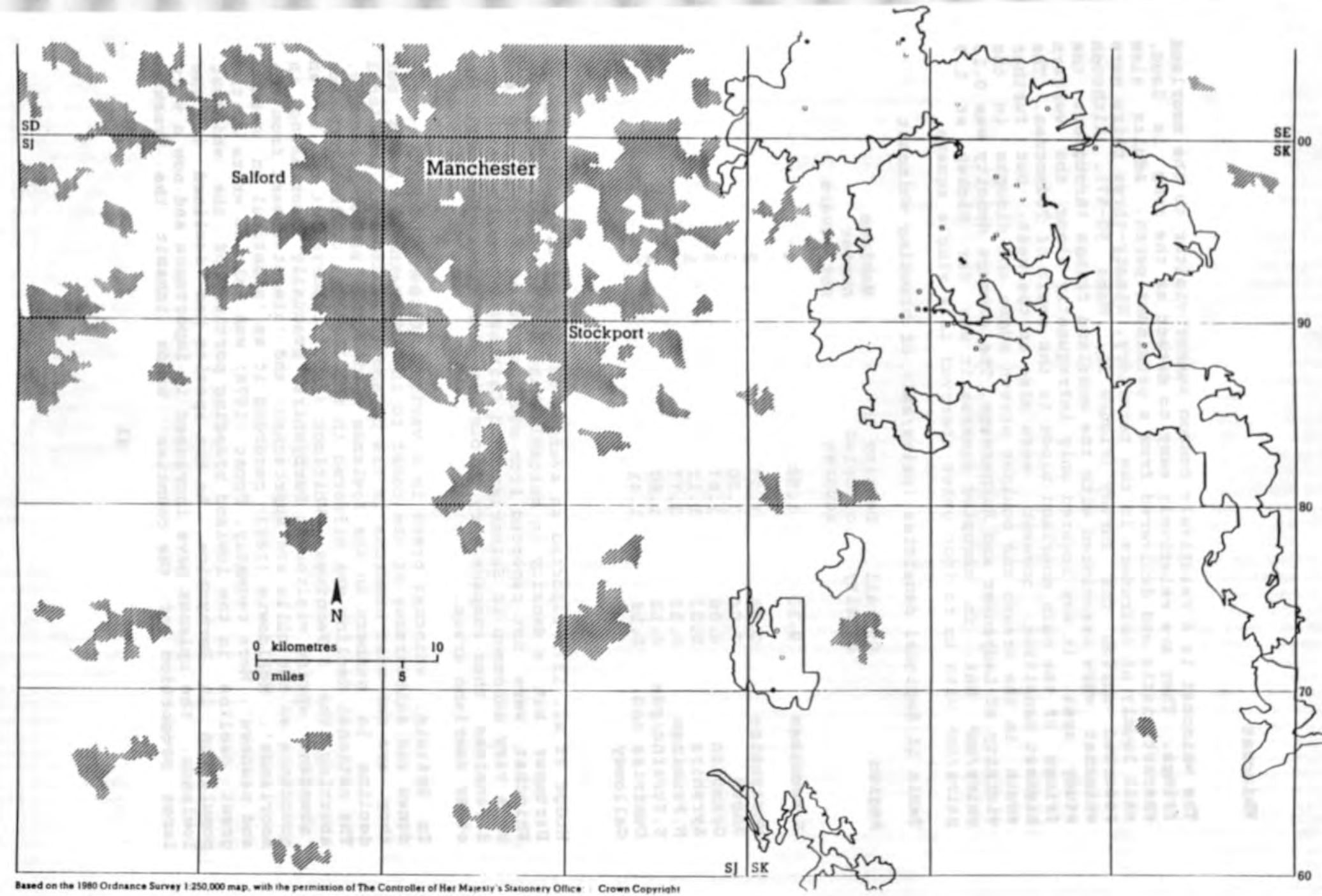
Dipper

Only four pairs of breeding dipper were recorded during the survey but an additional eleven birds for which no proof of breeding was obtained are thought likely to have been breeding in the study area. The species was very thinly distributed throughout the study area and was closely associated with the streams and rivers (Figure 20, Maps 34-41). This pattern is typical of other moorland areas - the birds usually being more abundant in adjoining upland habitat which may be outwith the study area boundaries. Densities have varied between the 0.01 pairs/km^2 recorded in the present survey to 0.15 pairs/km^2 in Angus and Grampian. Mudge *et al.* 1979 reported an density of 0.03 pairs/km^2 on Dartmoor whilst Ormerod *et al.* 1985 reported up to 10 pairs/km of river in Wales, but the abundance was related, amongst other factors to water acidity. Figures from other studies usually relate numbers to unit lengths of river, with, for example the BTO waterways survey provideing a mean vale of around 3.5 pairs/10km of river.

Dippers are found throughout upland Britain other than in the northern and western Isles where they are rare (Sharrock 1976). All the early county avifaunas suugest that the species is numerous and present on nearly all the streams in the S.Pennine uplands. Shooter (1970) estimated the Derbyshire population at about 107 pairs, 90% of which occurred within the National Park. The birds are particularly abundant on the limestone rivers in the dales of the White Peak. Very few dippers were recorded during the survey largely because land surrounding the larger rivers likely to hold dippers was cultivated or forested in some way, and the rivers therefore fell outside the remit of the survey.

Figure 20. Distribution of breeding pairs of ·Grey Wagtail and ·Dipper and non-breeding Grey Wagtail and ·Dipper recorded in the South Pennines study area 1990





Whinchat

The whinchat is a relatively common summer visitor to the moorland fringe. They are relatively easy to detect as the song is loud, characteristic and delivered from a prominent perch. Adults also call loudly at intruders in the territory. Ninety-three pairs were recorded during the survey (Figure 21, Maps 50-57). Although whinchat were associated with the moorland fringe throughout the study area, it was located only infrequently along the western fringe of the main moorland block to the south of Todmorden. The highest densities, however, were also on the west, but further south in the braken and boulder strewn edges and cloughs in the vicinity of Ladybower and Hathersage. The average density was 0.13 pairs/km² but, in occupied squares it was far higher at 1.9 pairs/km² with up to four pairs observed in a single square.

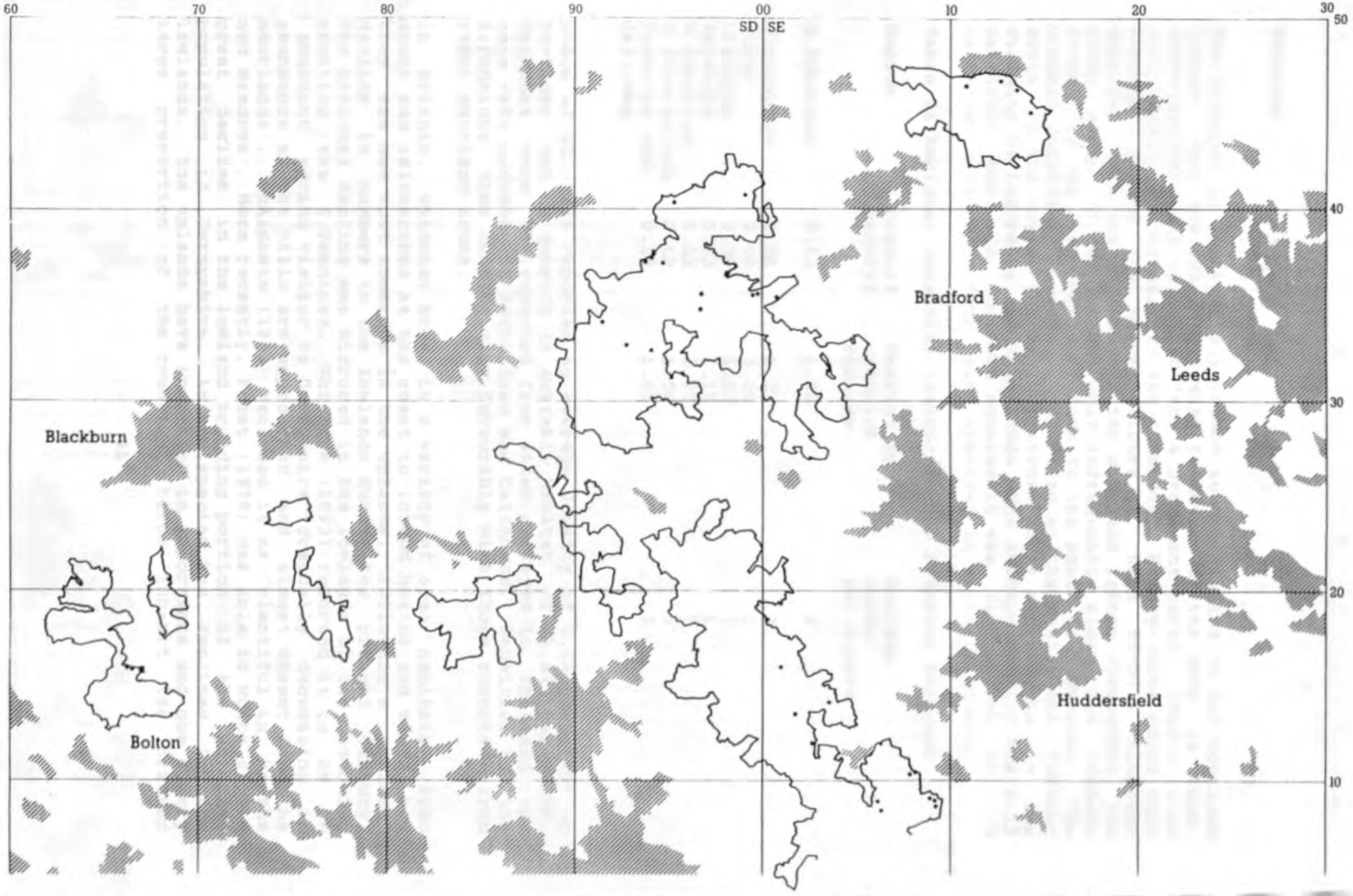
Table 11 Regional densities (pairs/km²) of breeding whinchat

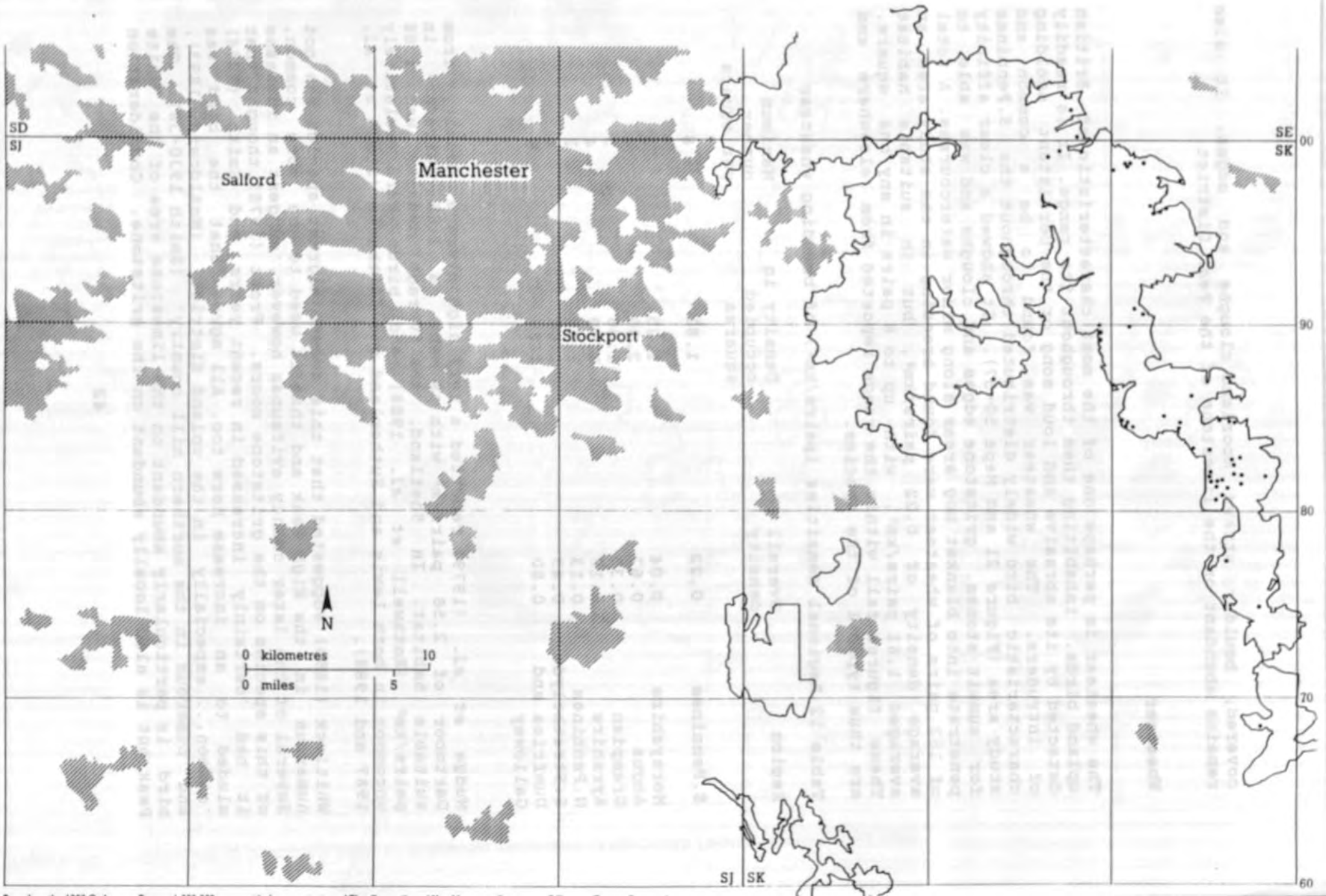
Region	Overall density	Density in occupied squares	Maximum number per square
S.Pennines	0.13	1.90	4
Morayshire	0.06	1.27	2
Angus	0.04	3.00	3
Grampian	0.06	1.67	3
Ayrshire	0.03	1.11	1
N.Pennines	0.53	3.77	7
S.Strathclyde	0.12	1.50	3
Dumfries and Galloway	0.19	1.41	3

Mudge *et al.* 1979 reported an average density of 0.46 pairs/km² on Dartmoor but a density in suitable habitat of 1.68 pairs/km². Whinchat were not reported from sites surveyed in Shetland and were very uncommon in Sutherland and Caithness. Densities in the S.Pennines thus compare very favourably with those reported from other moorland areas.

In Britain, whinchat breed in a variety of open habitats, from dunes and saltmarshes at the coast to inland heaths and moors, but they are now most numerous in the uplands, following a national decline in numbers in the lowlands during the present century. The national decline was mirrored in the lowlands of the counties abutting the S.Pennines. Whitlock (1893) reported it to be an 'abundant spring visitor to Derbyshire''gradually decreasing in abundance as the hills are approached' and 'almost absent from the moorlands'. McAldowie (1893) recorded it as 'plentiful in heaths and meadows'. More recently, Frost (1978) was able to write of the great decline in the lowland breeding portion of the whinchat population in Derbyshire. As the species has declined in the lowlands, the uplands have increased in importance and now a very large proportion of the counties' birds inhabit the bracken

Figure 21. Distribution of breeding pairs of Whinchat recorded in the South Pennines study area 1990

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covered, boulder strewn moorland cloughs and edges. It also remains abundant on the limestone of the Peak District.

Wheatear

The wheatear is perhaps one of the most characteristic of British upland birds, inhabiting them throughout its range. It is readily detected by its abrasive and loud song or the persistent scolding of intruders. The wheatear was found to be a common and characteristic bird widely distributed throughout the S.Pennines study area (Figure 21 and Maps 50-57). It showed a clear affinity for summit stones, gritstone edges and cloughs and was able to penetrate into blanket bog areas along minor watercourses. A total of 162 pairs of wheatear were found breeding in the study area, an average density of 0.22 pairs/km², but in suitable habitat averaged 1.81 pairs/km², with up to 8 pairs in any one square. These figures fall within the range reported from elsewhere and are thus typical of the species.

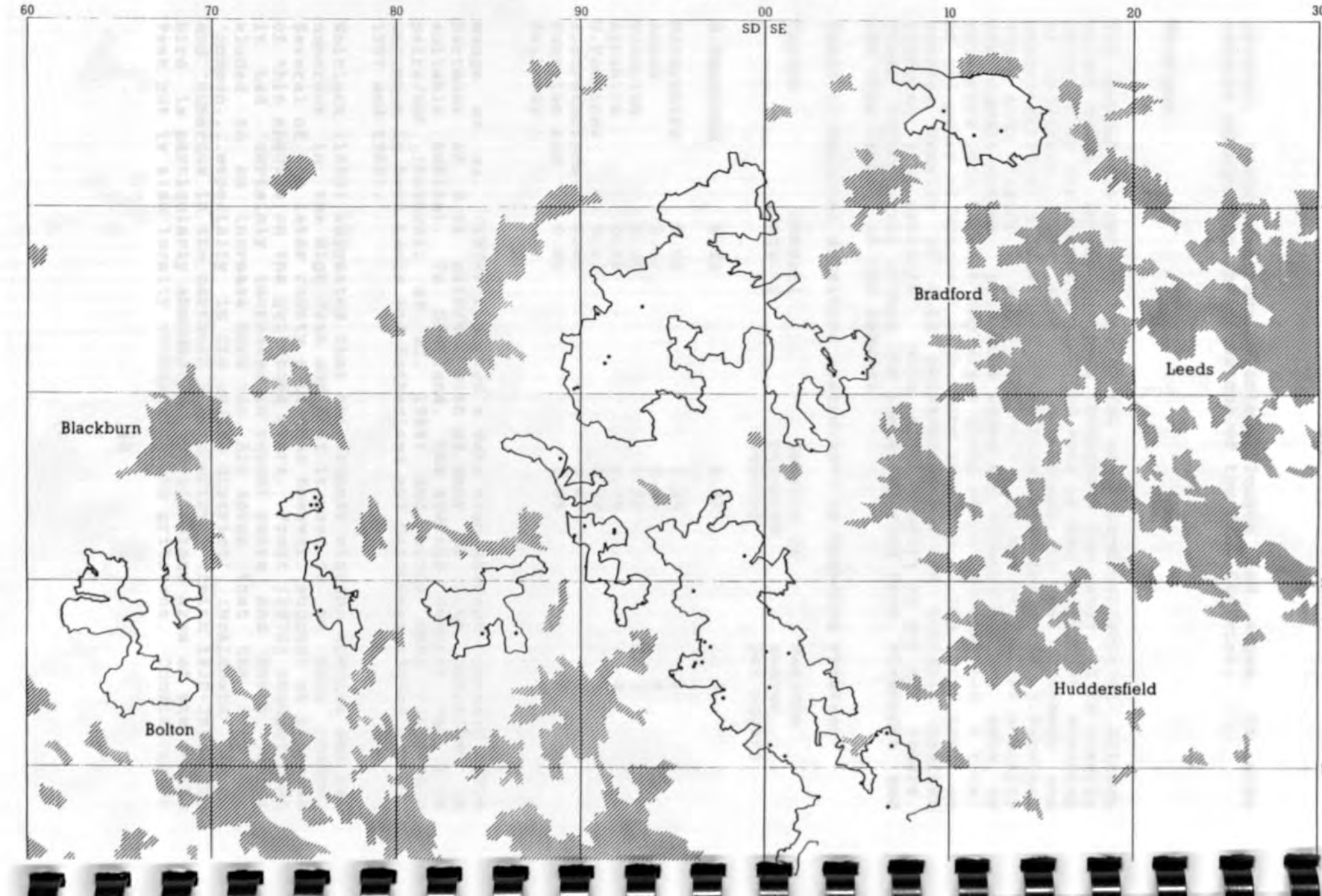
Table 12 Regional densities (pairs/km²) of breeding wheatear

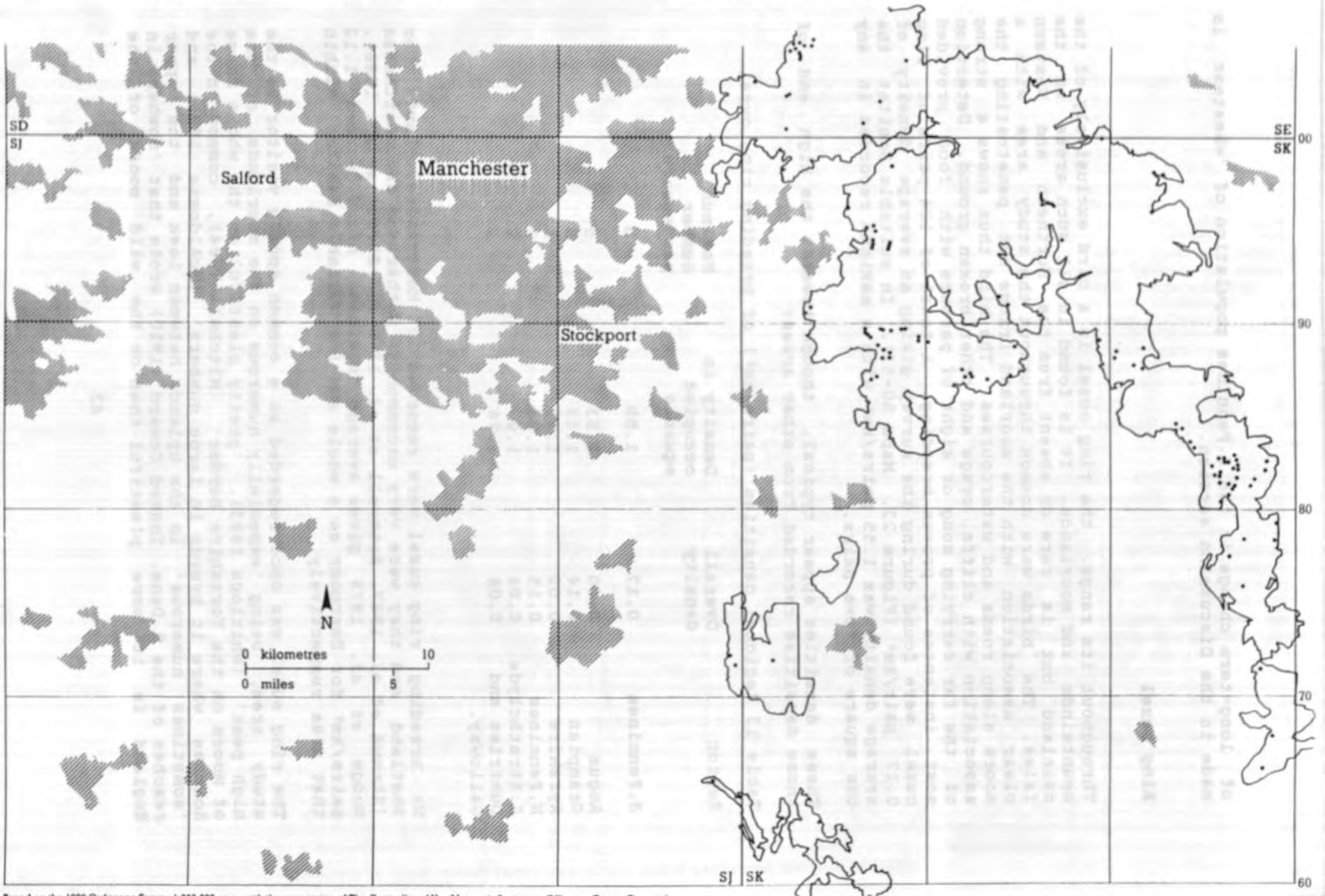
Region	Overall density	Density in occupied squares	Maximum number per square
S.Pennines	**0.22**	**1.81**	**8**
Morayshire	0.04	1.25	1
Angus	0.67	2.36	4
Grampian	0.35	1.36	3
Ayrshire	0.18	1.79	4
N.Pennines	0.13	1.40	3
S.Strathclyde	0.43	2.06	4
Dumfries and Galloway	0.80	1.89	5

Mudge *et al.* (1979) reported a very high average density from Dartmoor of 2.58 pair/km² with as many as 3.66 pairs/km² in suitable habitat. In Shetland, the average density was 1.88 pairs/km² (Rothwell *et al.* 1988) and birds were relatively uncommon in both Lewis and Sutherland and Caithness (Stoud *et al.* 1987 and 1988).

Whitlock (1893) suggested that this summer migrant species was not numerous in the High Peak and that it used to be more common. Several of the later county avifaunas however, suggest an increase of this species on the gritstone moors. Frost (1978) thought that it had 'certainly increased in recent years and Smith (1974) aluded to an increase here too. All agree that the bird was 'common....especially in the upland district' (McAldowie 1893), and 'numerous in the northern hill country' (Smith 1930-38). The bird is particularly abundant on the limestone area of the White Peak but is also locally abundant on the gritstone. Consideration

Figure 22. Distribution of breeding pairs of Wheatear recorded in the South Pennines study area 1990

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of long-term change in the S.Pennines population of wheatear is made in the Discussion section.

Ring ouzel

Throughout its range, the ring ouzel is a bird exclusively of the mountainds and moorlands. It is found in all such areas on the mainland but is rare or absent from the Northern and Western Isles. The birds were common throughout the study area with a clear association with the moorland fringe but penetrating the moors along roads and watercourses. The bird thus shows a strong association with cliffs, crags and other broken ground. Detection of the far carrying song or sight of parents with food provided most instances of proven breeding. A total of 124 pairs of ring ouzel were found during the survey giving an average density of 0.17 pair/km² (Figure 23, Maps 50-57). In suitable habitat the average density was 1.55 pairs/km² with a maximum recorded in any one square of five pairs.

These densities appear typical, though towards the high end of those densities recorded from other areas:

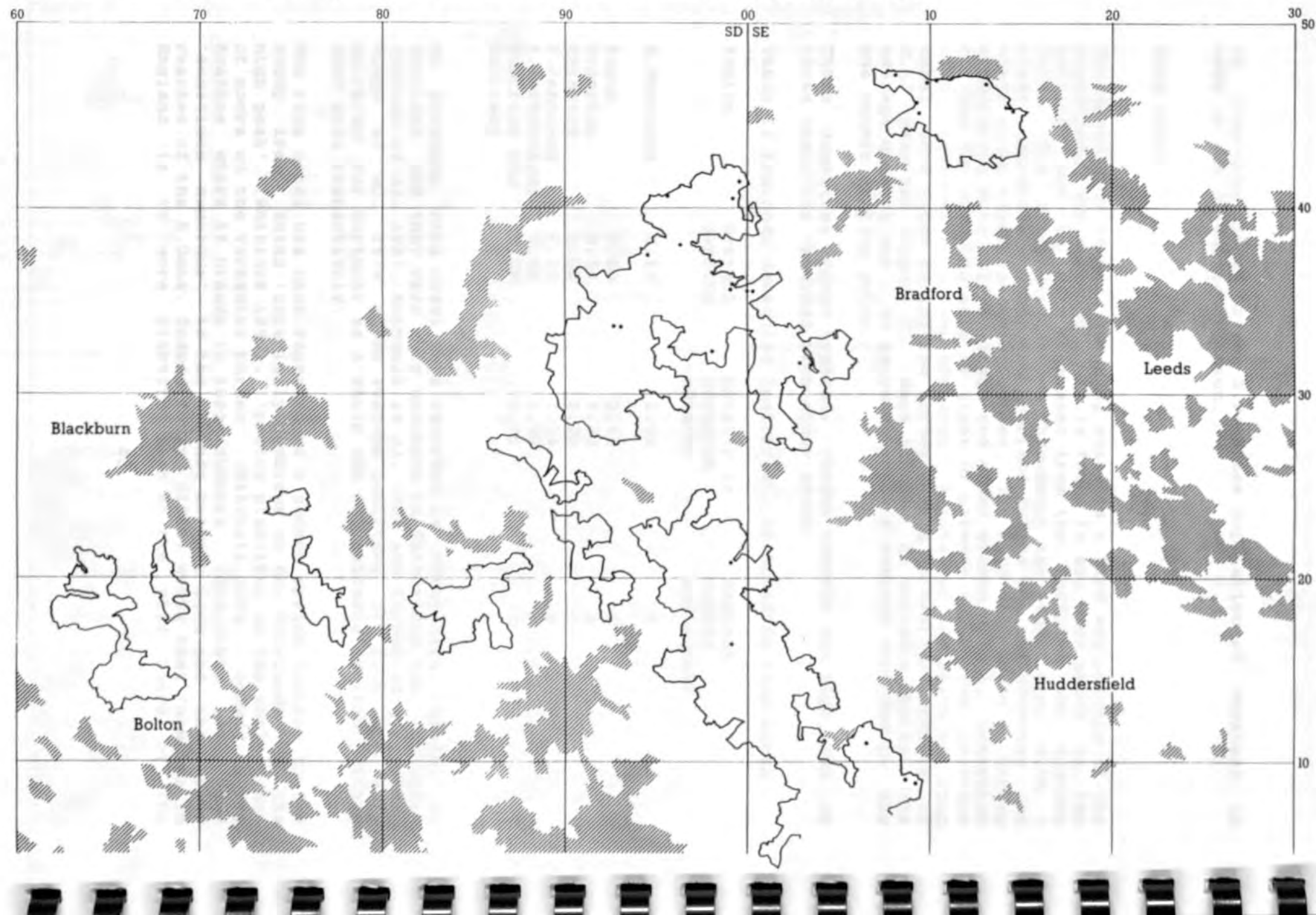
Table 13 Regional densities (pairs/km²) of breeding ring ouzel

Region	Overall density	Density in occupied squares	Maximum number per square
S.Pennines	**0.17**	**1.55**	**5**
Angus	0.60	2.53	5
Grampian	0.14	1.33	3
Ayrshire	0.02	1.20	1
N.Pennines	0.15	1.14	2
S.Strathclyde	0.04	1.00	1
Dumfries and Galloway.	0.08	1.76	3

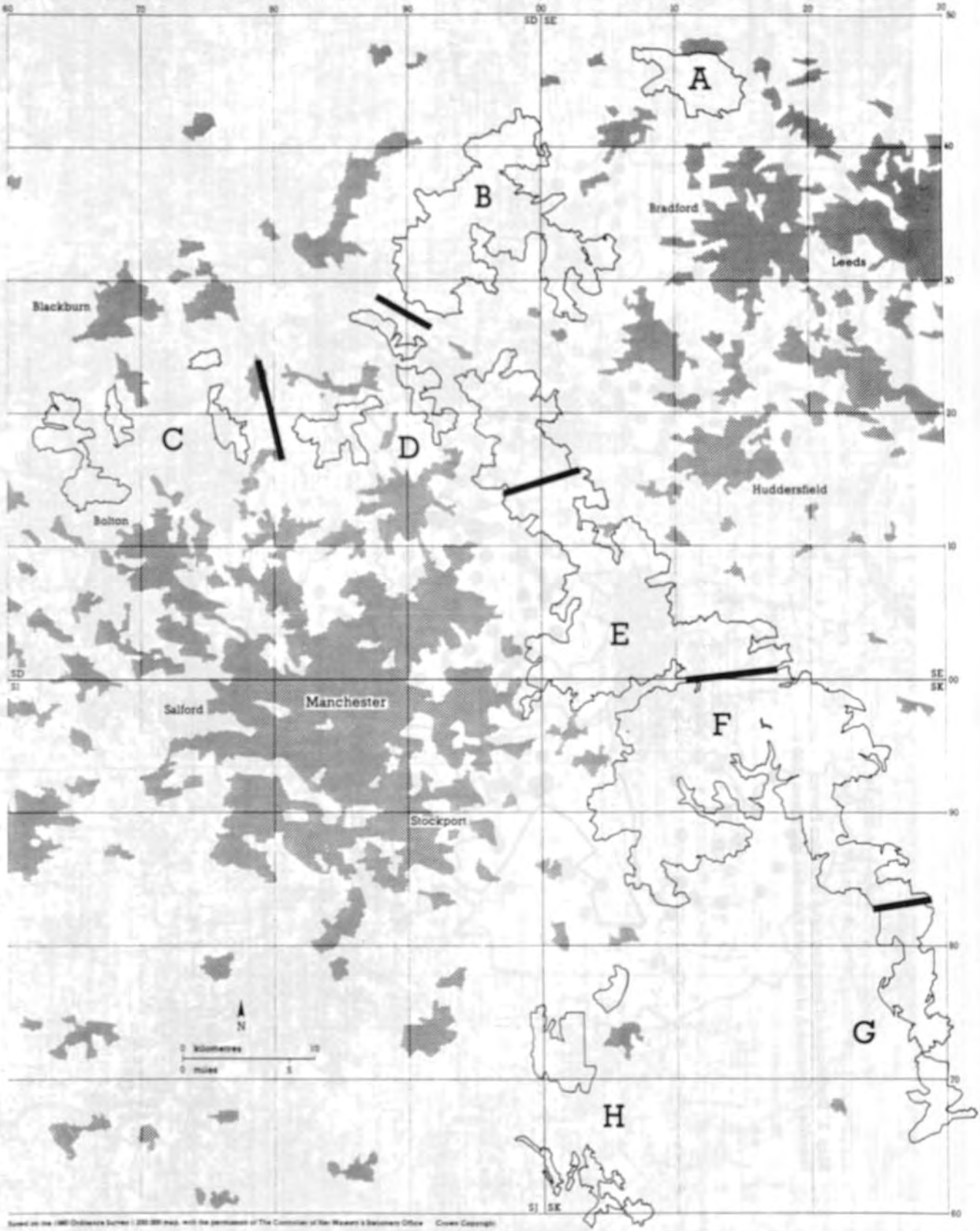
No breeding ring ouzel were recorded in Morayshire, Lewis, or Shetland and they were very uncommon in Sutherland and Caithness (Stroud *et al.* 1987, Rothwell *et al.* 1988 and Stroud *et al.* 1988). Mudge *et al.* 1979 gives average densities of 0.06 and 1.12 pairs/km² for Dartmoor as a whole and for suitable habitat within that area respectively.

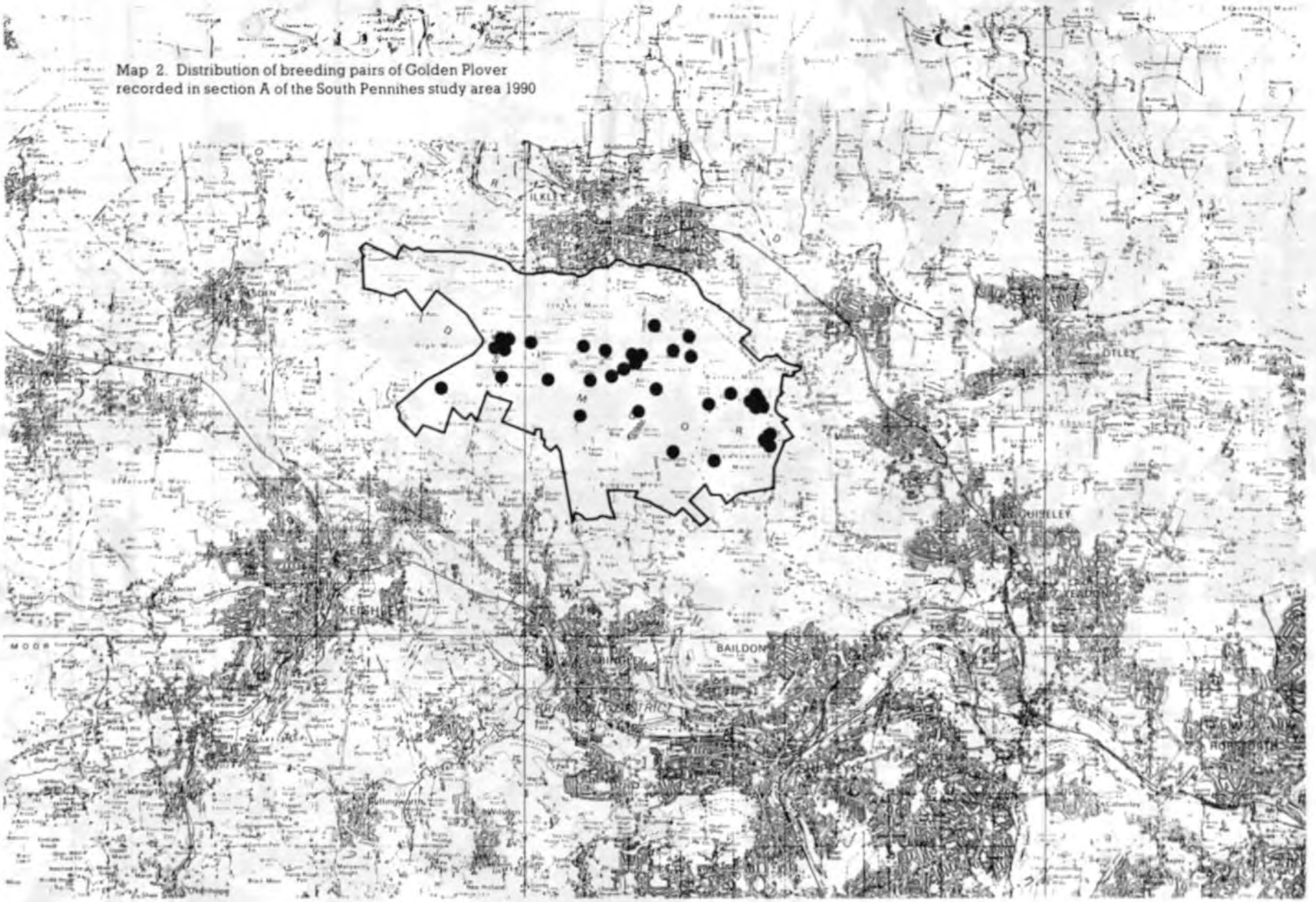
The ring ouzel was once regarded as a common spring visitor to the study area, being 'especially numerous on the moorlands of the high peak' (Whitlock 1893), 'pretty plentiful on the whole range of moors on the Yorkshire border' (Mitchell 1884), common on the Roaches where it breeds in large numbers' (McAldowie 1893) and 'sometimes numerous' in the uplands between Leek and the upper reaches of the R.Dane. Indeed Coward (1910) wrote that 'nowhere in England is it more plentiful than on the wild moors of the

Figure 23. Distribution of breeding pairs of Ring Ouzel recorded in the South Pennines study area 1990

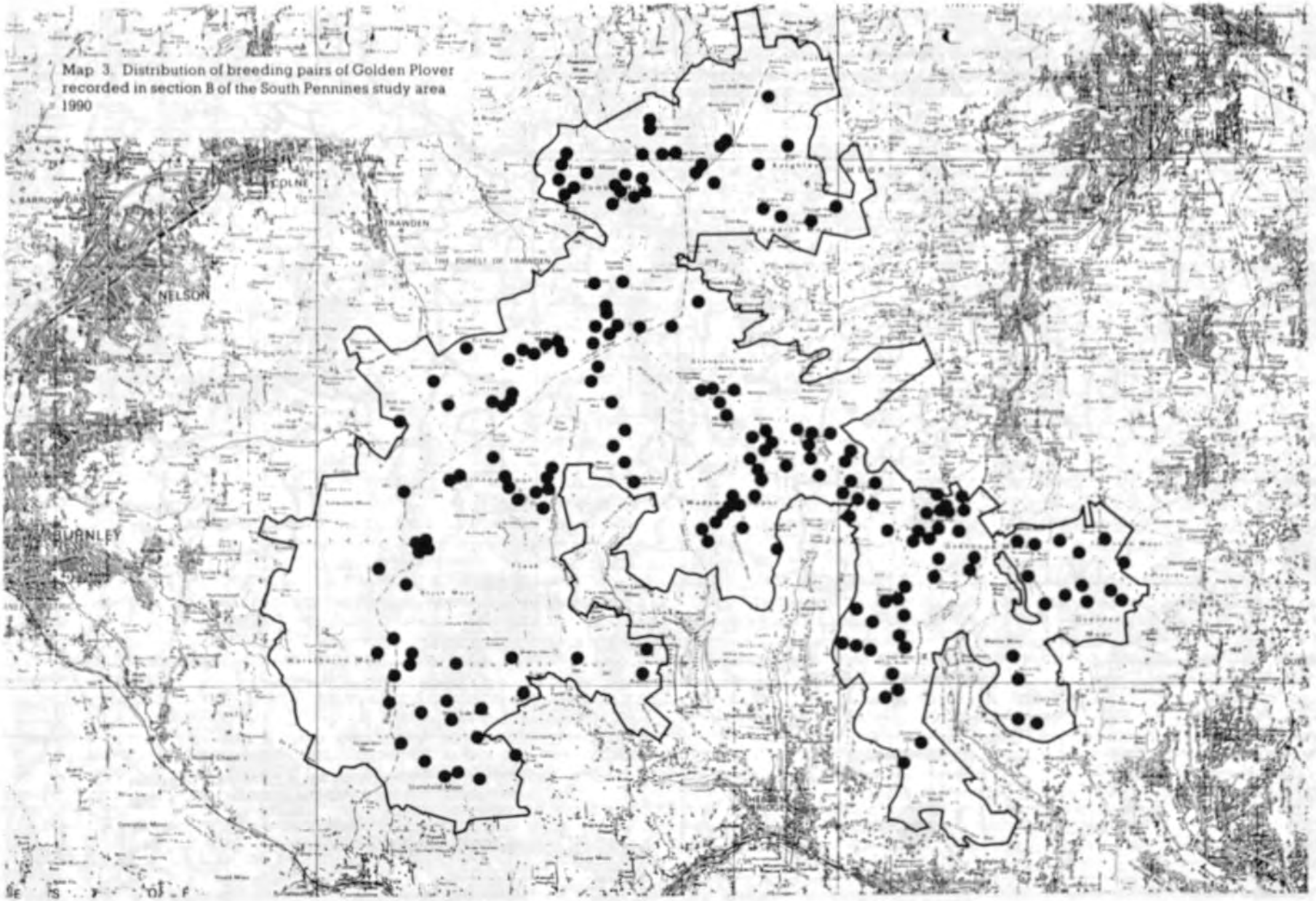


Map 1. The South Pennines study area 1990 showing boundaries of sections A to H shown in maps 2-57

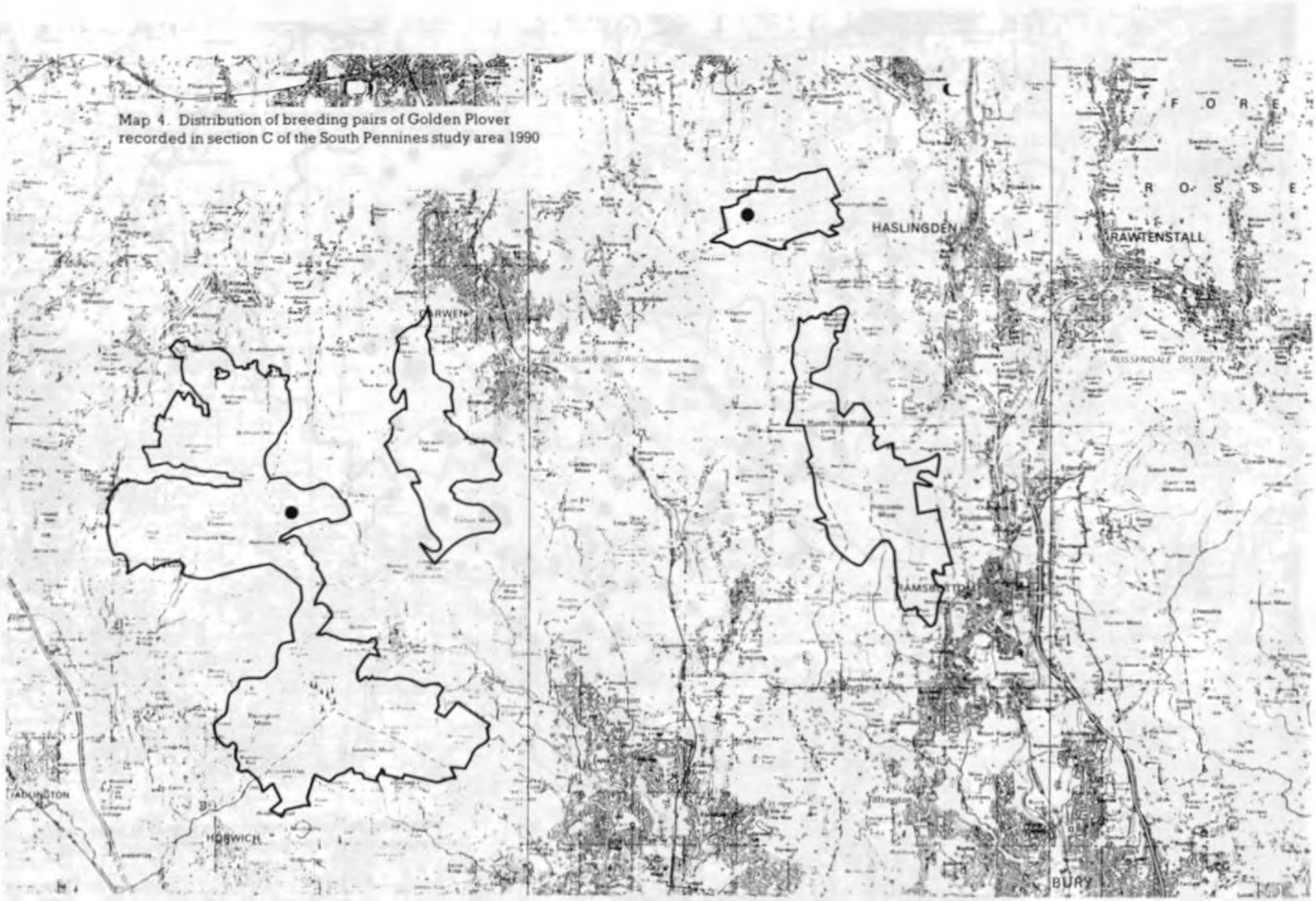




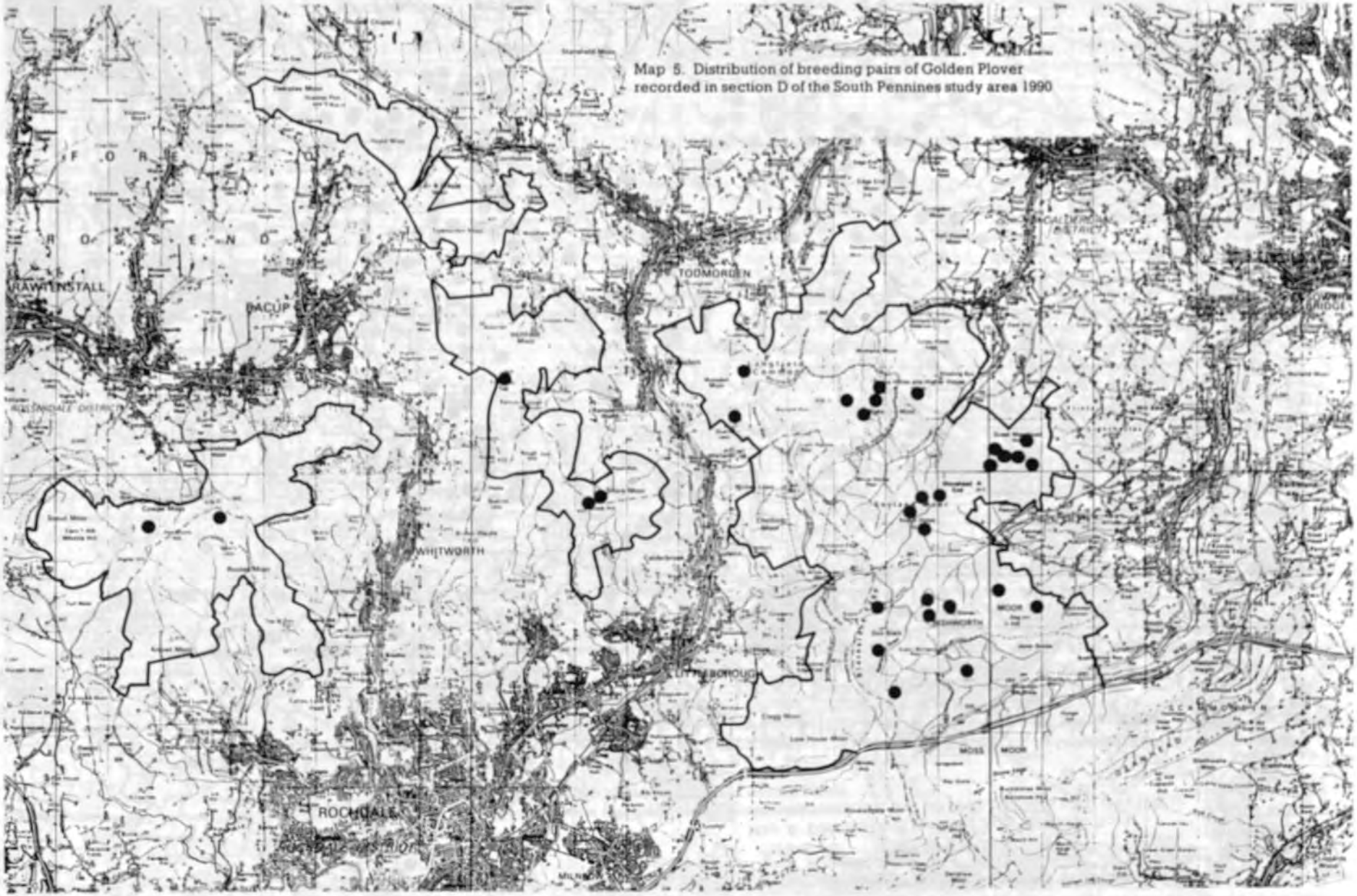
Map 2. Distribution of breeding pairs of Golden Plover recorded in section A of the South Pennines study area 1990



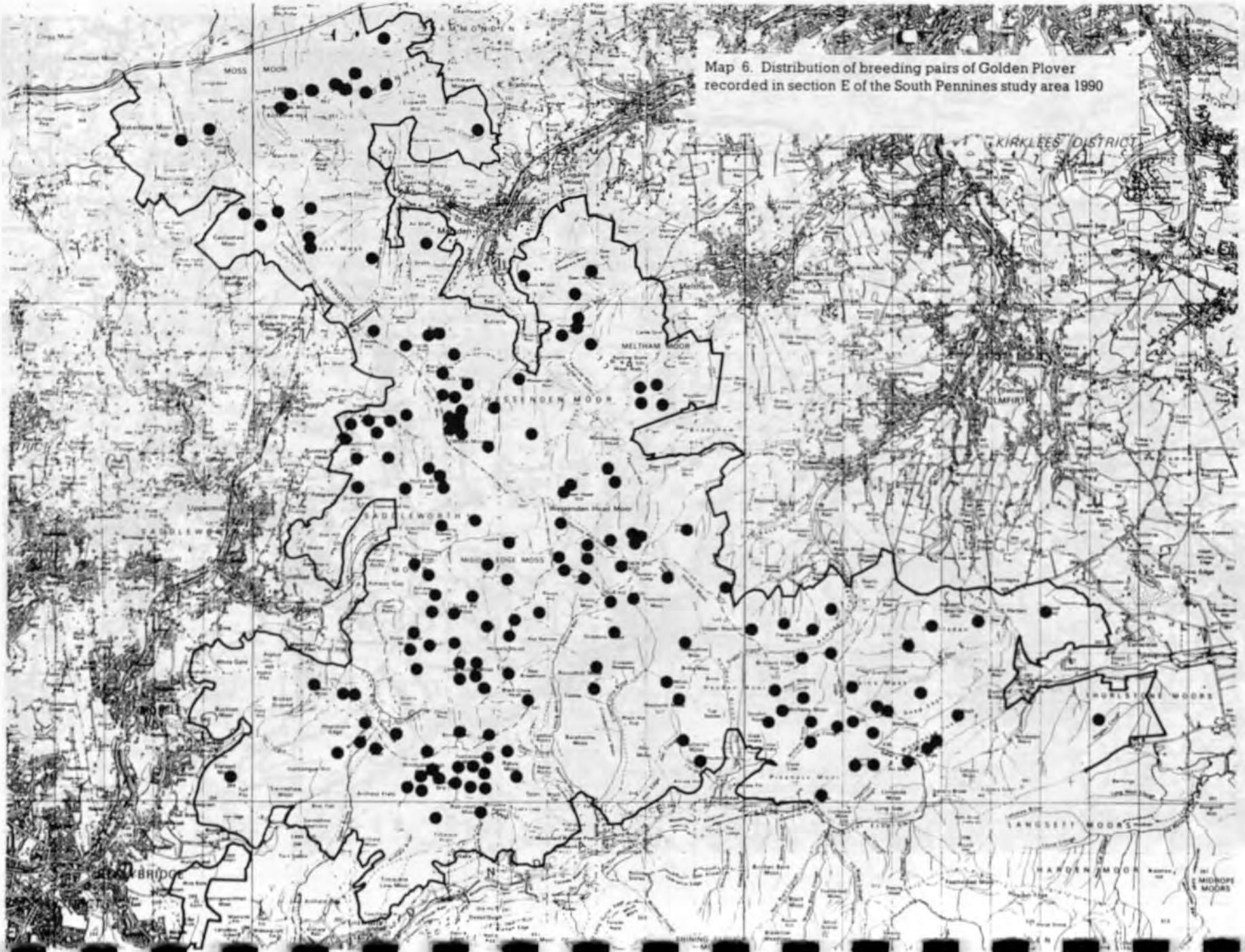
Map 3. Distribution of breeding pairs of Golden Plover recorded in section B of the South Pennines study area 1990



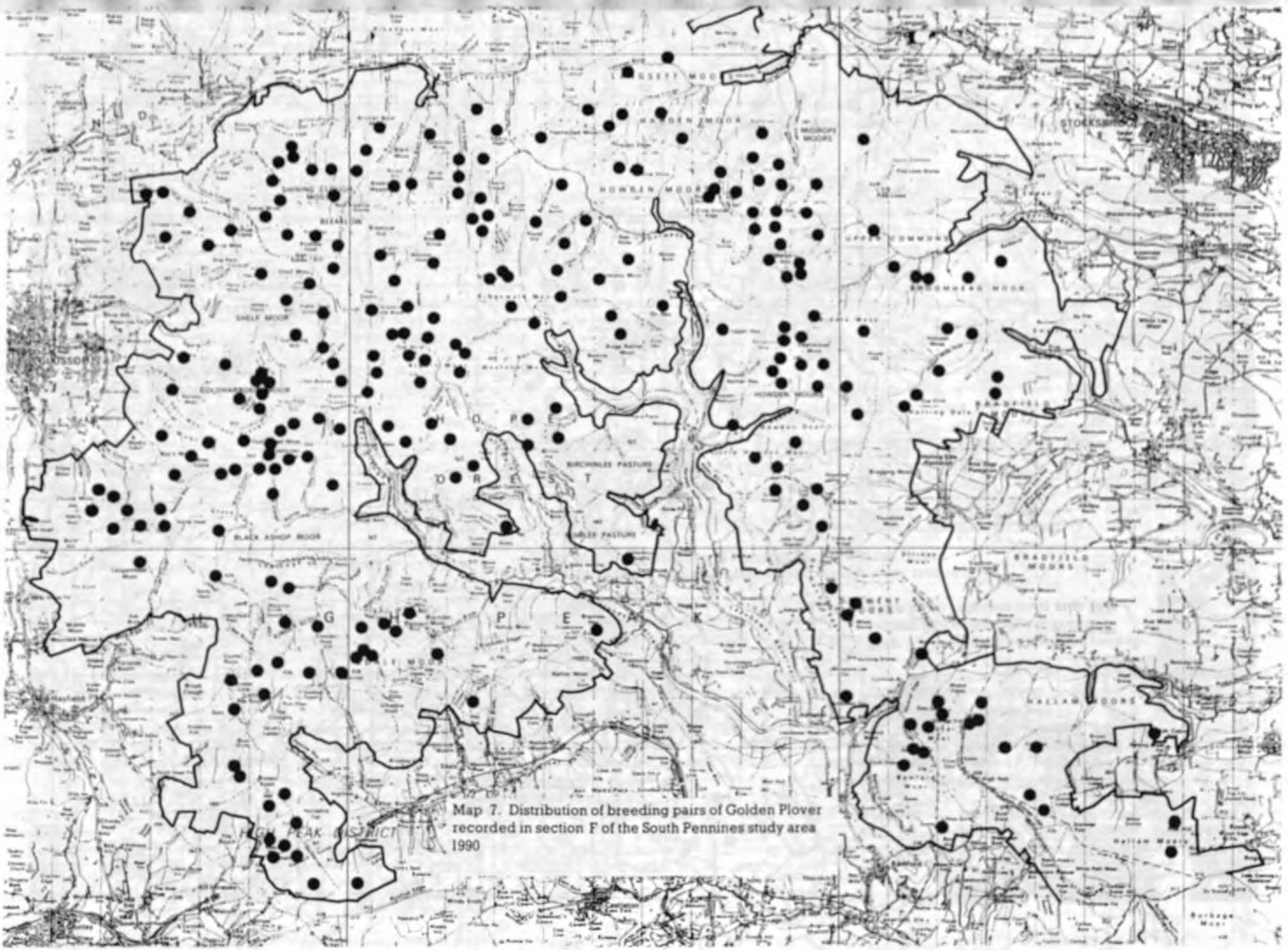
Map 4. Distribution of breeding pairs of Golden Plover recorded in section C of the South Pennines study area 1990



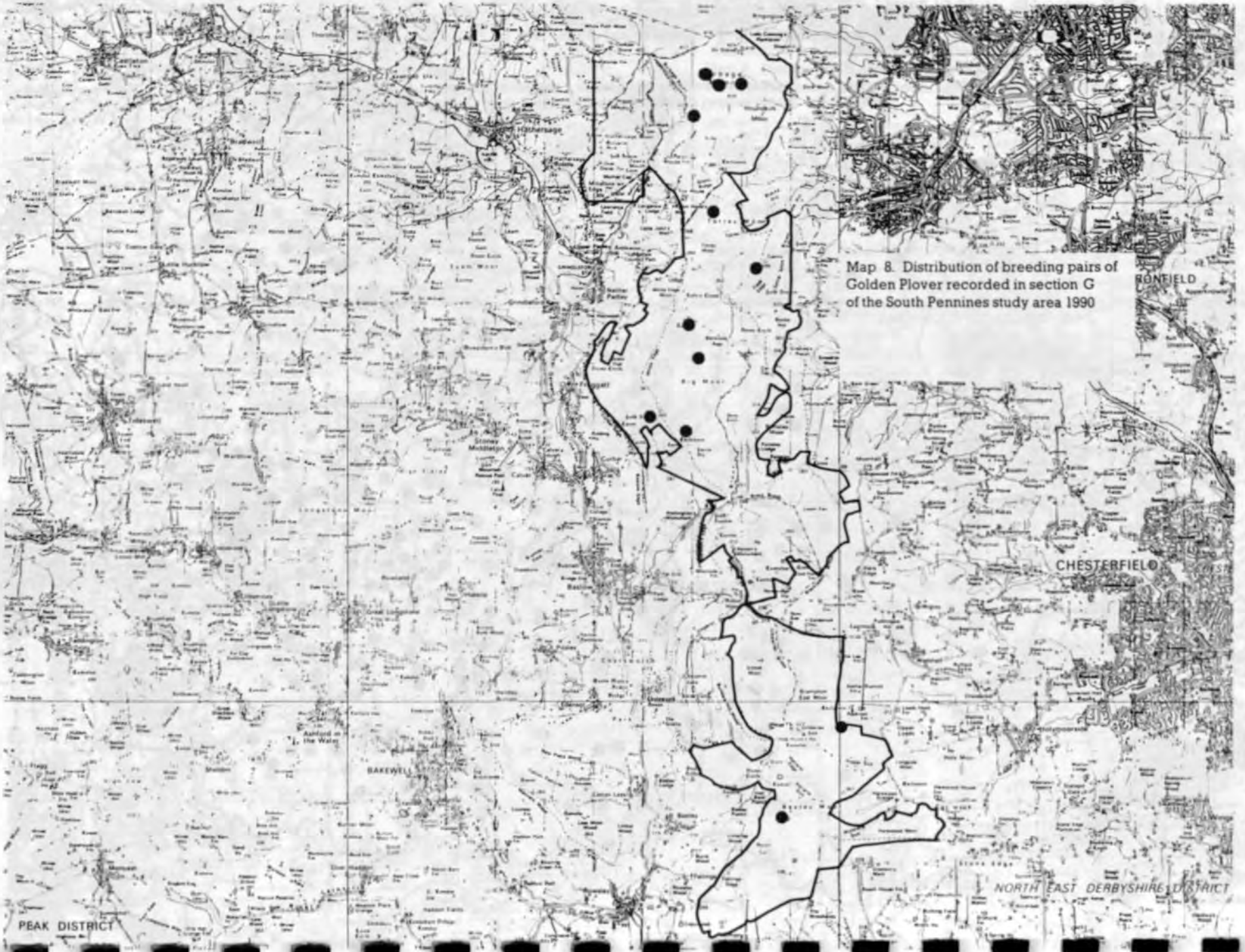
Map 5. Distribution of breeding pairs of Golden Plover recorded in section D of the South Pennines study area 1990

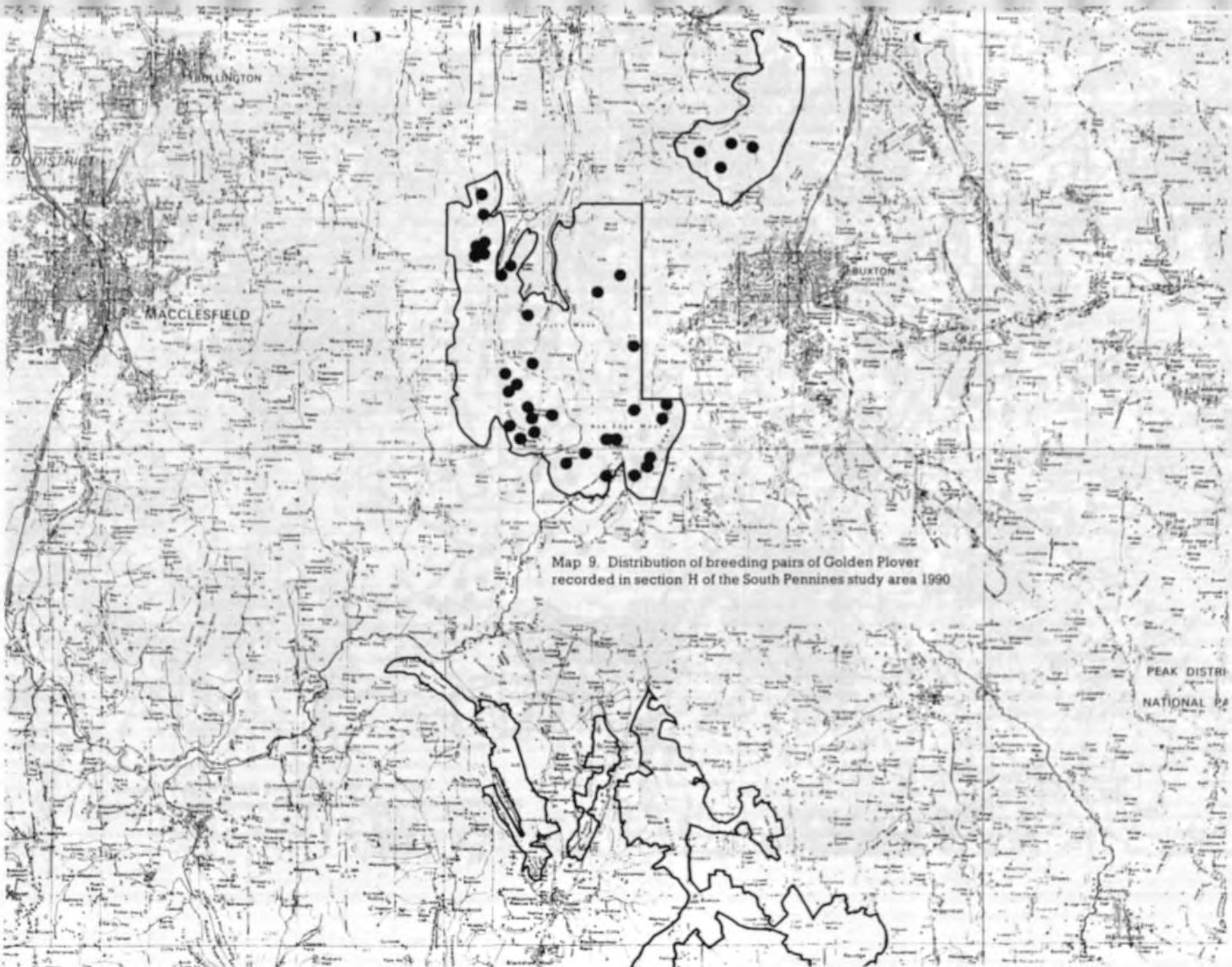


Map 6. Distribution of breeding pairs of Golden Plover recorded in section E of the South Pennines study area 1990

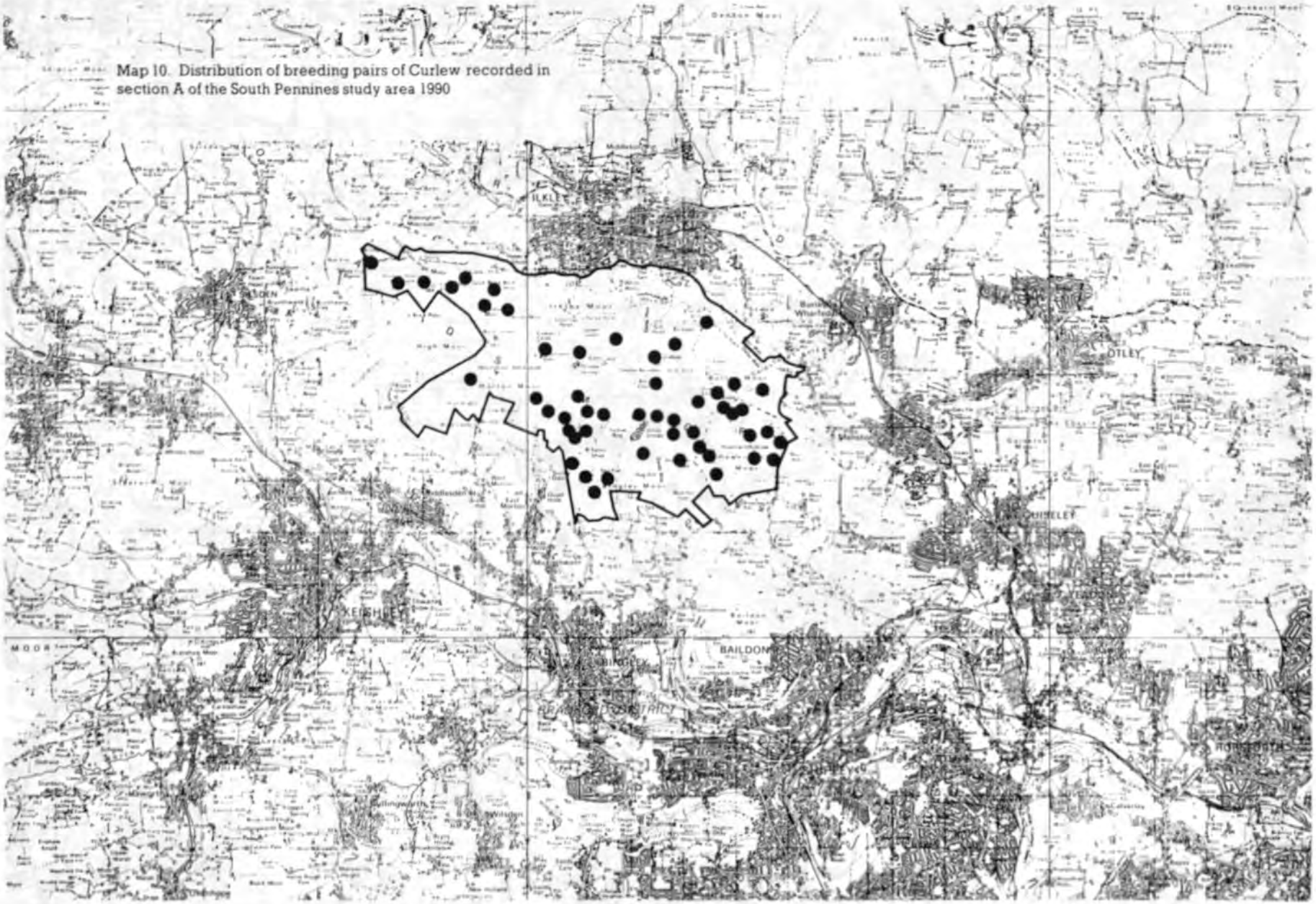


Map 7. Distribution of breeding pairs of Golden Plover recorded in section F of the South Pennines study area 1990

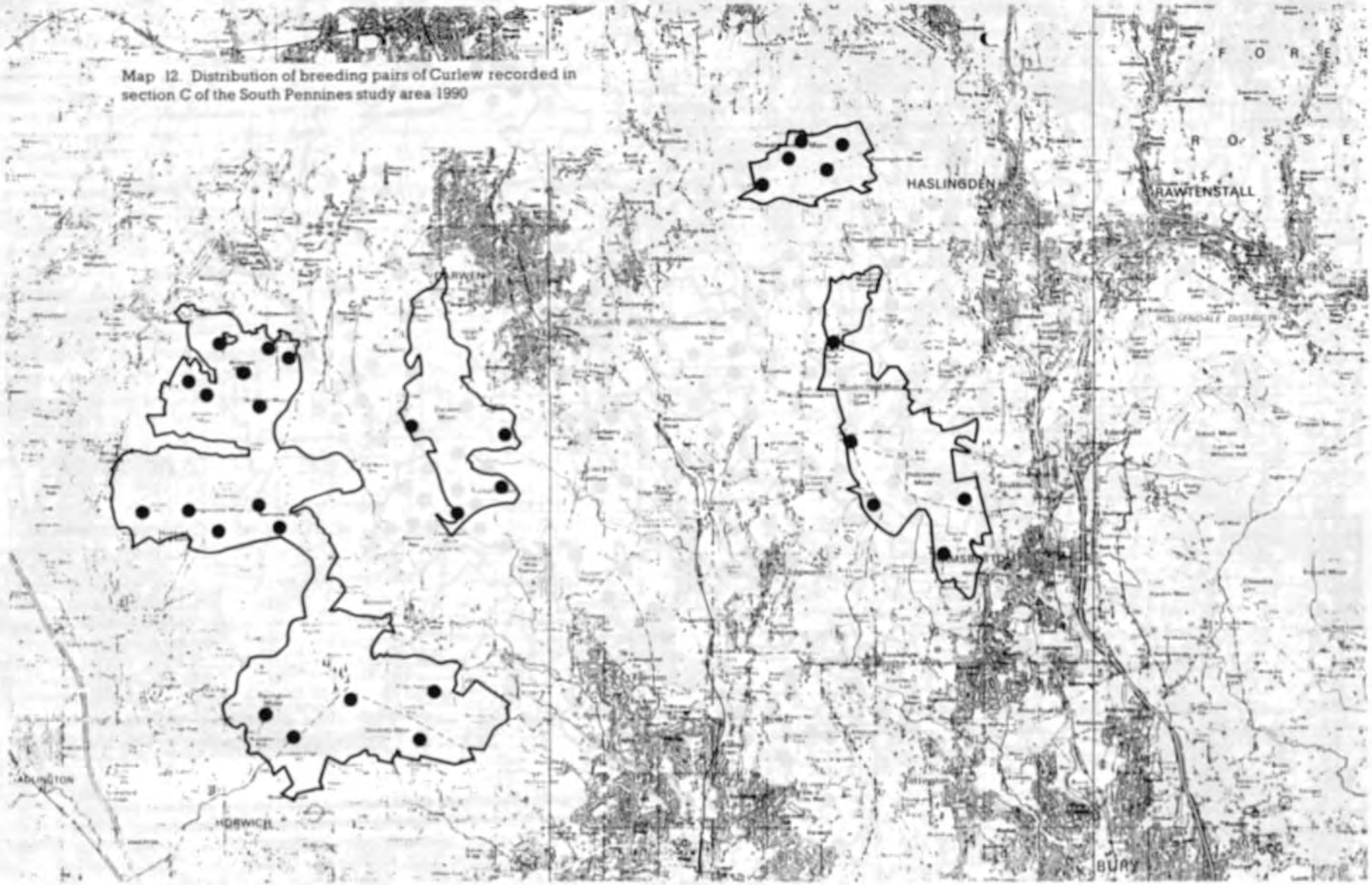

Map 8. Distribution of breeding pairs of Golden Plover recorded in section G of the South Pennines study area 1990
CHESTERFIELD
BAKEWELL
PEAK DISTRICT
NORTH EAST DERBYSHIRE DISTRICT



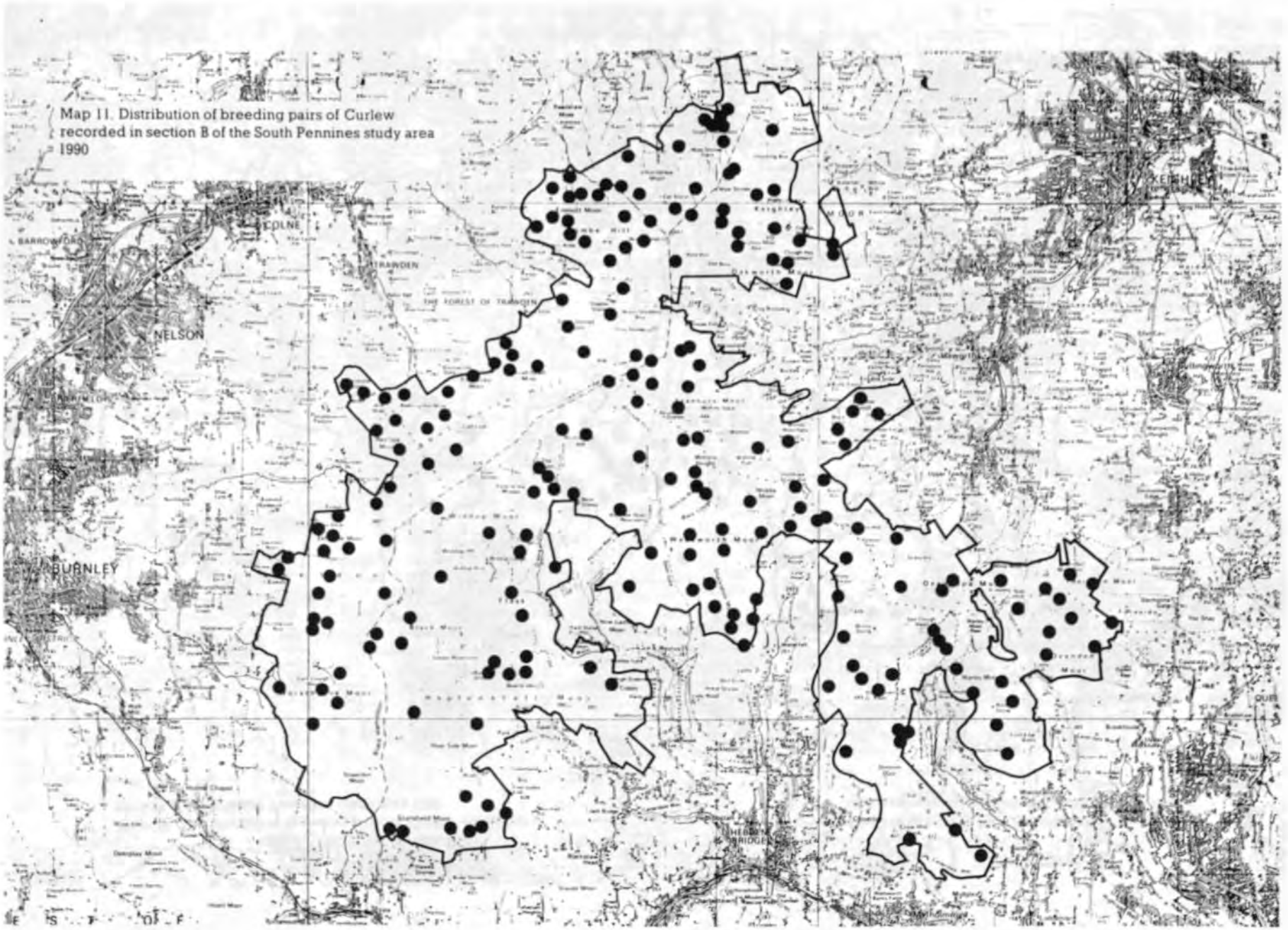
Map 9. Distribution of breeding pairs of Golden Plover recorded in section H of the South Pennines study area 1990



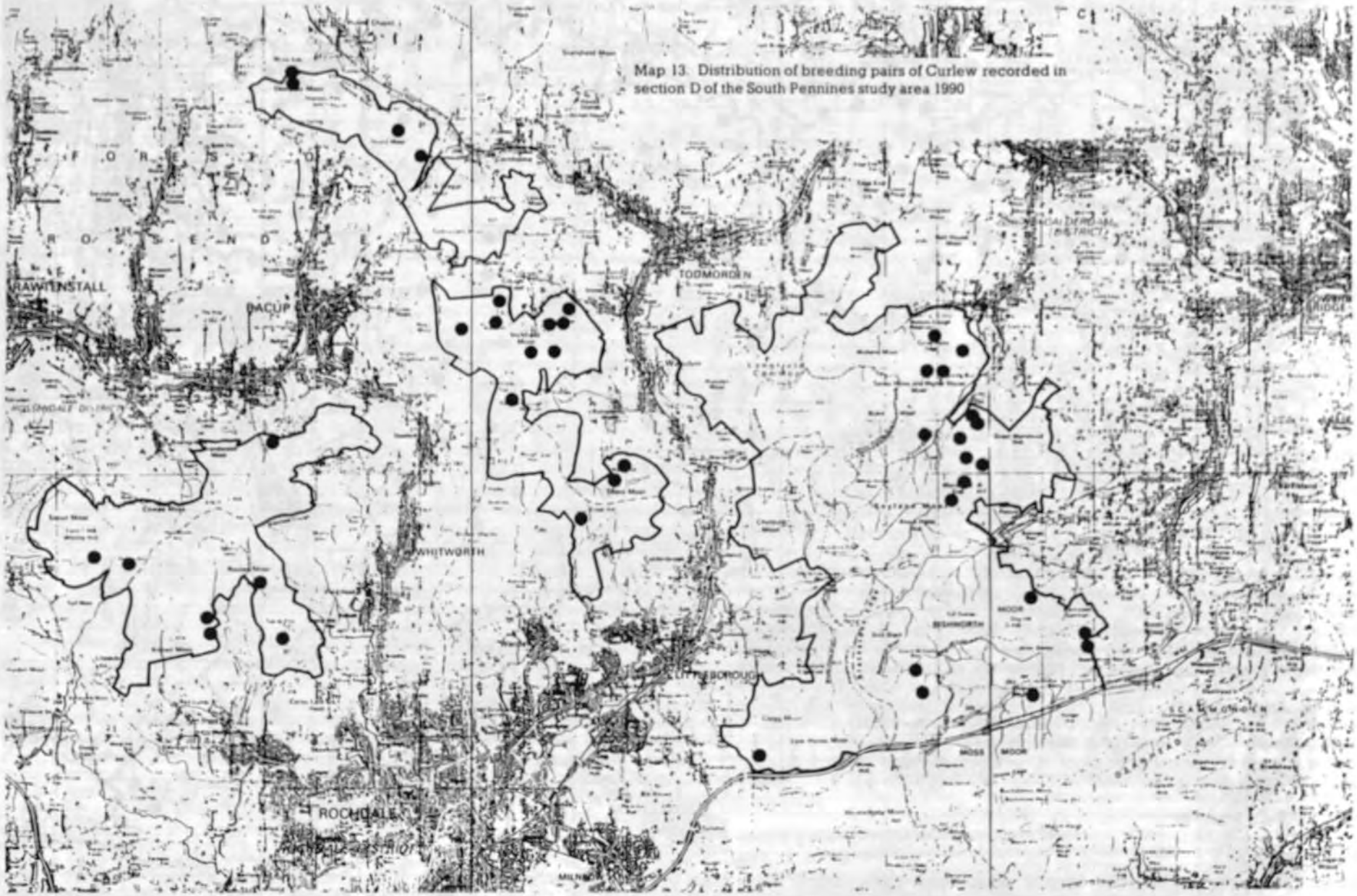
Map 10. Distribution of breeding pairs of Curlew recorded in section A of the South Pennines study area 1990



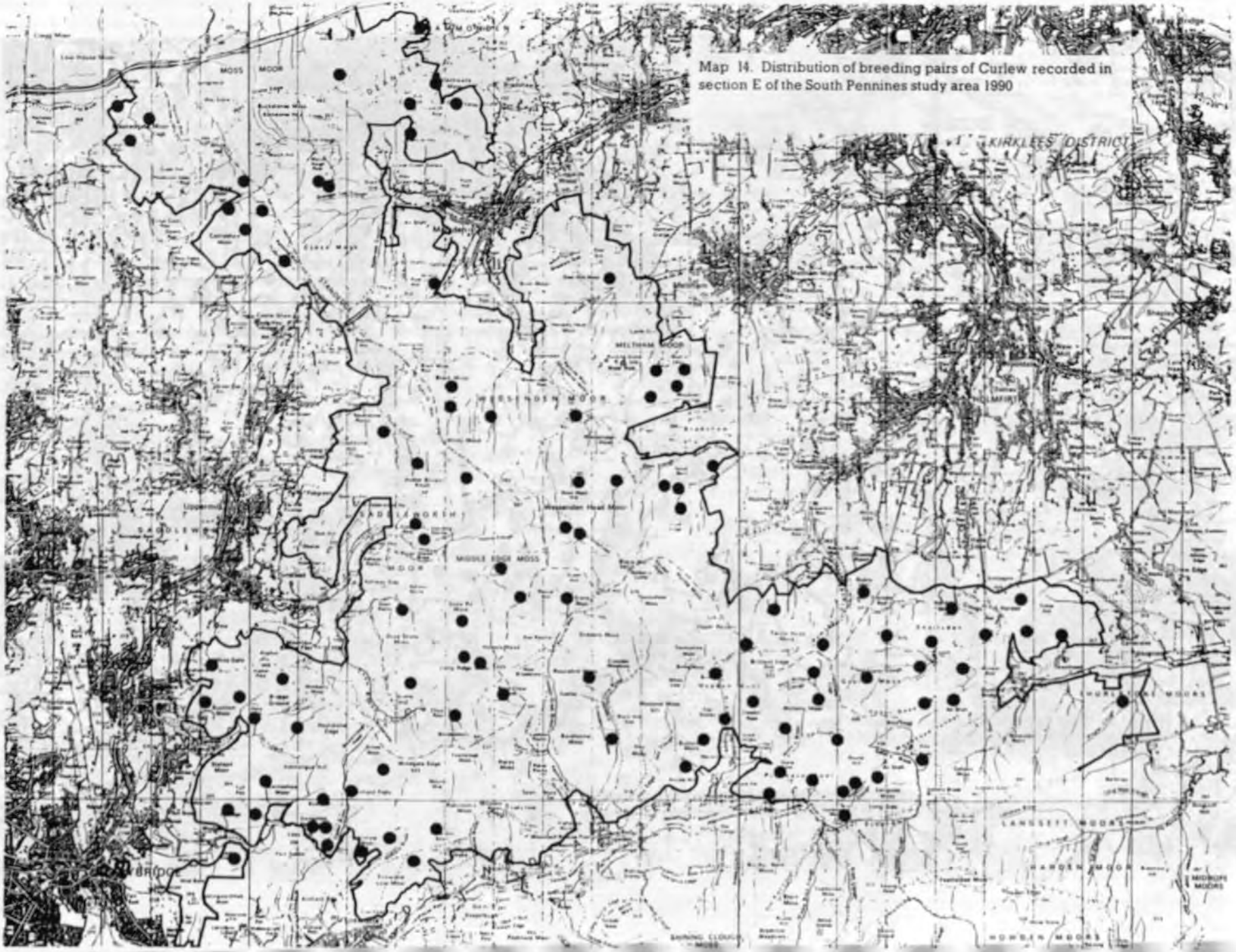
Map 12. Distribution of breeding pairs of Curlew recorded in section C of the South Pennines study area 1990



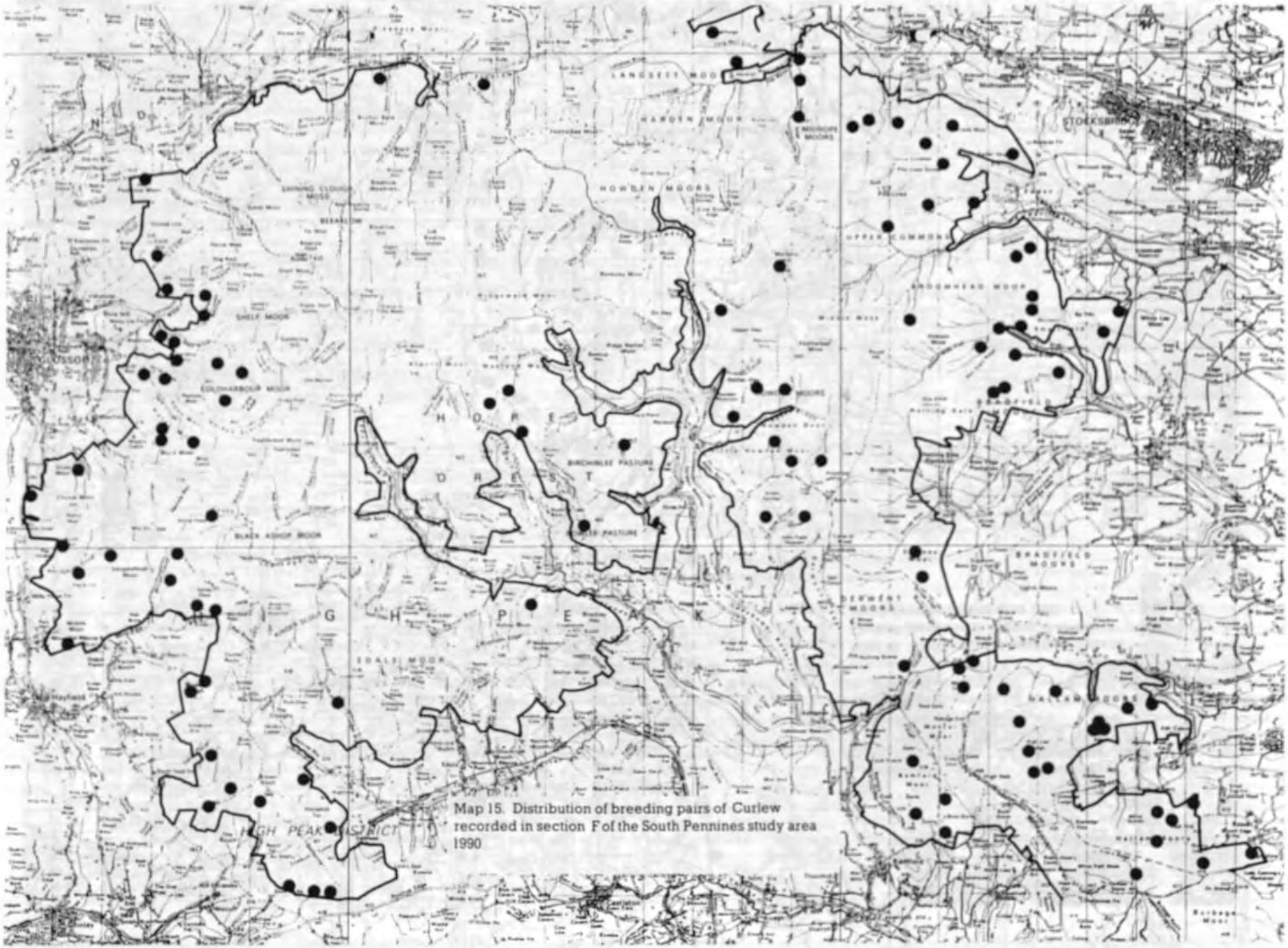
Map 11. Distribution of breeding pairs of Curlew recorded in section B of the South Pennines study area 1990



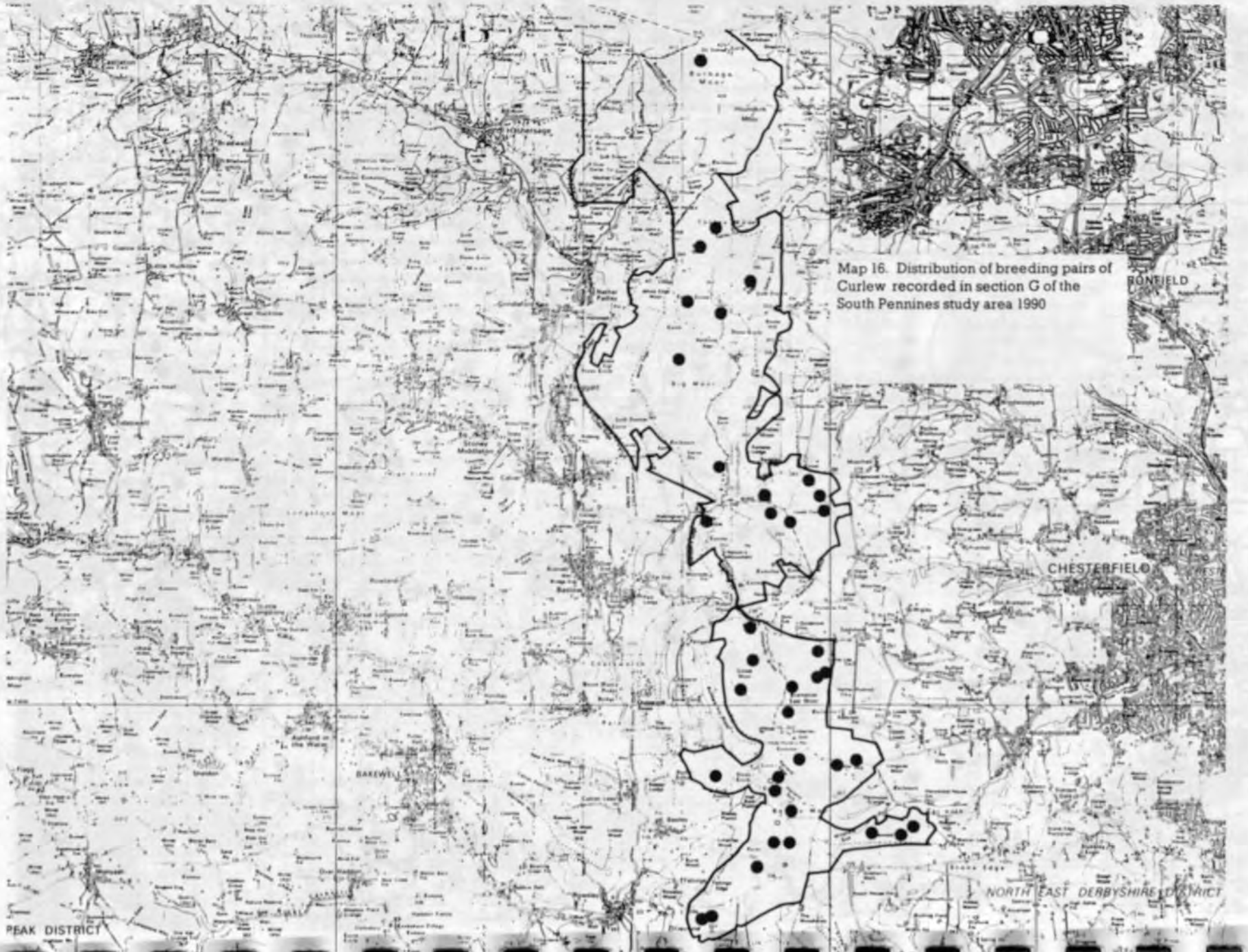
Map 13. Distribution of breeding pairs of Curlew recorded in section D of the South Pennines study area 1990



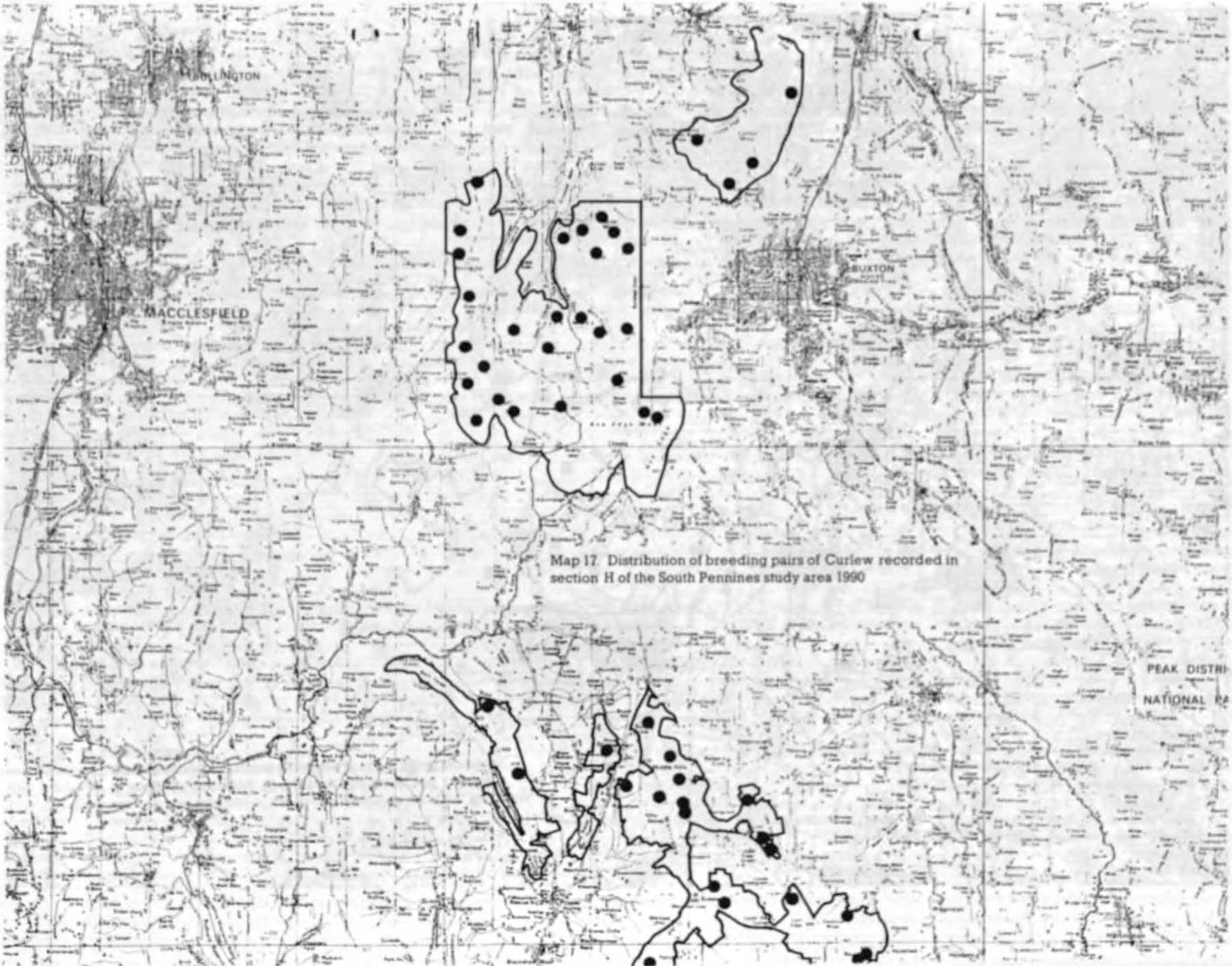
Map 14. Distribution of breeding pairs of Curlew recorded in section E of the South Pennines study area 1990



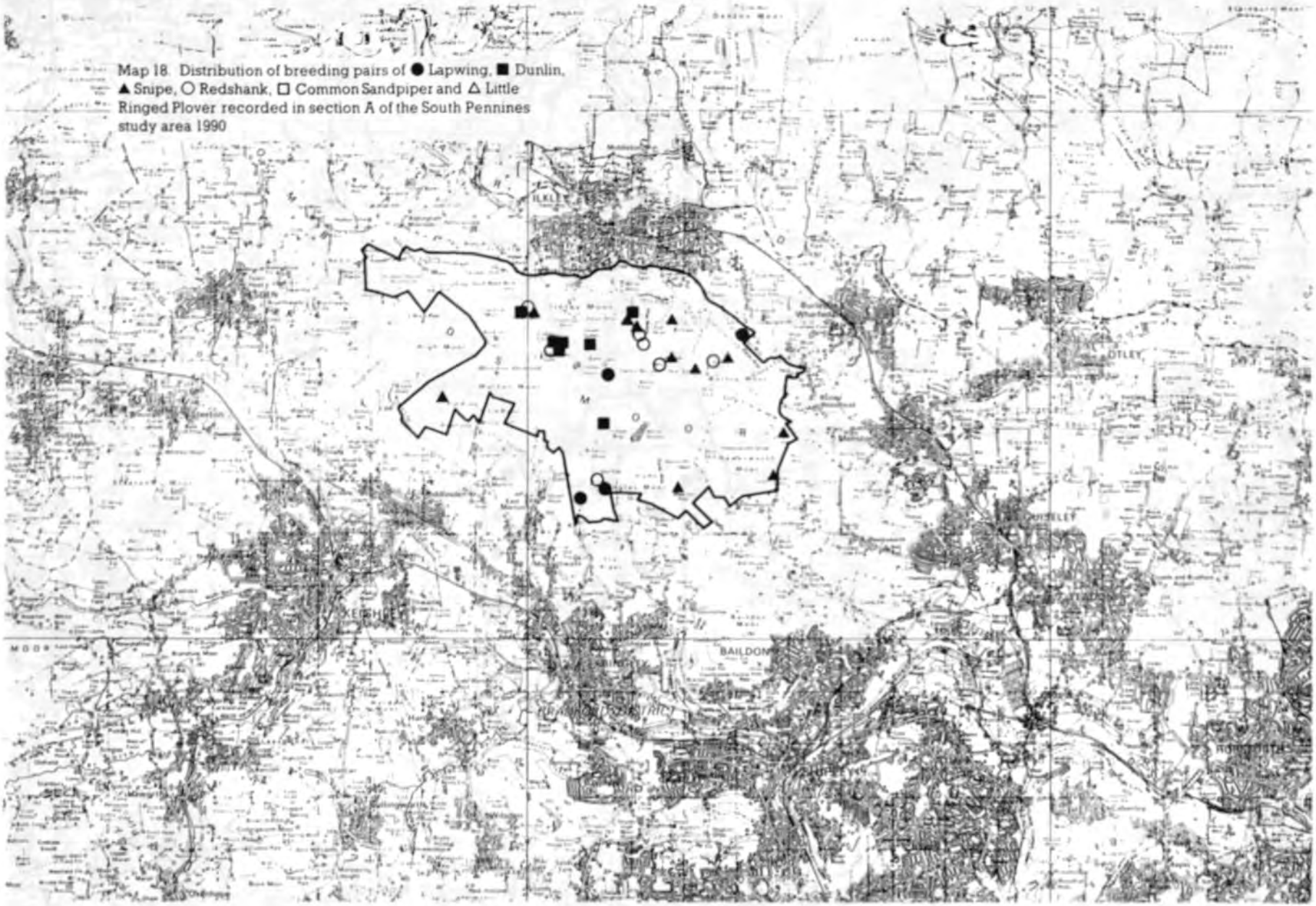
Map 15. Distribution of breeding pairs of Curlew recorded in section F of the South Pennines study area 1990



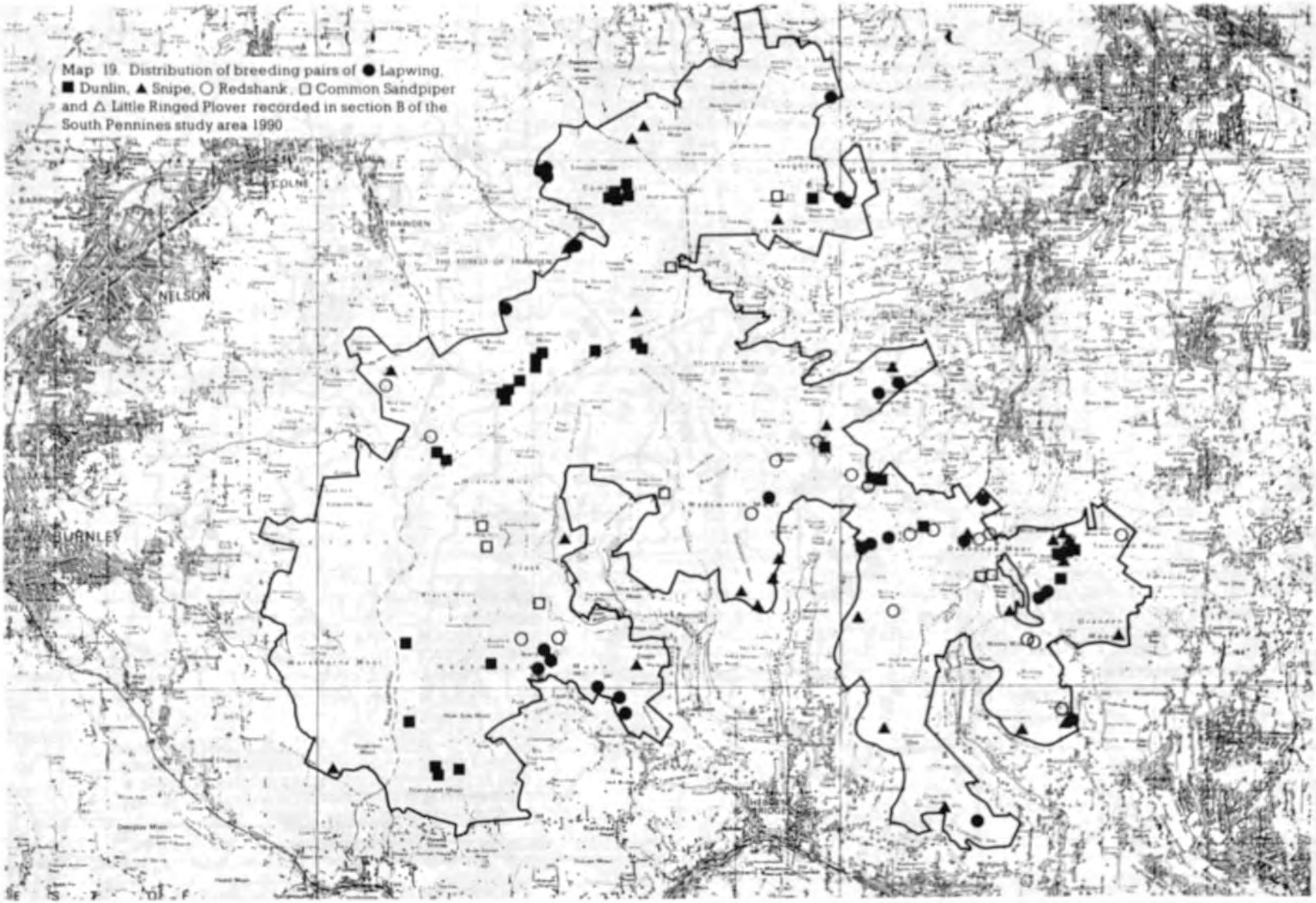
Map 16. Distribution of breeding pairs of Curlew recorded in section G of the South Pennines study area 1990

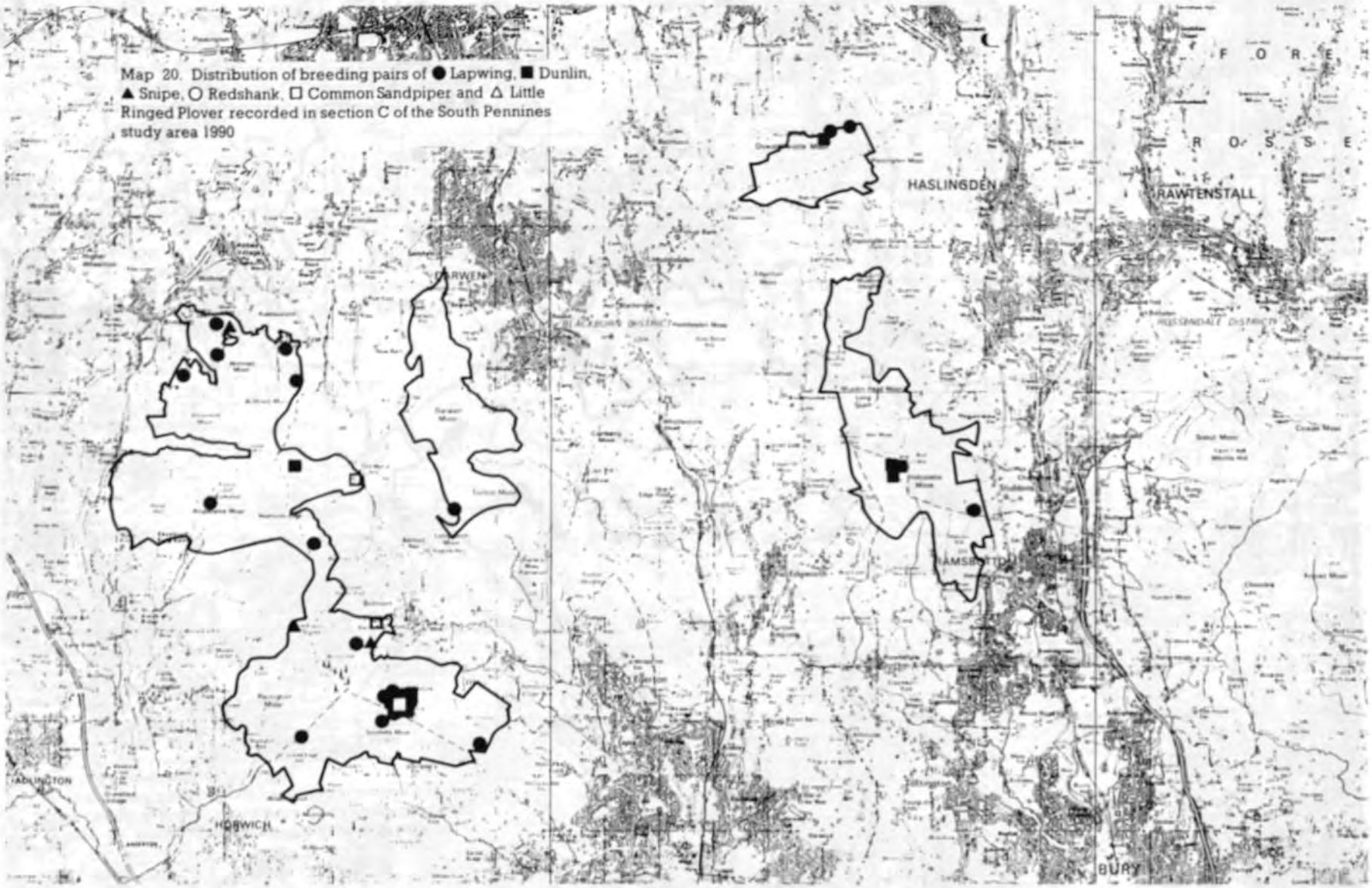


Map 17. Distribution of breeding pairs of Curlew recorded in section H of the South Pennines study area 1990

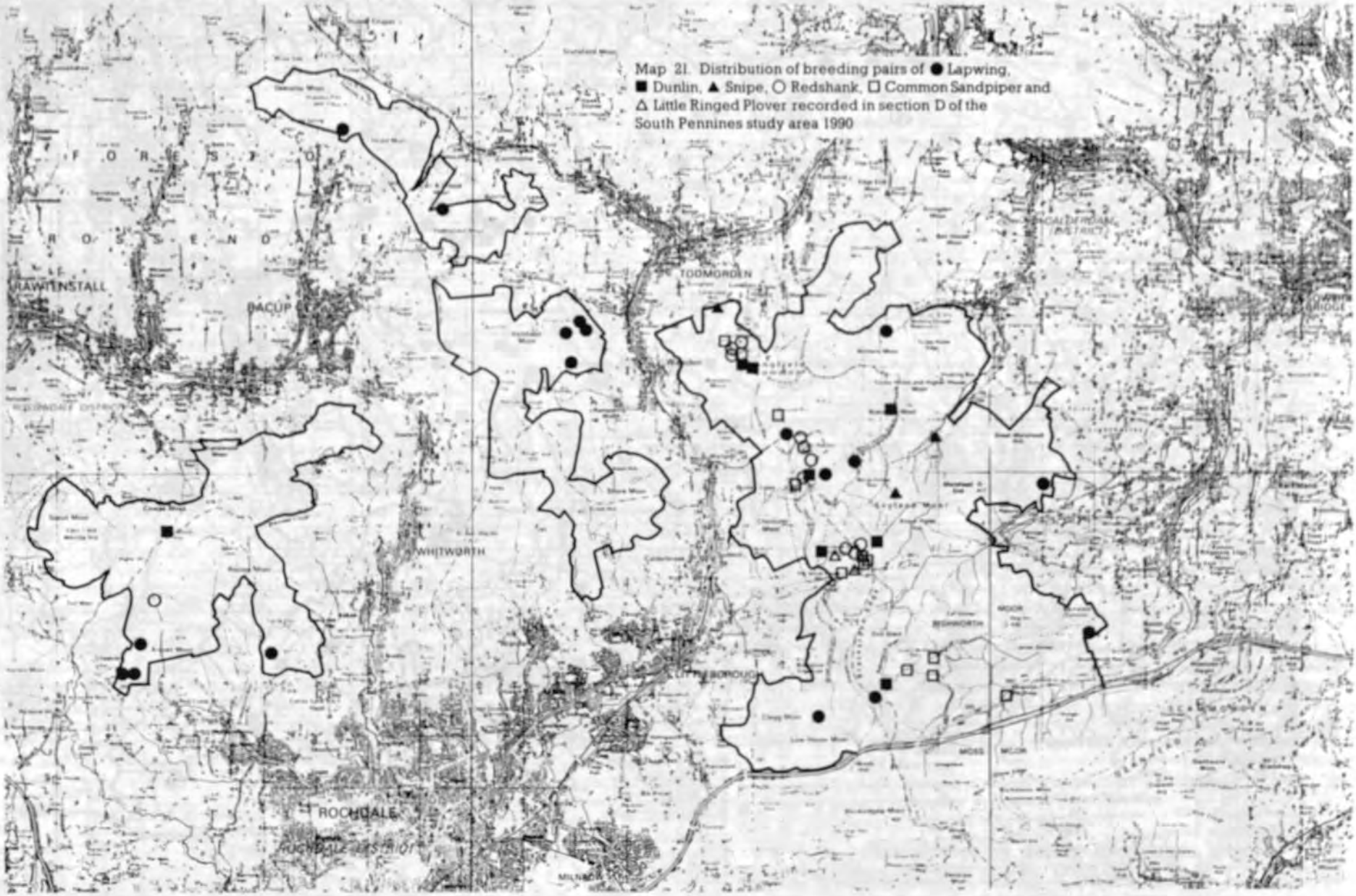


Map 18. Distribution of breeding pairs of ● Lapwing, ■ Dunlin, ▲ Snipe, ○ Redshank, □ Common Sandpiper and △ Little Ringed Plover recorded in section A of the South Pennines study area 1990

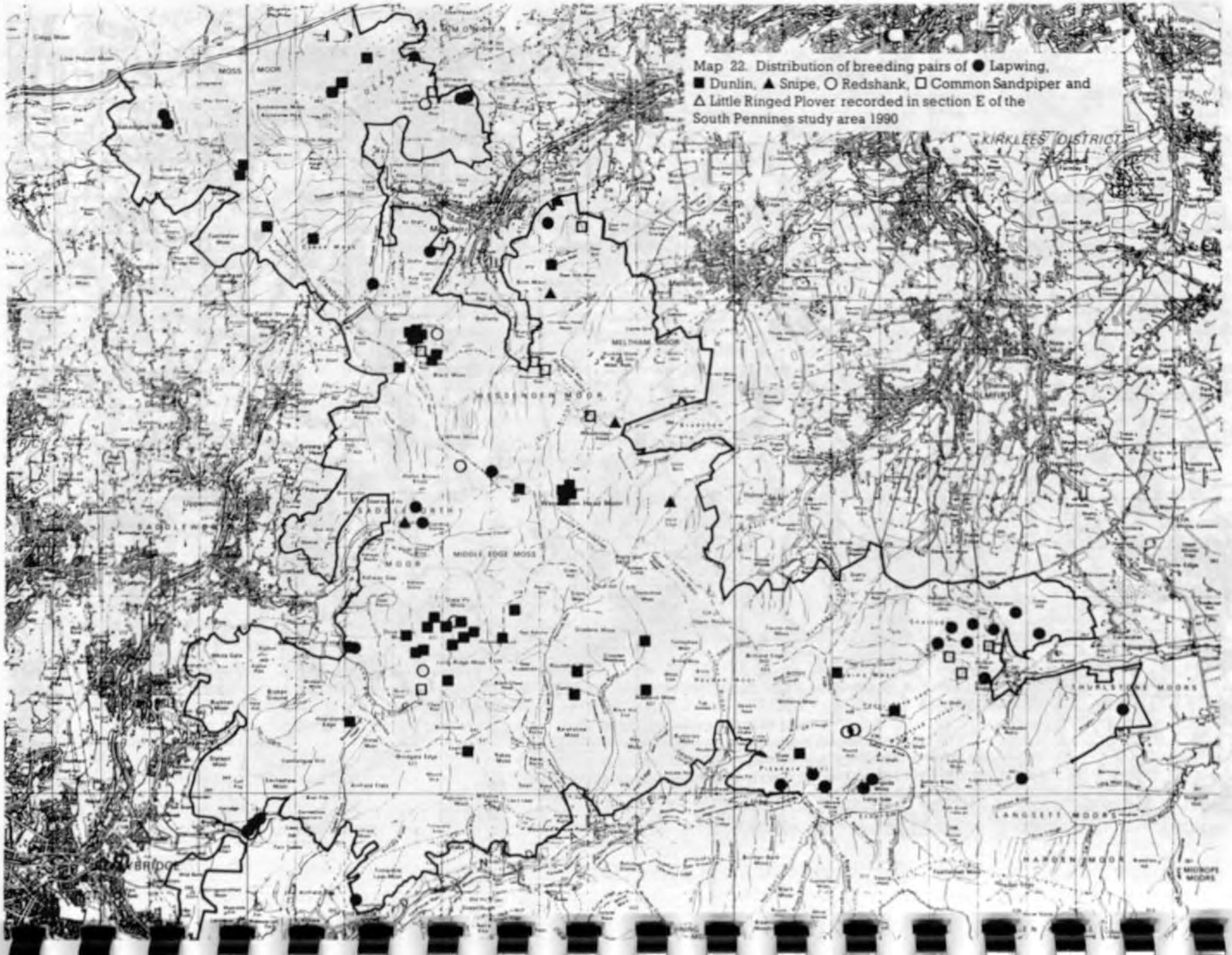

Map 19. Distribution of breeding pairs of ● Lapwing, ■ Dunlin, ▲ Snipe, ○ Redshank, □ Common Sandpiper and △ Little Ringed Plover recorded in section B of the South Pennines study area 1990
NELSON
BURNLEY



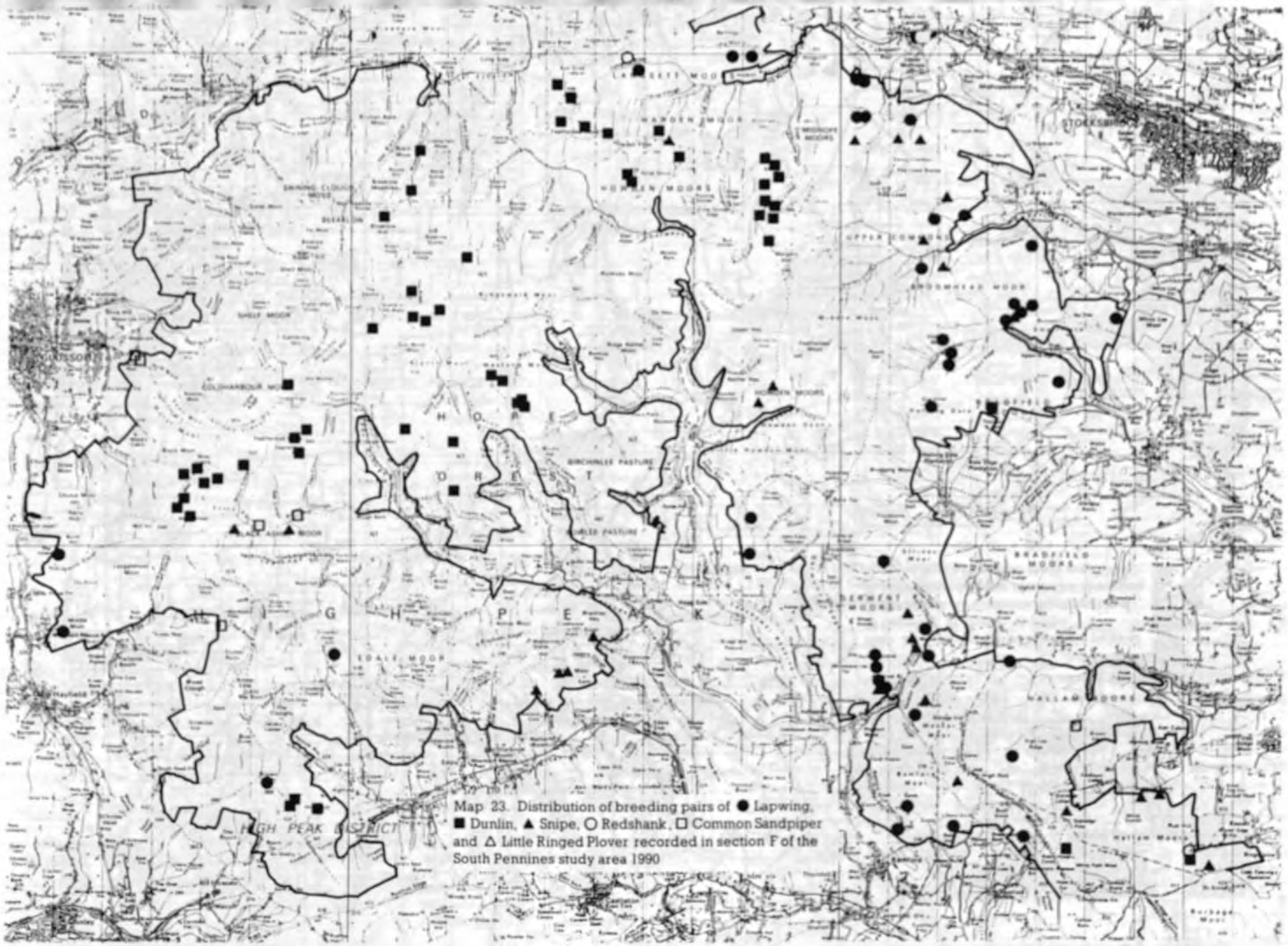
Map 20. Distribution of breeding pairs of ● Lapwing, ■ Dunlin, ▲ Snipe, ○ Redshank, □ Common Sandpiper and △ Little Ringed Plover recorded in section C of the South Pennines study area 1990



Map 21. Distribution of breeding pairs of ● Lapwing, ■ Dunlin, ▲ Snipe, ○ Redshank, □ Common Sandpiper and △ Little Ringed Plover recorded in section D of the South Pennines study area 1990

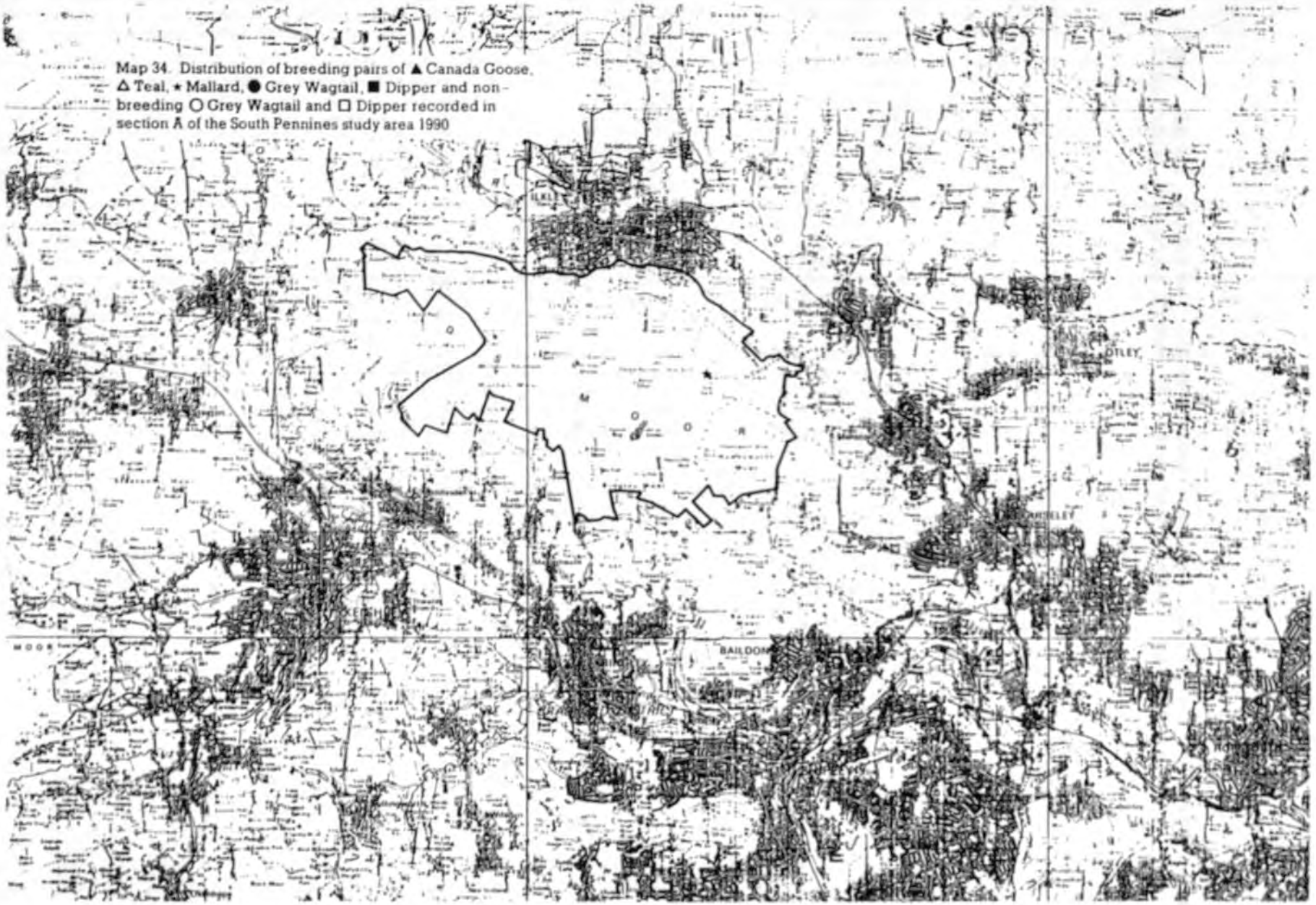


Map 22. Distribution of breeding pairs of ● Lapwing, ■ Dunlin, ▲ Snipe, ○ Redshank, □ Common Sandpiper and △ Little Ringed Plover recorded in section E of the South Pennines study area 1990

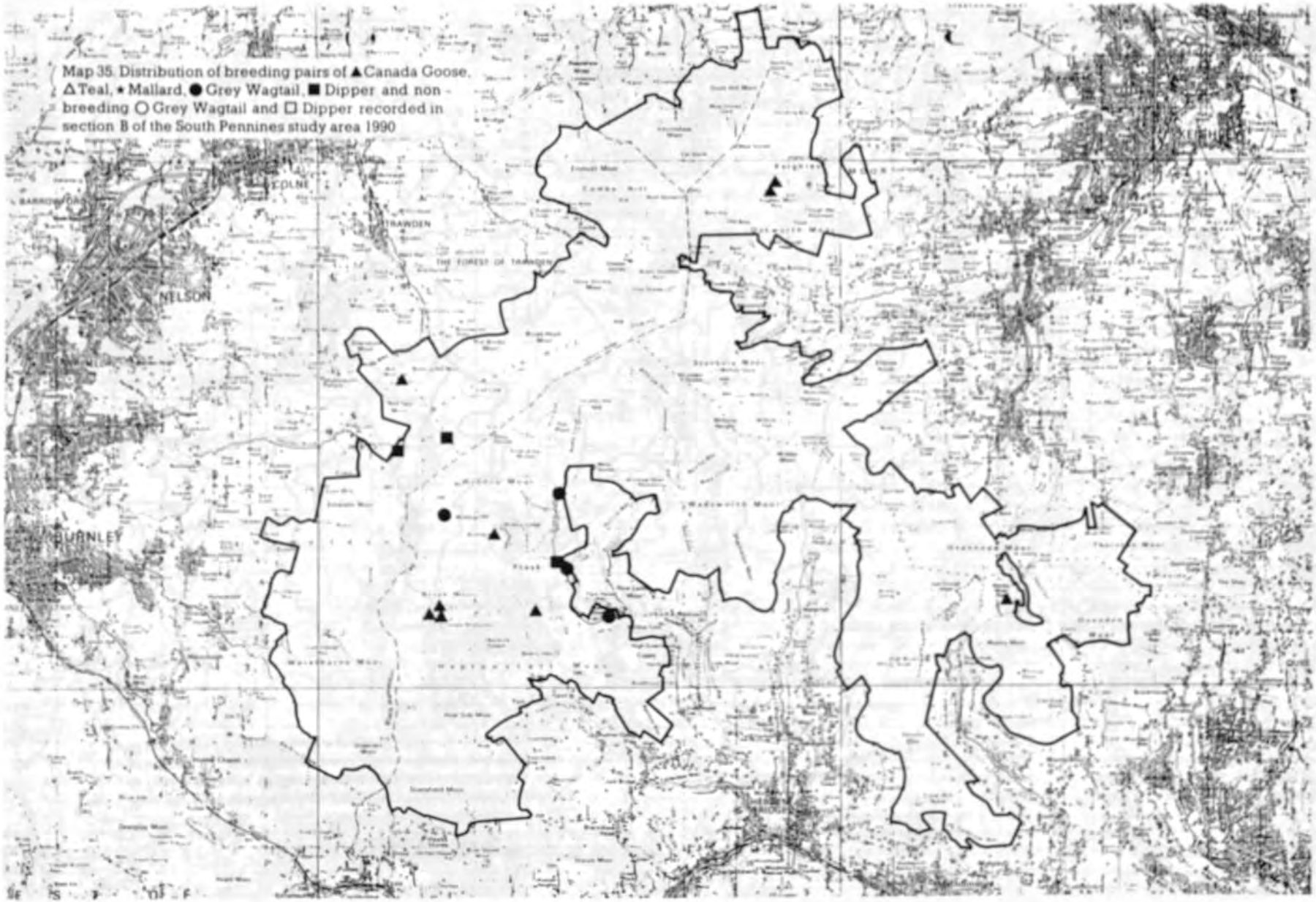


Map 23. Distribution of breeding pairs of ● Lapwing, ■ Dunlin, ▲ Snipe, ○ Redshank, □ Common Sandpiper and △ Little Ringed Plover recorded in section F of the South Pennines study area 1990

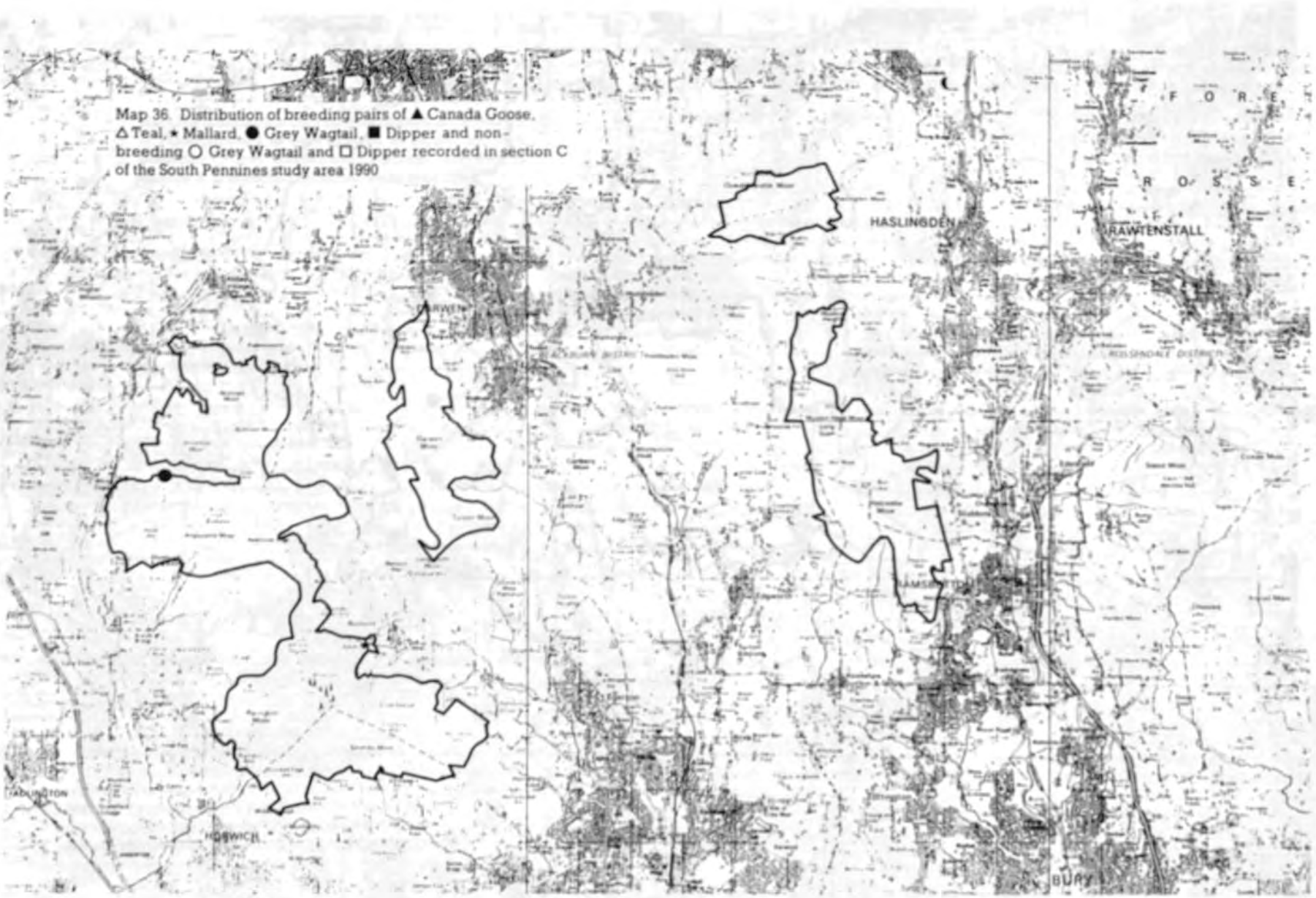
Maps 26-33 contain information on the location of rare and vulnerable breeding birds and are therefore confidential.



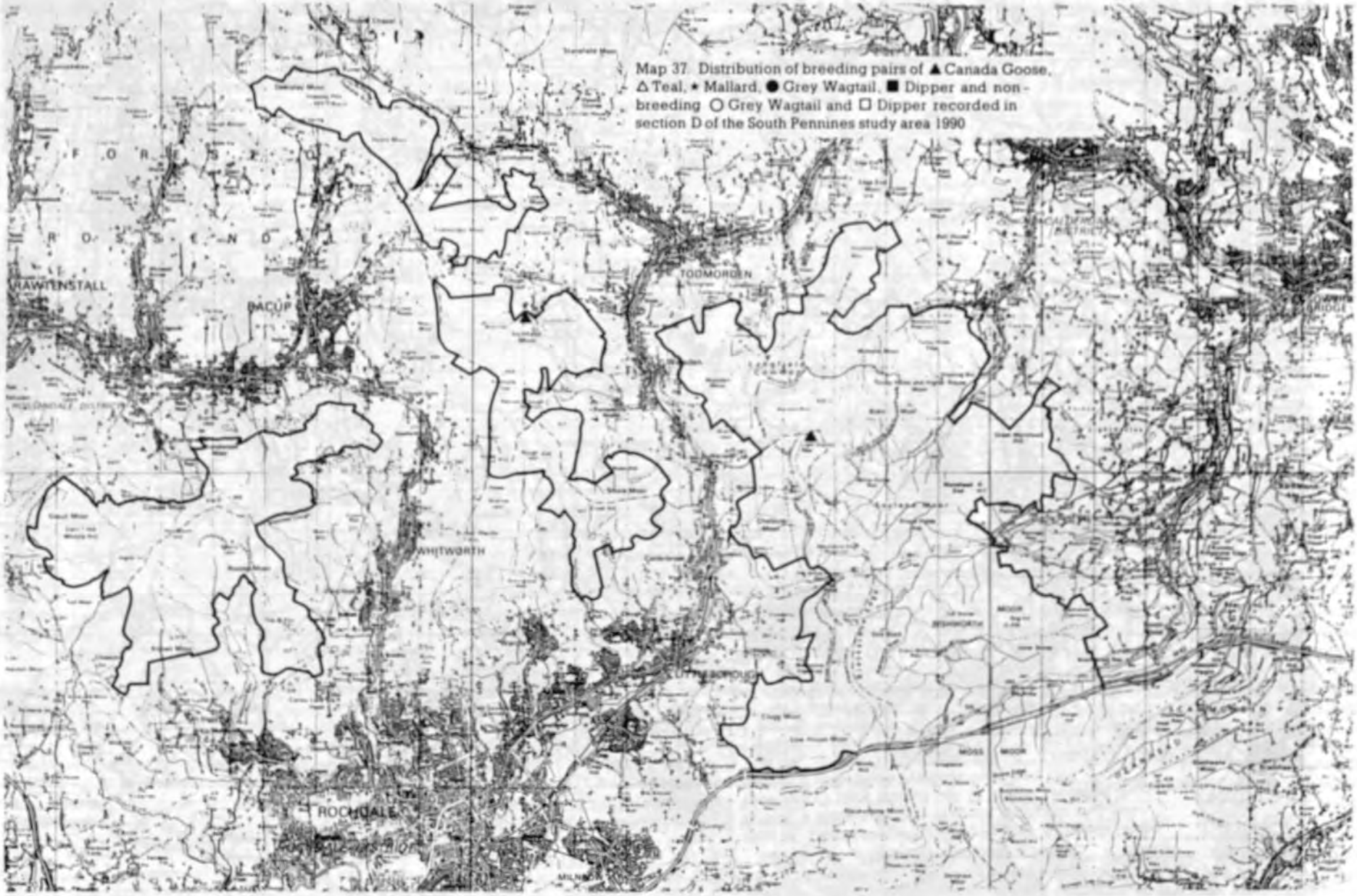
Map 34. Distribution of breeding pairs of ▲ Canada Goose, △ Teal, ★ Mallard, ● Grey Wagtail, ■ Dipper and non-breeding ○ Grey Wagtail and □ Dipper recorded in section A of the South Pennines study area 1990



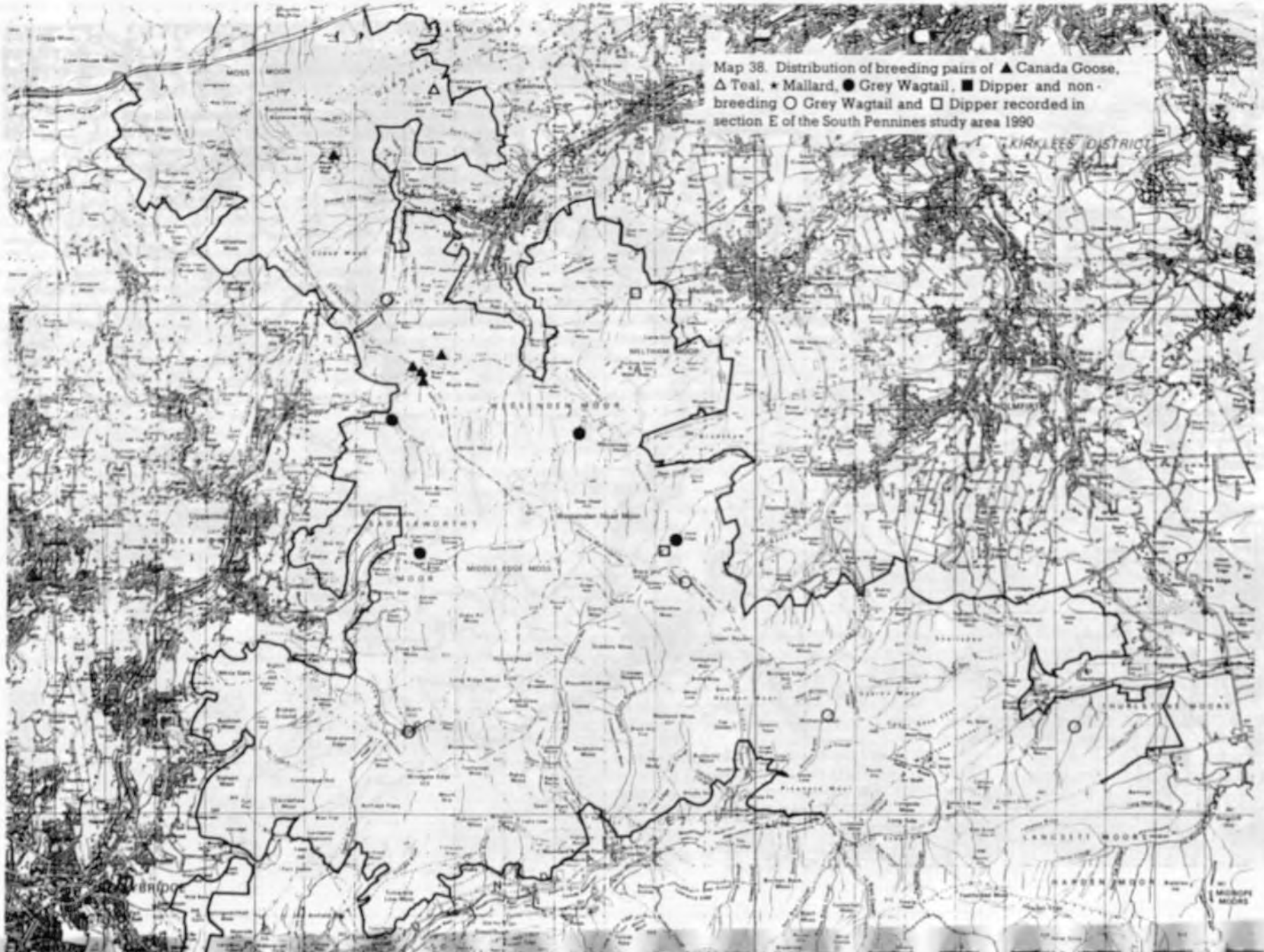
Map 35. Distribution of breeding pairs of ▲Canada Goose, △Teal, • Mallard, ● Grey Wagtail, ■ Dipper and non - breeding ○ Grey Wagtail and □ Dipper recorded in section B of the South Pennines study area 1990



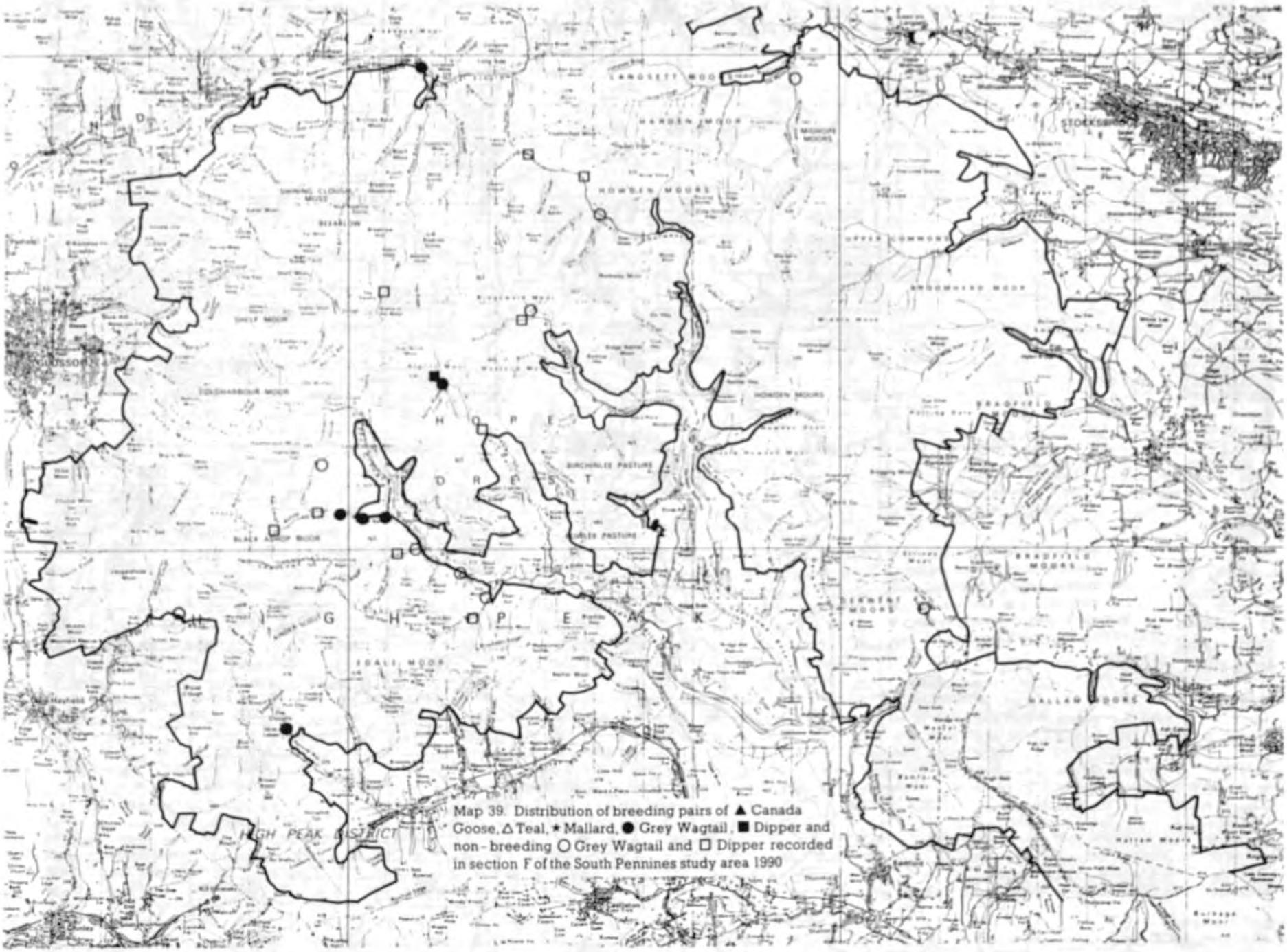
Map 36. Distribution of breeding pairs of ▲ Canada Goose, △ Teal, * Mallard, ● Grey Wagtail, ■ Dipper and non-breeding ○ Grey Wagtail and □ Dipper recorded in section C of the South Pennines study area 1990



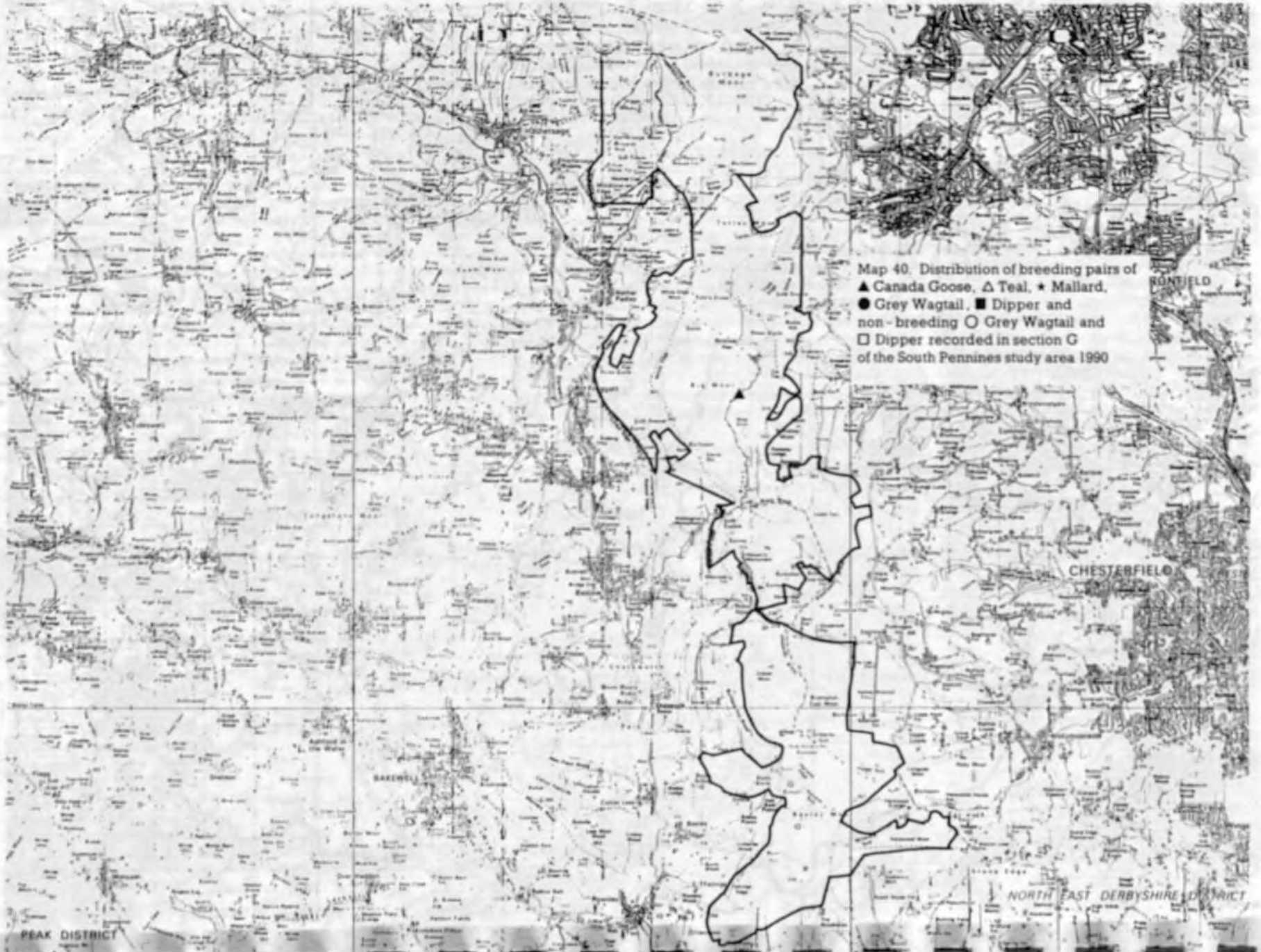
Map 37. Distribution of breeding pairs of ▲ Canada Goose, △ Teal, * Mallard, ● Grey Wagtail, ■ Dipper and non-breeding ○ Grey Wagtail and □ Dipper recorded in section D of the South Pennines study area 1990



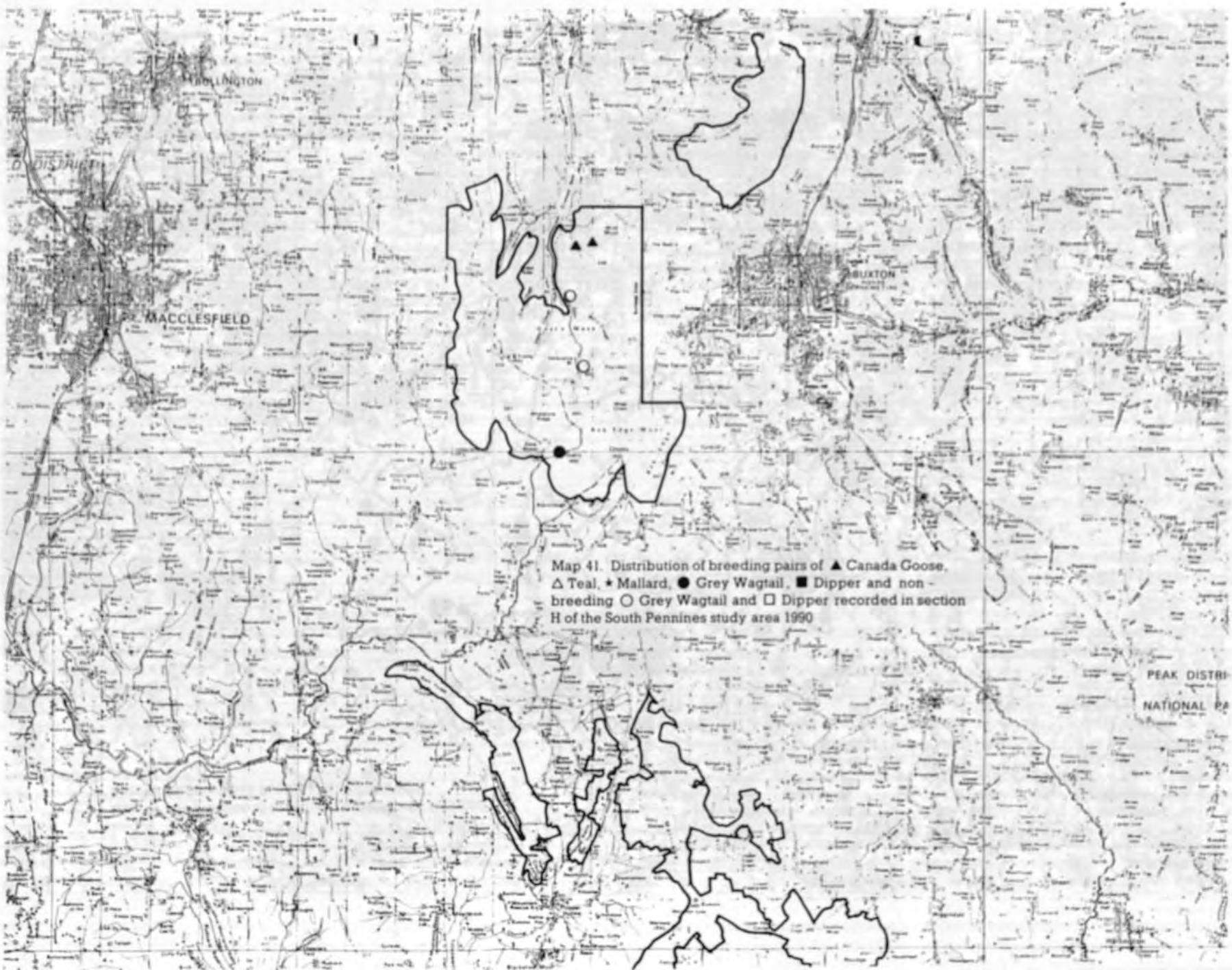
Map 38. Distribution of breeding pairs of ▲ Canada Goose, △ Teal, ★ Mallard, ● Grey Wagtail, ■ Dipper and non-breeding ○ Grey Wagtail and □ Dipper recorded in section E of the South Pennines study area 1990



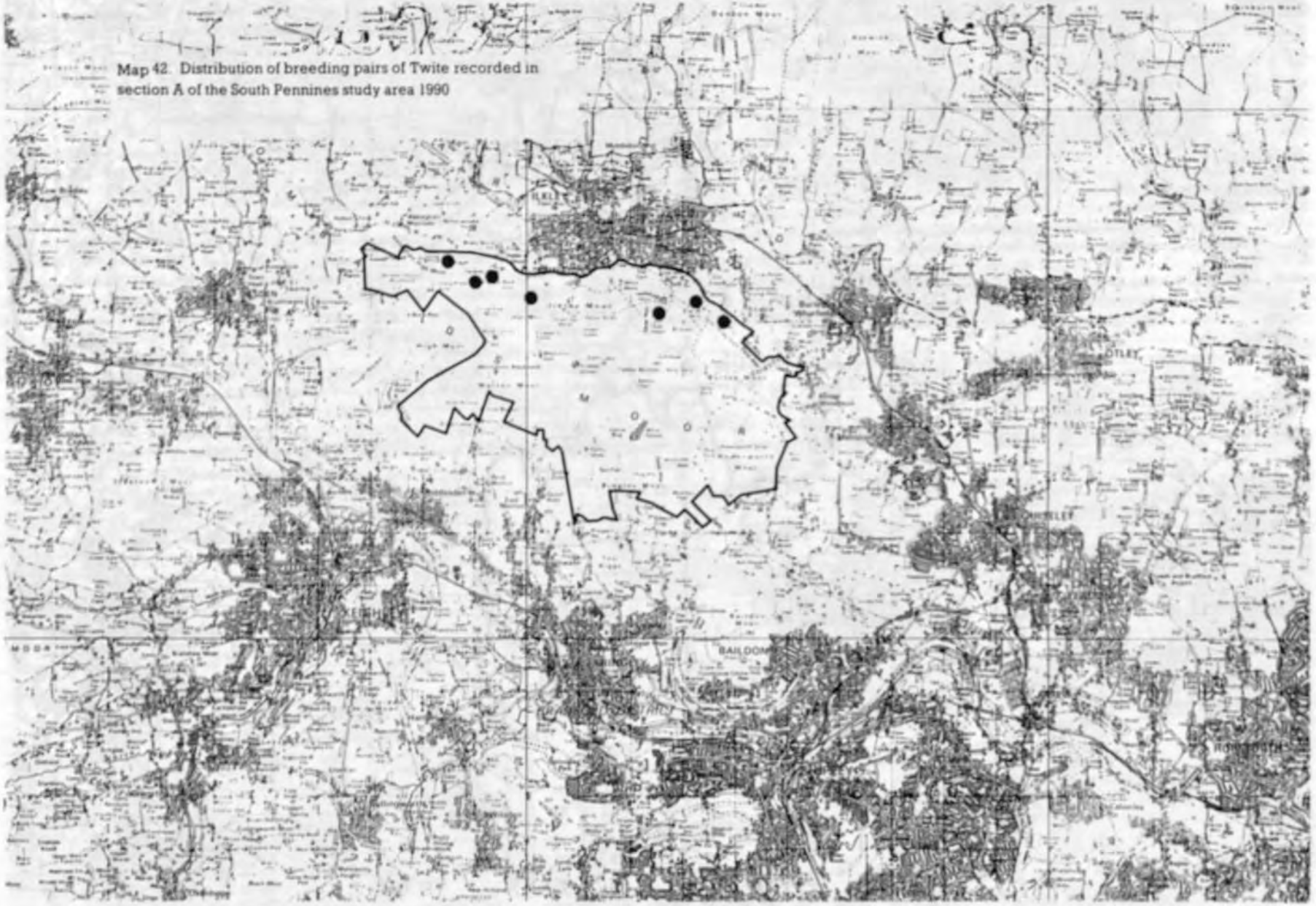
Map 39. Distribution of breeding pairs of ▲ Canada Goose, △ Teal, ★ Mallard, ● Grey Wagtail, ■ Dipper and non-breeding ○ Grey Wagtail and □ Dipper recorded in section F of the South Pennines study area 1990



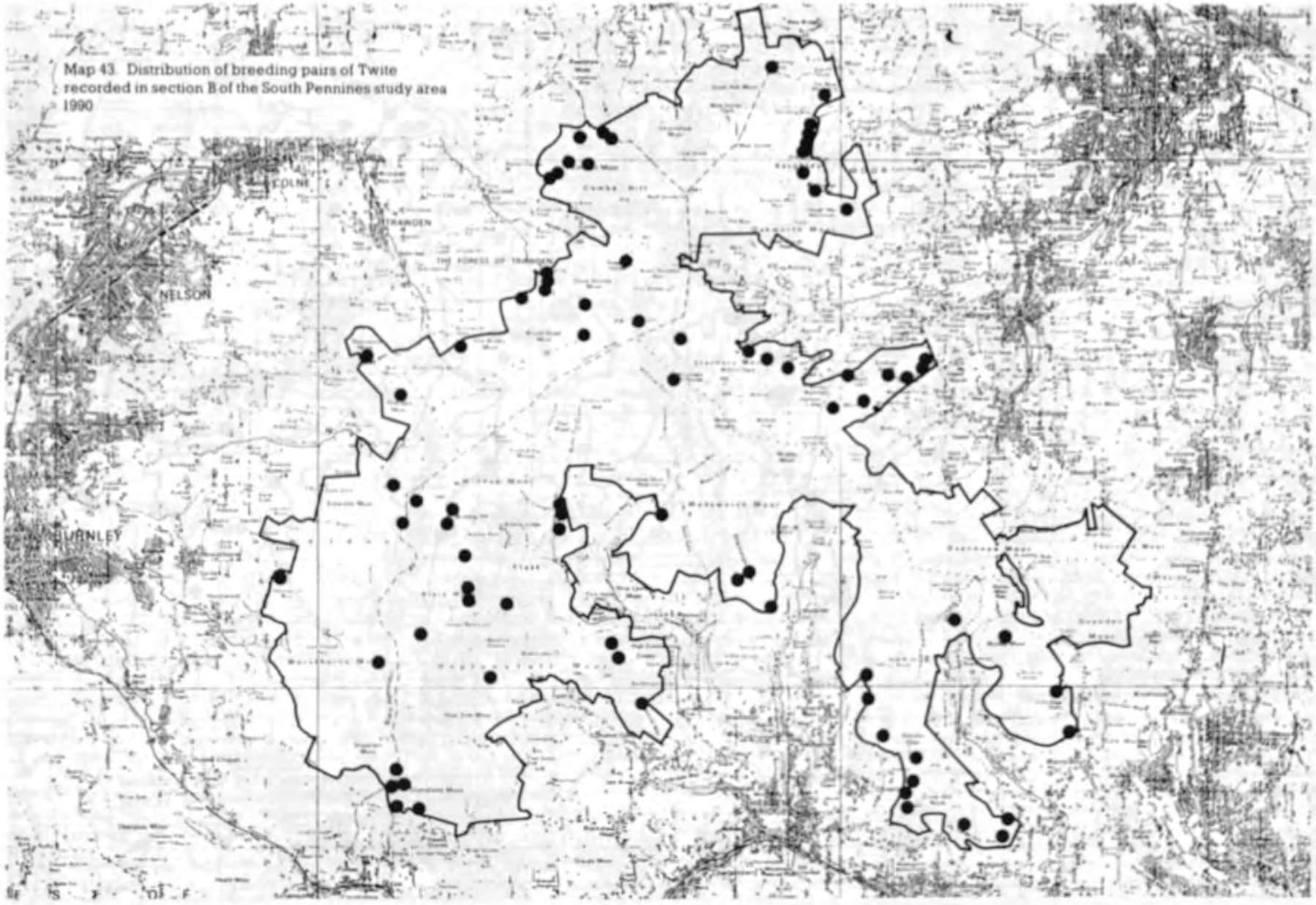
Map 40. Distribution of breeding pairs of ▲ Canada Goose, Δ Teal, ★ Mallard, ● Grey Wagtail, ■ Dipper and non-breeding ○ Grey Wagtail and □ Dipper recorded in section G of the South Pennines study area 1990



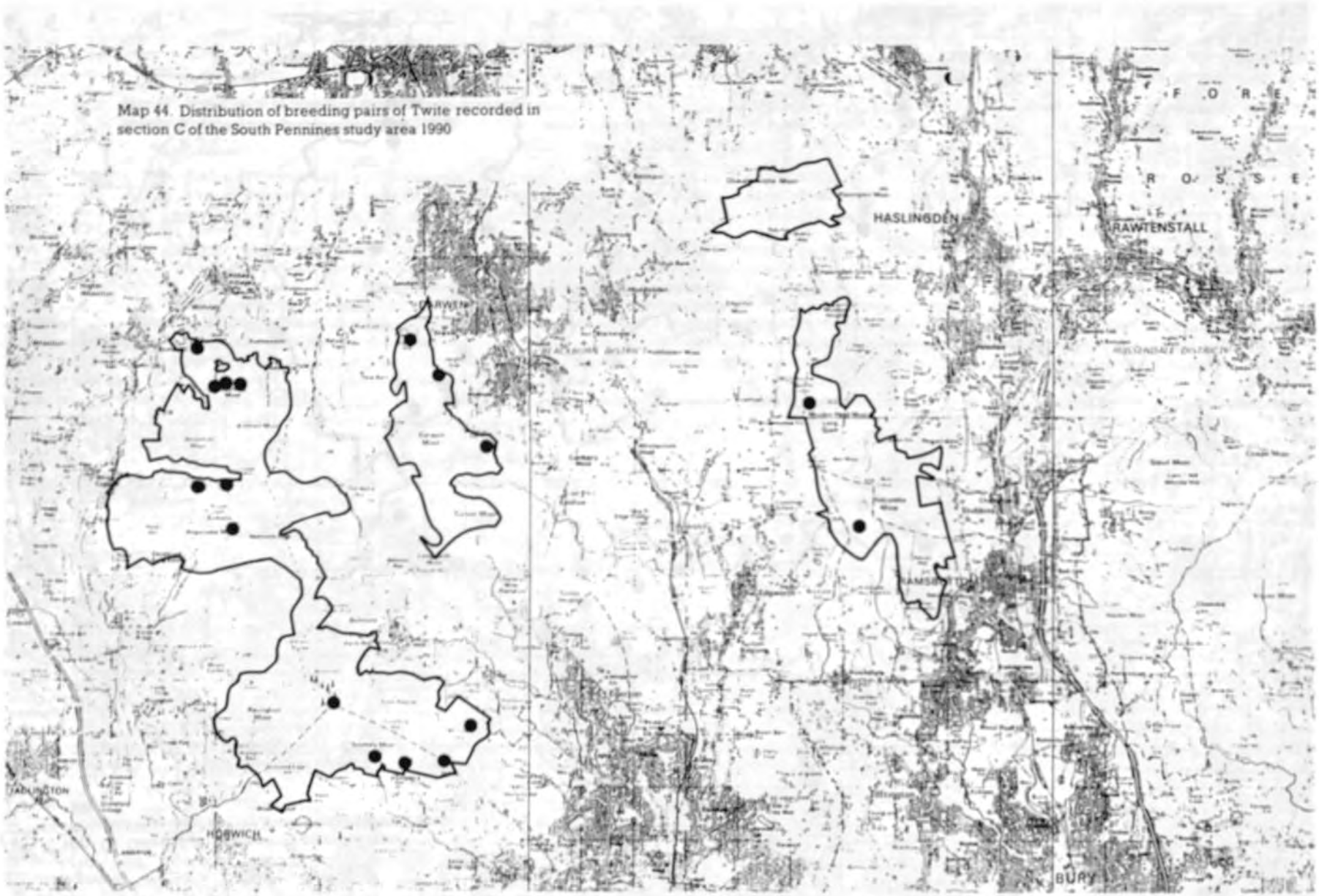
Map 41. Distribution of breeding pairs of ▲ Canada Goose, △ Teal, ★ Mallard, ● Grey Wagtail, ■ Dipper and non - breeding ○ Grey Wagtail and □ Dipper recorded in section H of the South Pennines study area 1990



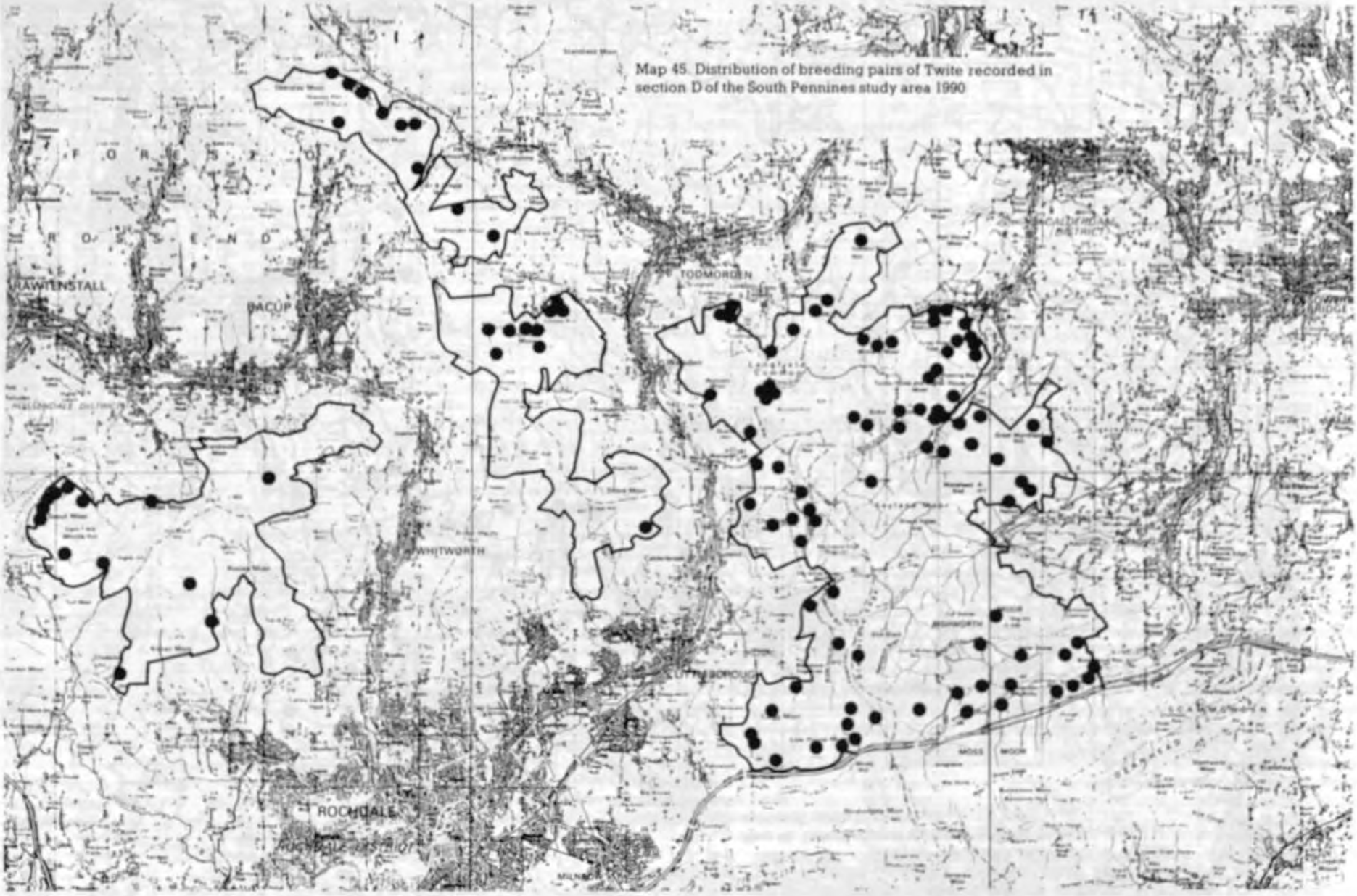
Map 42. Distribution of breeding pairs of Twite recorded in section A of the South Pennines study area 1990



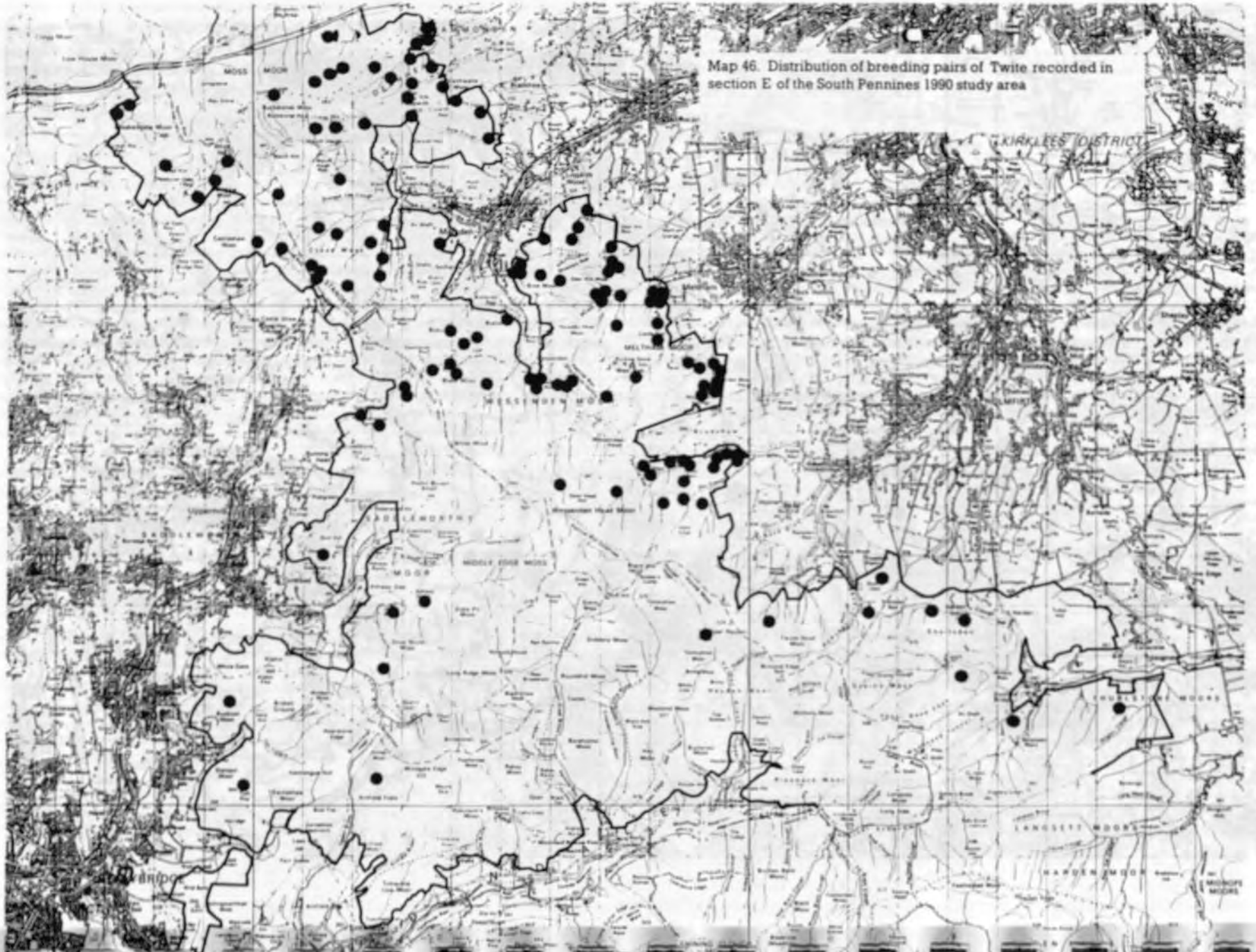
Map 43 Distribution of breeding pairs of Twite recorded in section B of the South Pennines study area 1990



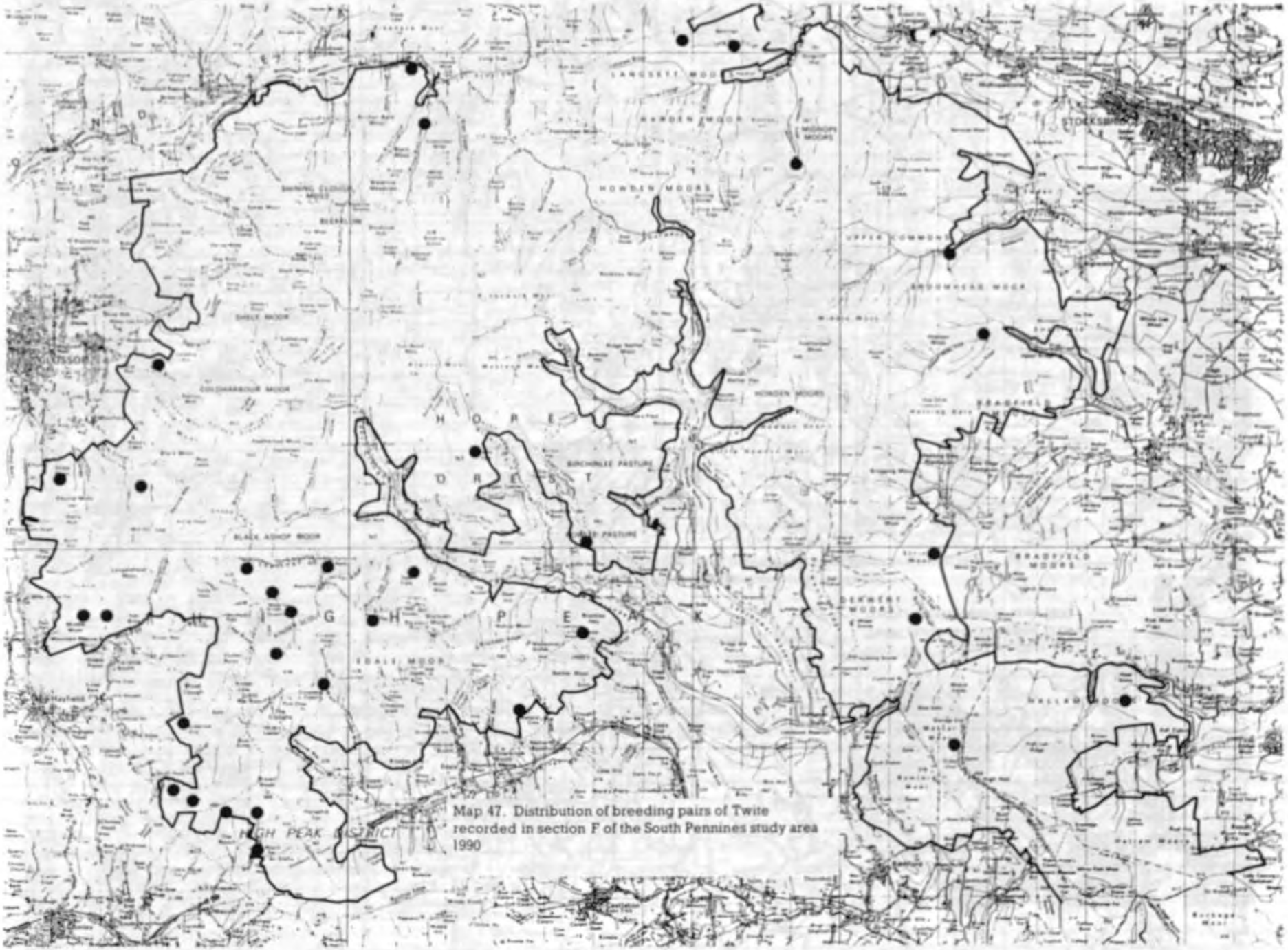
Map 44. Distribution of breeding pairs of Twite recorded in section C of the South Pennines study area 1990



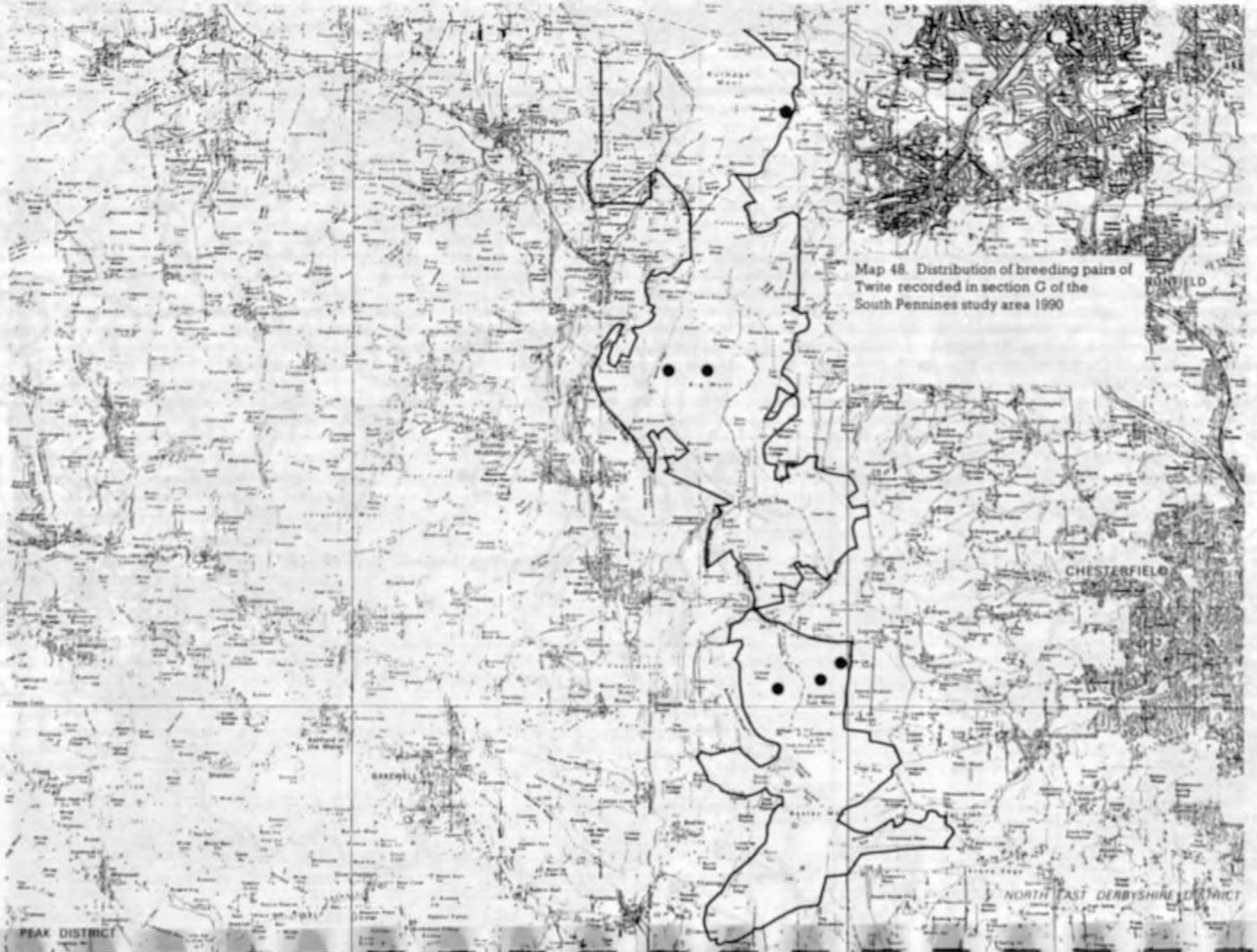
Map 45. Distribution of breeding pairs of Twite recorded in section D of the South Pennines study area 1990



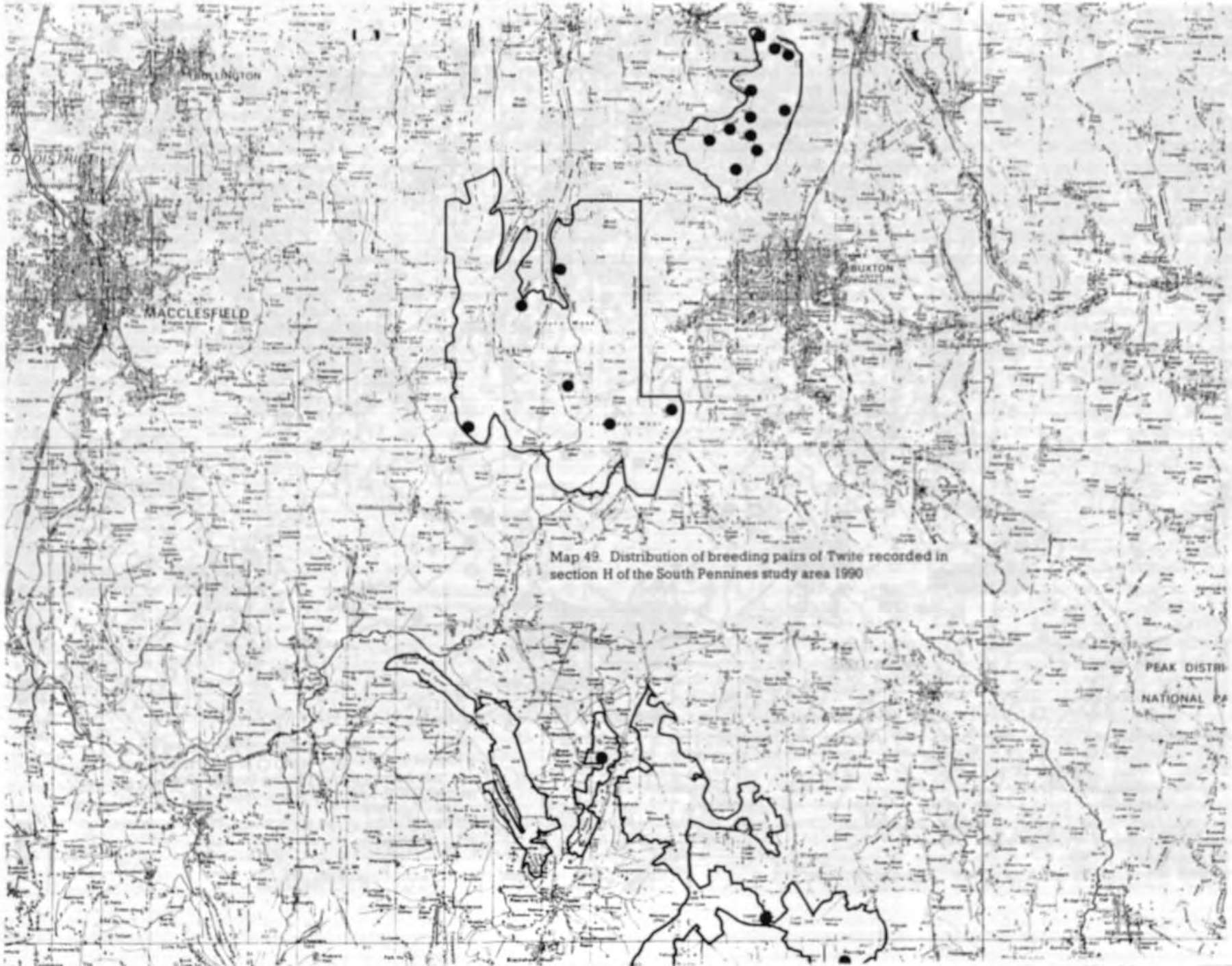
Map 46. Distribution of breeding pairs of Twite recorded in section E of the South Pennines 1990 study area



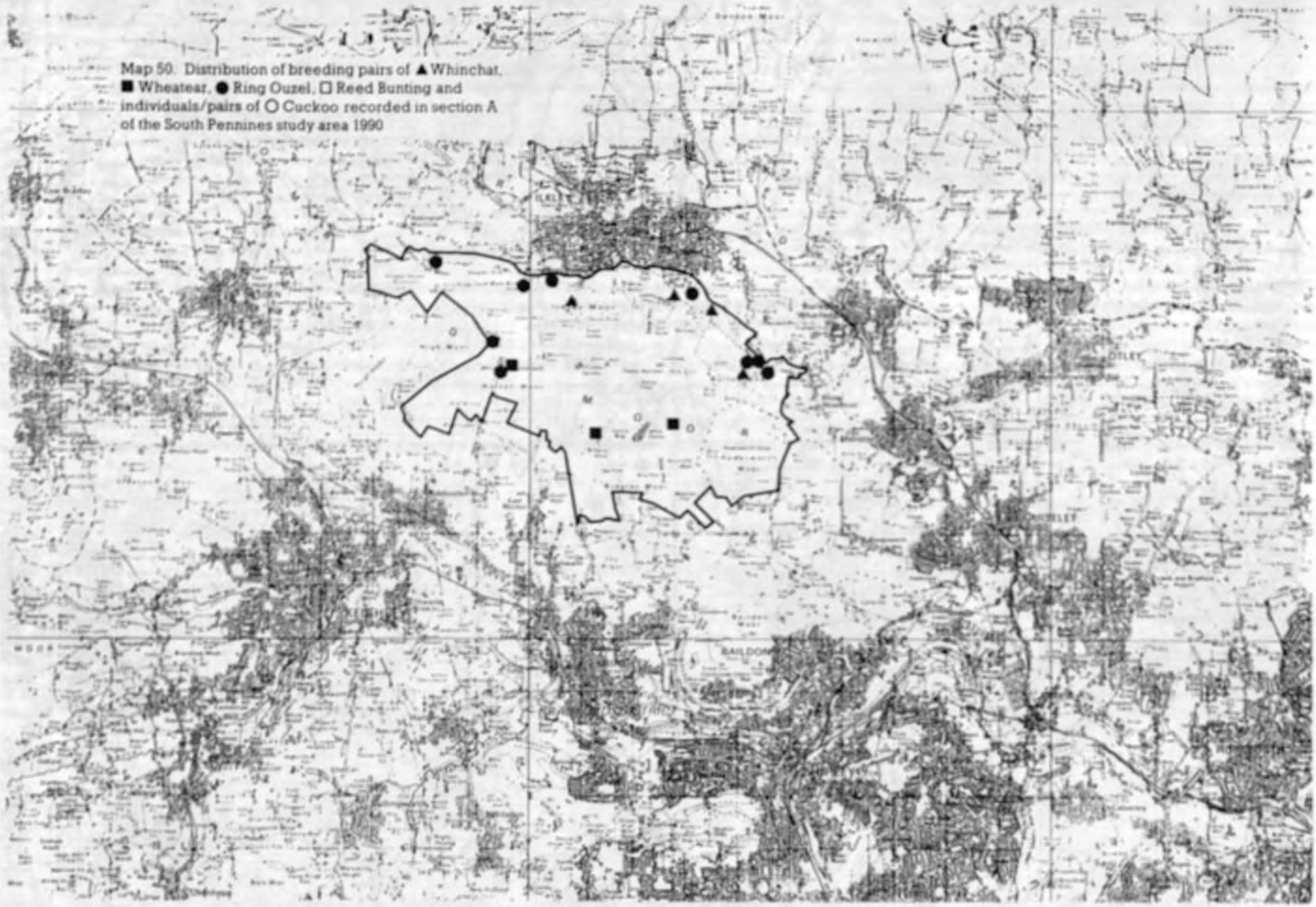
Map 47. Distribution of breeding pairs of Twite recorded in section F of the South Pennines study area 1990



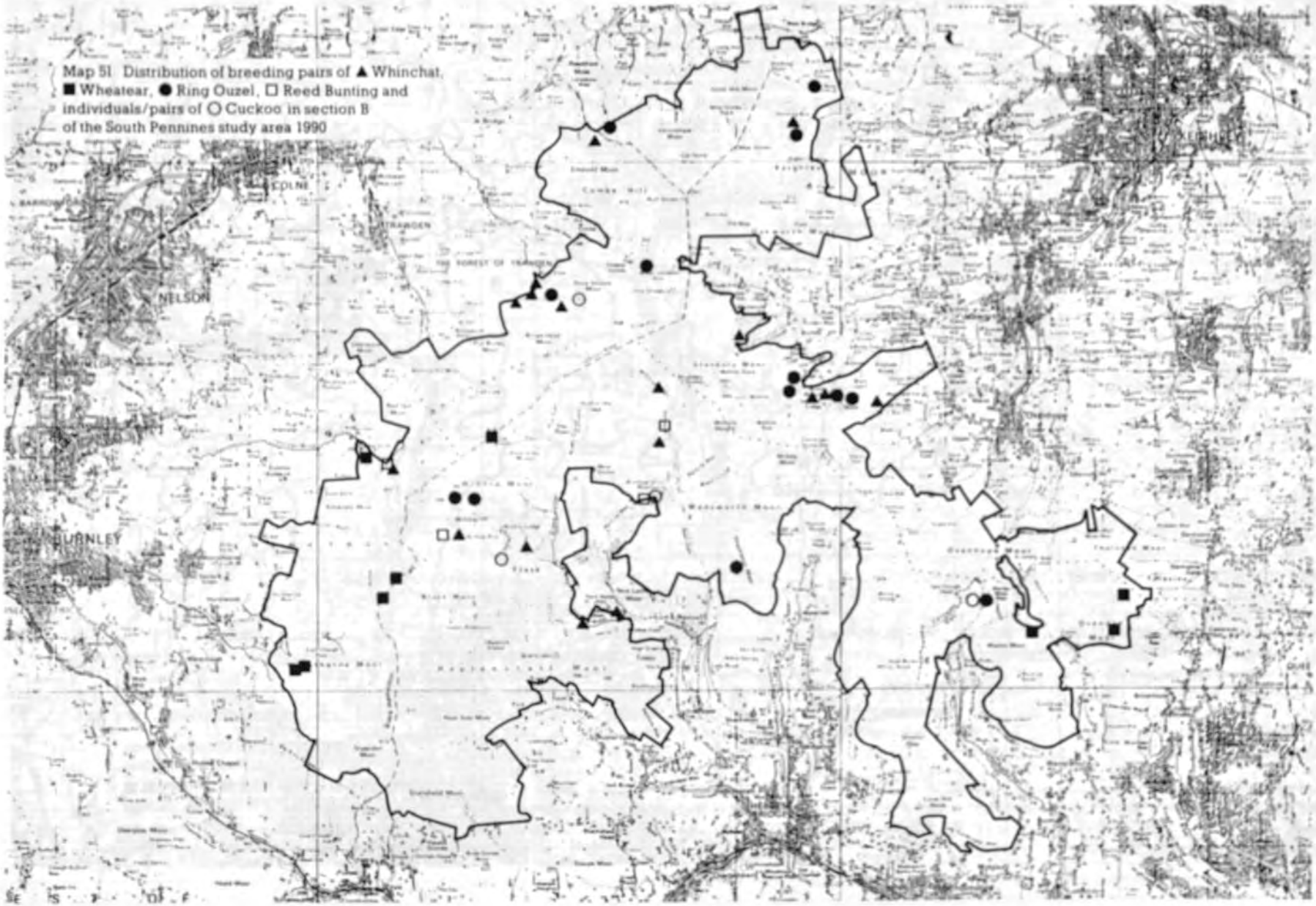
Map 48. Distribution of breeding pairs of Twite recorded in section G of the South Pennines study area 1990



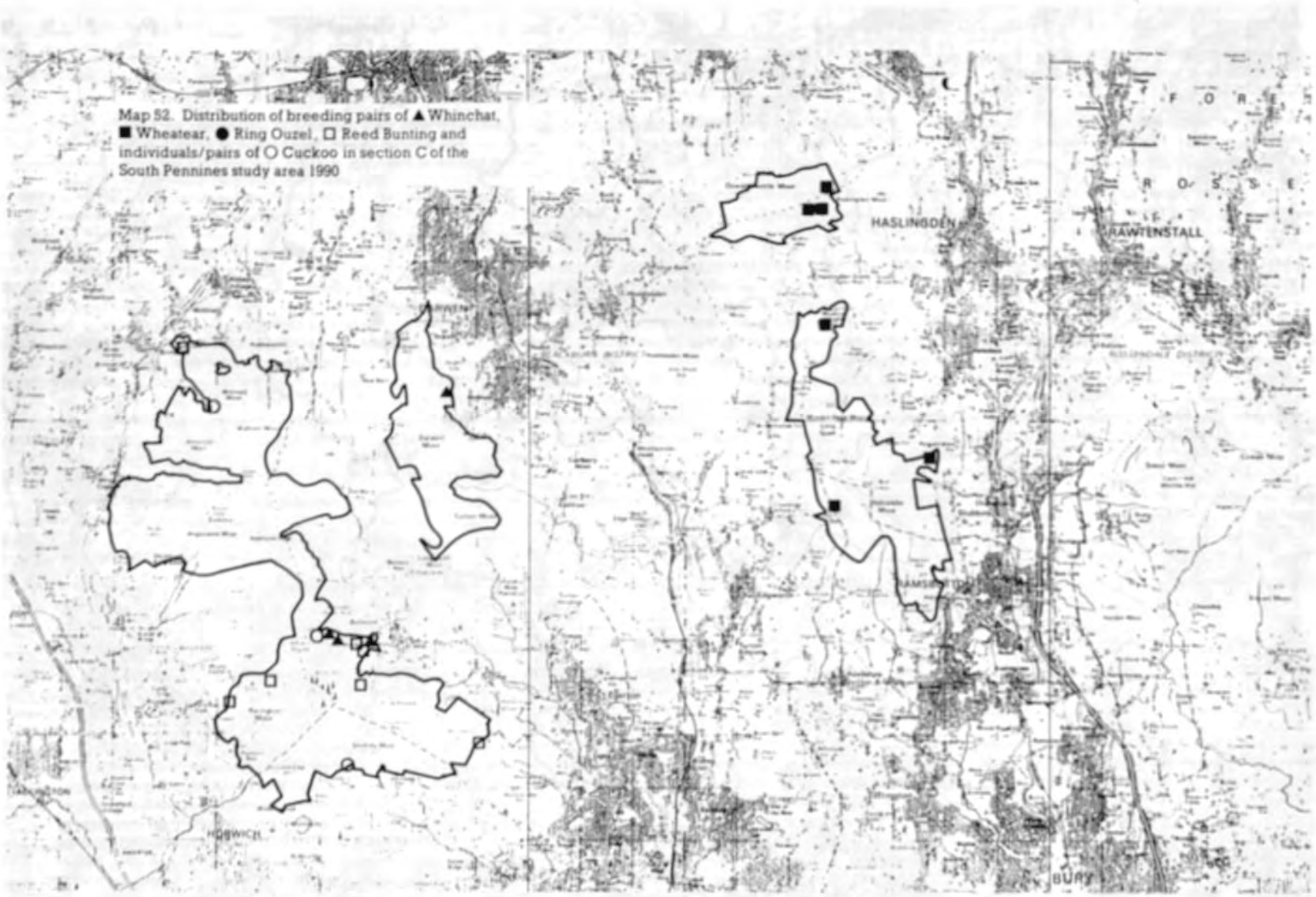
Map 49. Distribution of breeding pairs of Twite recorded in section H of the South Pennines study area 1990



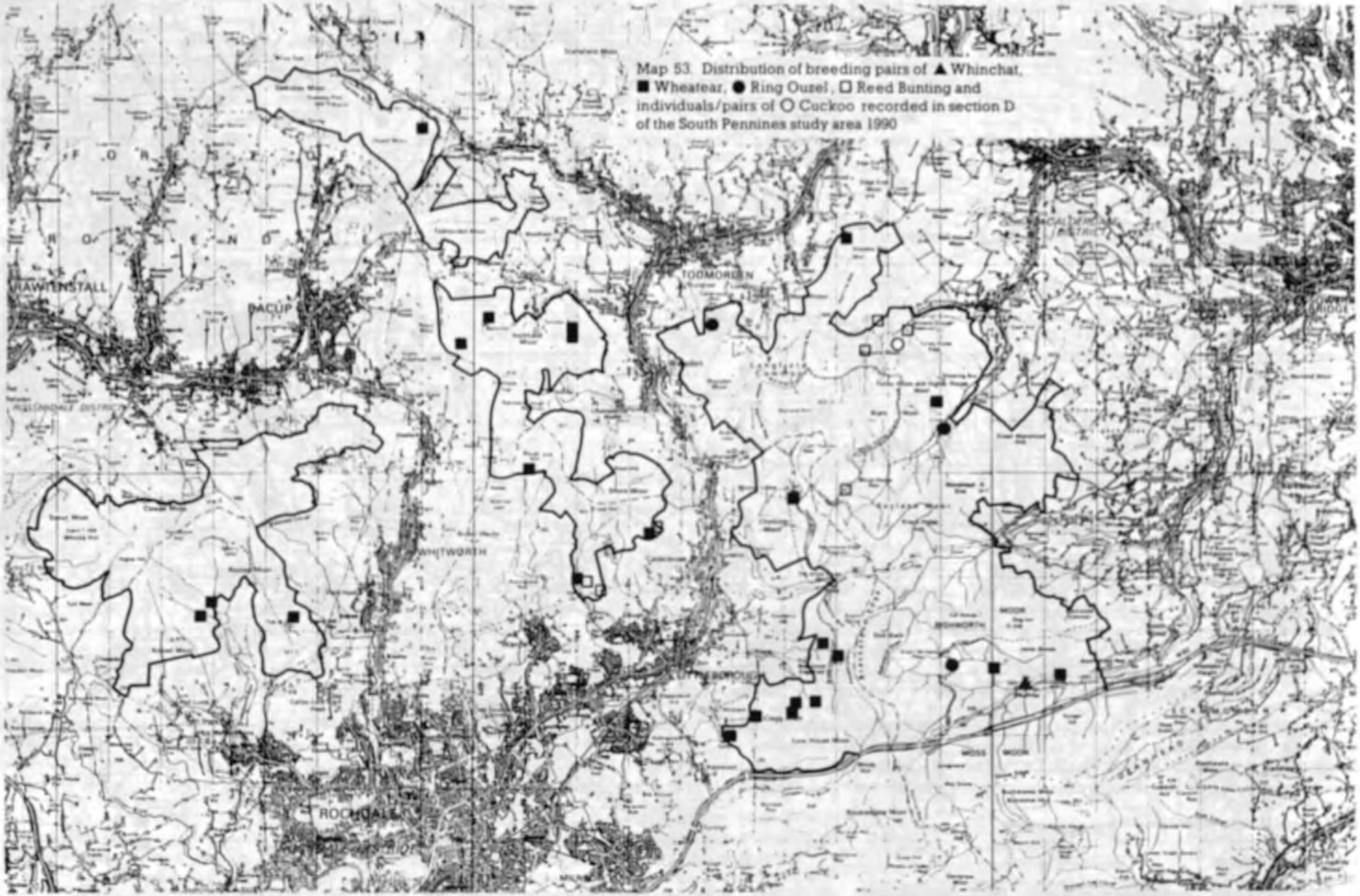
Map 50. Distribution of breeding pairs of ▲ Whinchat, ■ Wheatear, ● Ring Ouzel, □ Reed Bunting and individuals/pairs of ○ Cuckoo recorded in section A of the South Pennines study area 1990



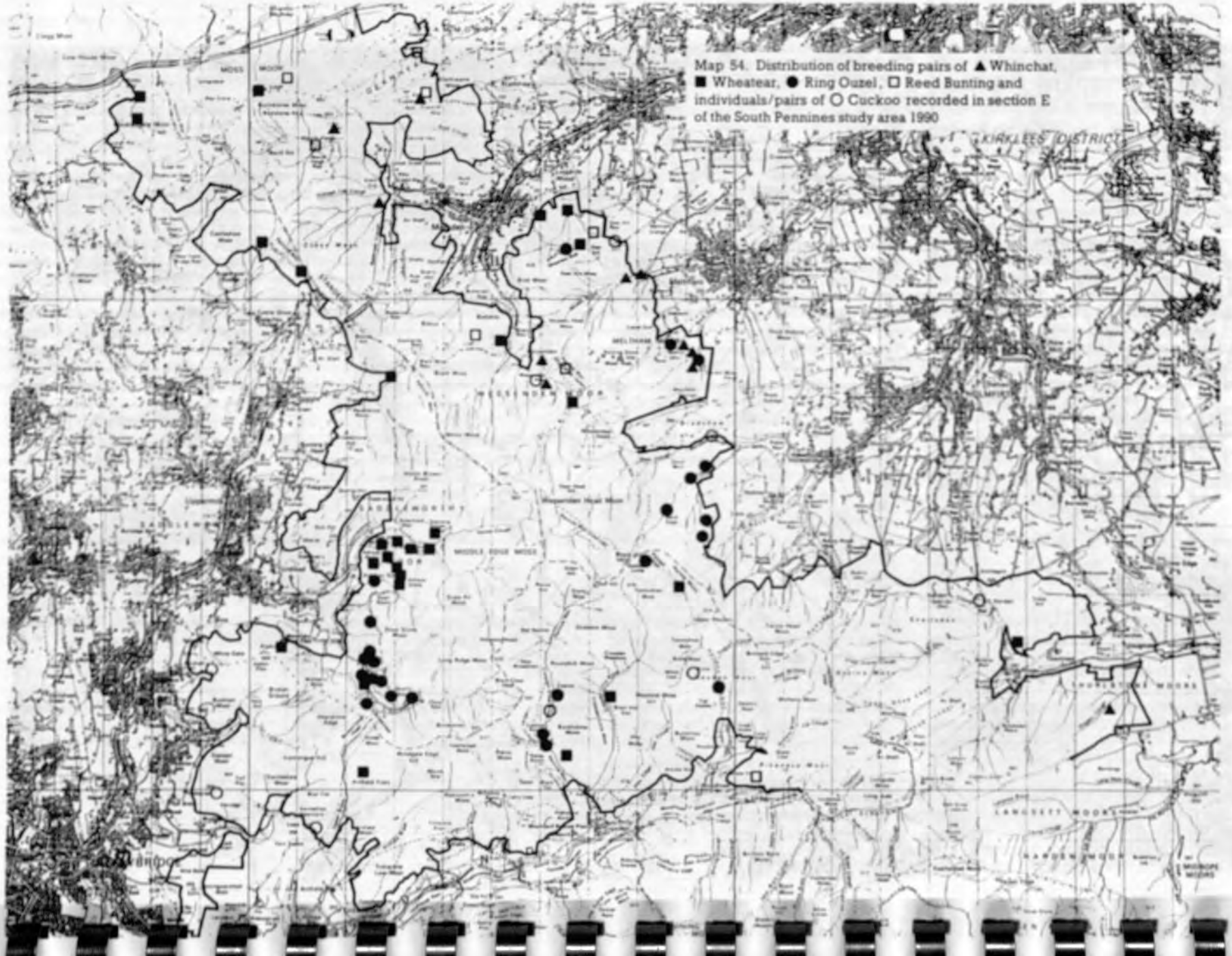
Map 51 Distribution of breeding pairs of ▲ Whinchat, ■ Wheatear, ● Ring Ouzel, □ Reed Bunting and individuals/pairs of ○ Cuckoo in section B of the South Pennines study area 1990



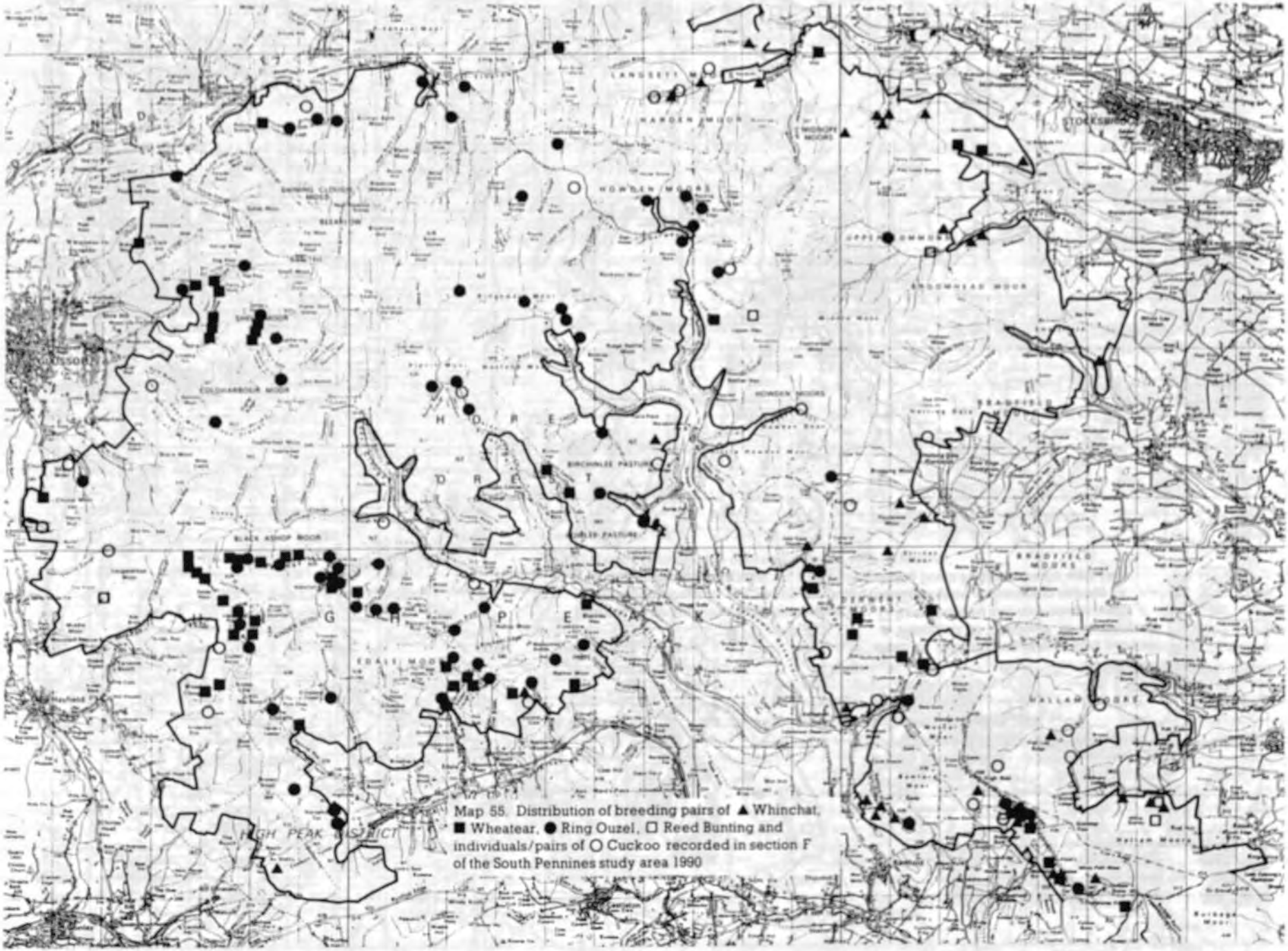
Map 52. Distribution of breeding pairs of ▲ Whinchat, ■ Wheatear, ● Ring Ouzel, □ Reed Bunting and individuals/pairs of ○ Cuckoo in section C of the South Pennines study area 1990



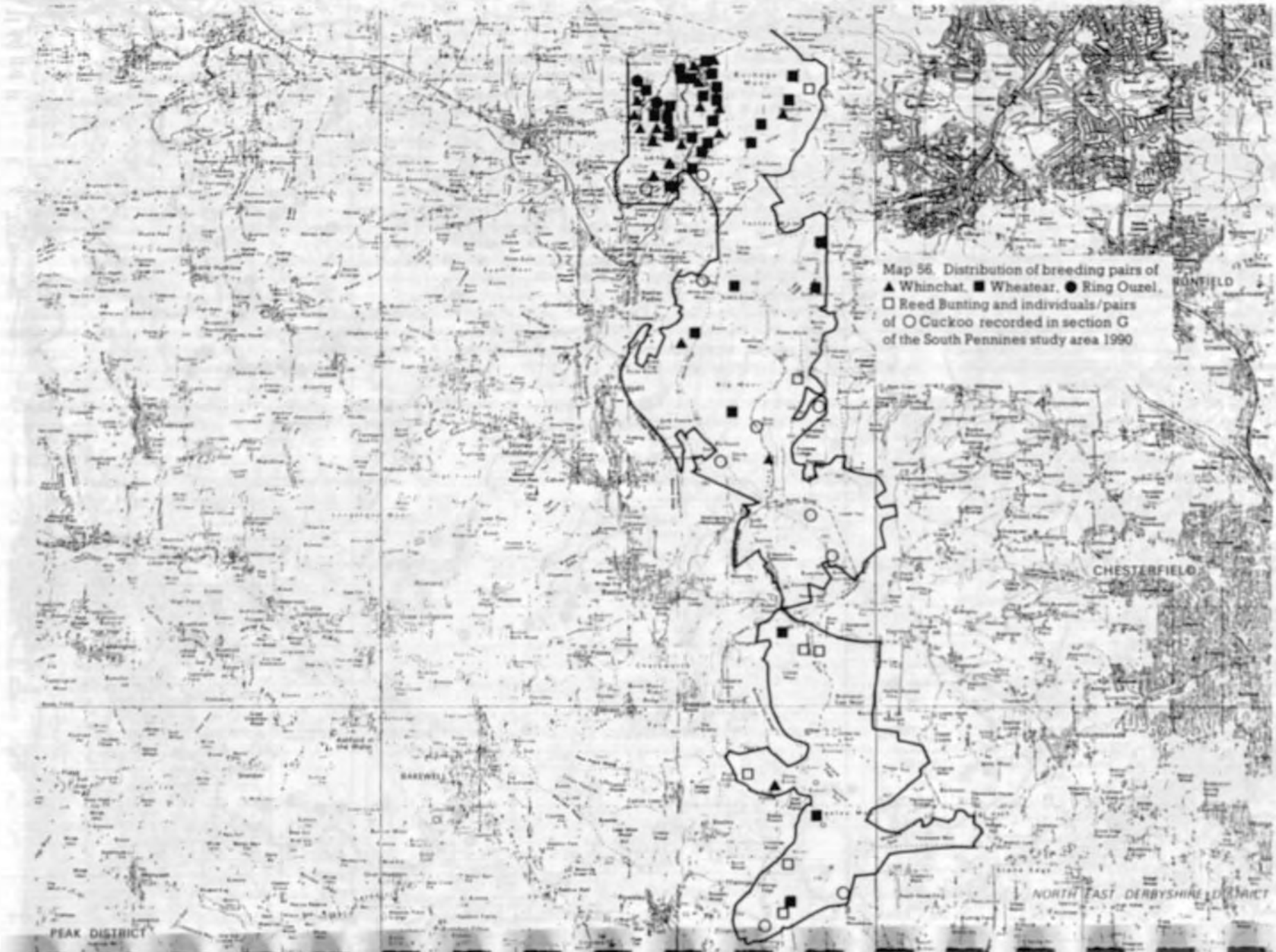
Map 53. Distribution of breeding pairs of ▲ Whinchat, ■ Wheatear, ● Ring Ouzel, □ Reed Bunting and individuals/pairs of ○ Cuckoo recorded in section D of the South Pennines study area 1990



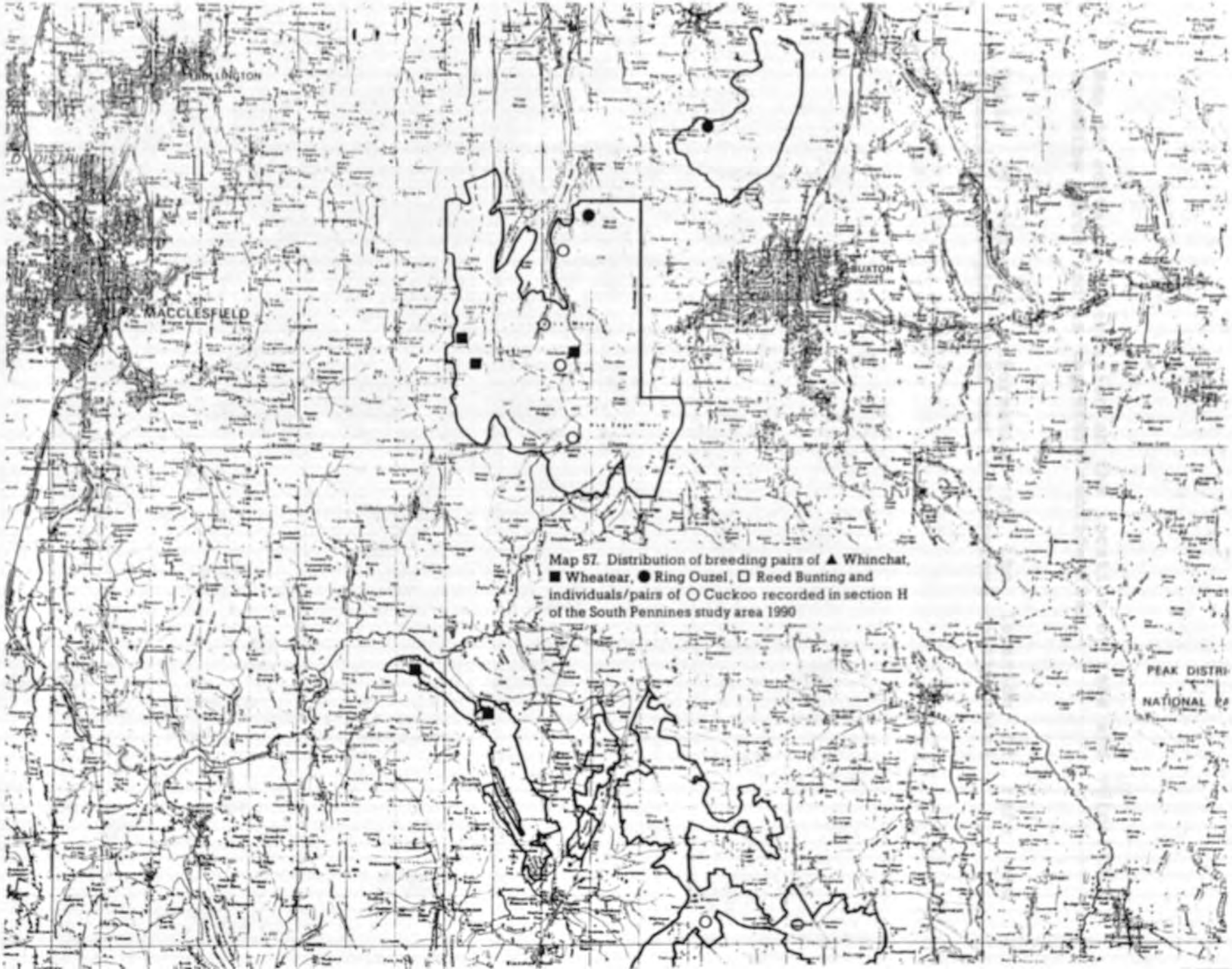
Map 54. Distribution of breeding pairs of ▲ Whinchat, ■ Wheatear, ● Ring Ouzel, □ Reed Bunting and individuals/pairs of ○ Cuckoo recorded in section E of the South Pennines study area 1990



Map 55. Distribution of breeding pairs of ▲ Whinchat, ■ Wheatear, ● Ring Ouzel, □ Reed Bunting and individuals/pairs of ○ Cuckoo recorded in section F of the South Pennines study area 1990



Map 56. Distribution of breeding pairs of ▲ Whinchat, ■ Wheatear, ● Ring Ouzel, □ Reed Bunting and individuals/pairs of ○ Cuckoo recorded in section G of the South Pennines study area 1990



Map 57. Distribution of breeding pairs of ▲ Whinchat, ■ Wheatear, ● Ring Ouzel, □ Reed Bunting and individuals/pairs of ○ Cuckoo recorded in section H of the South Pennines study area 1990

Map 58 contains information on the location of rare and vulnerable breeding birds and is therefore confidential.

Table 25 contains information on the location of rare and vulnerable breeding birds and is therefore confidential.

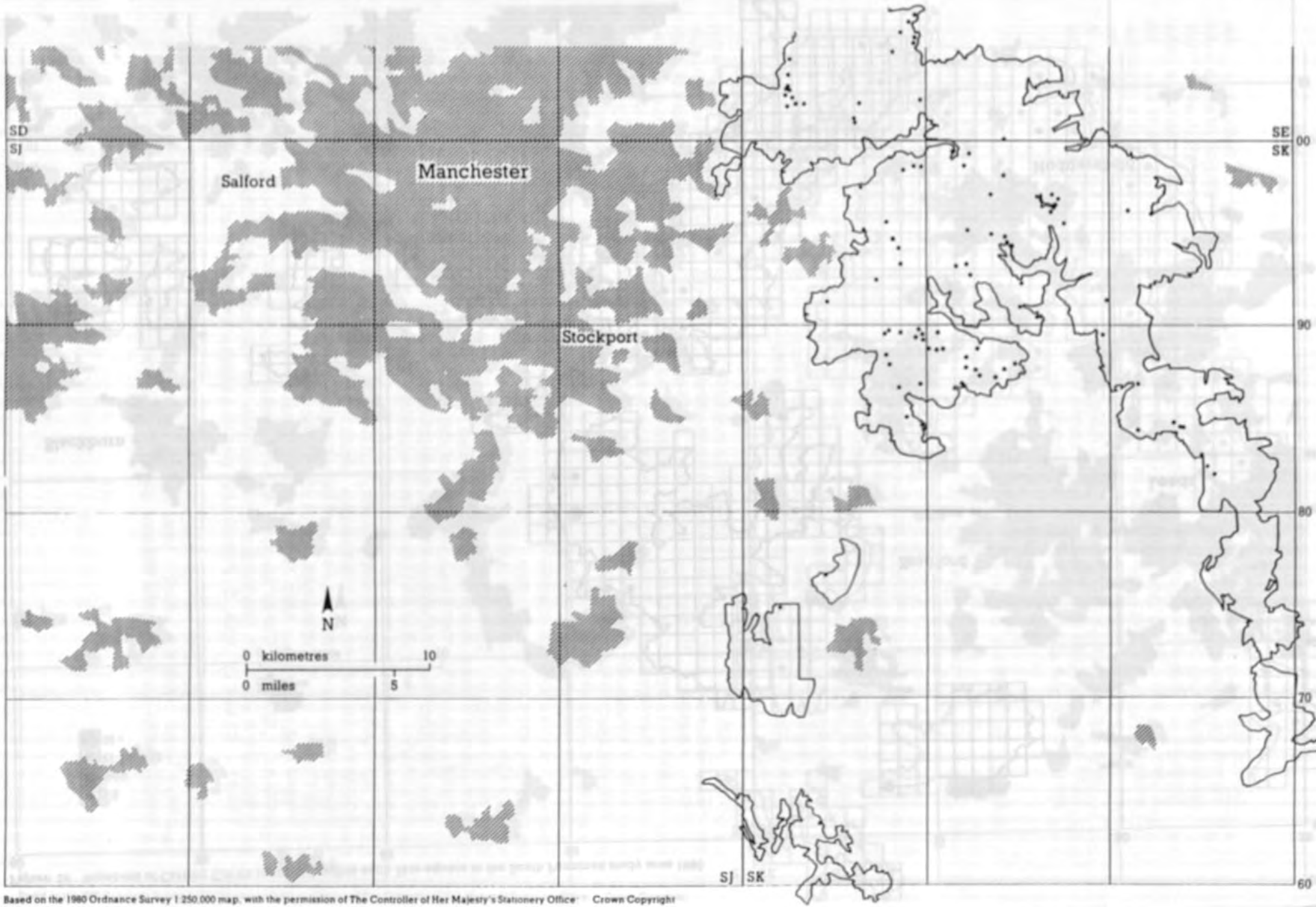
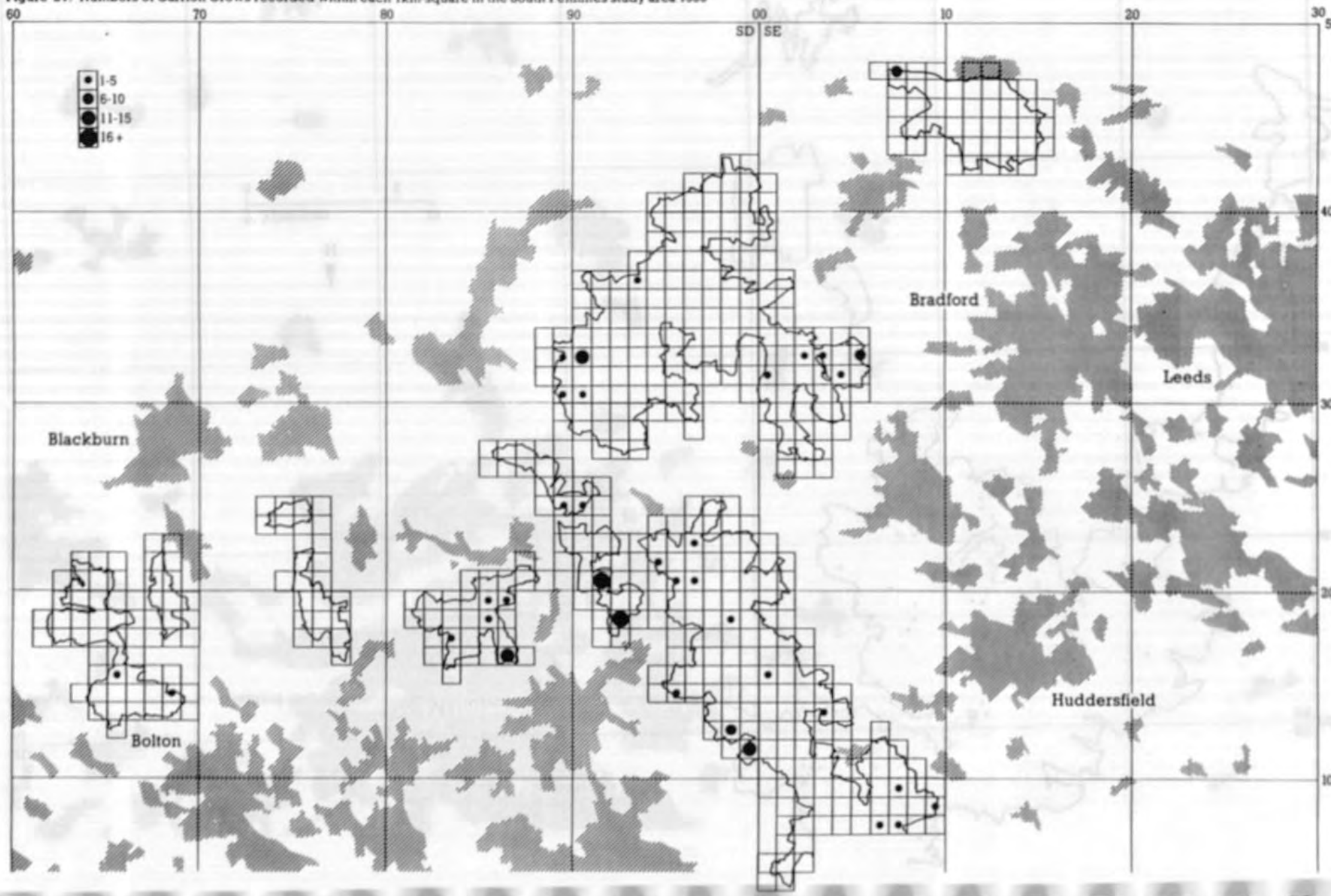
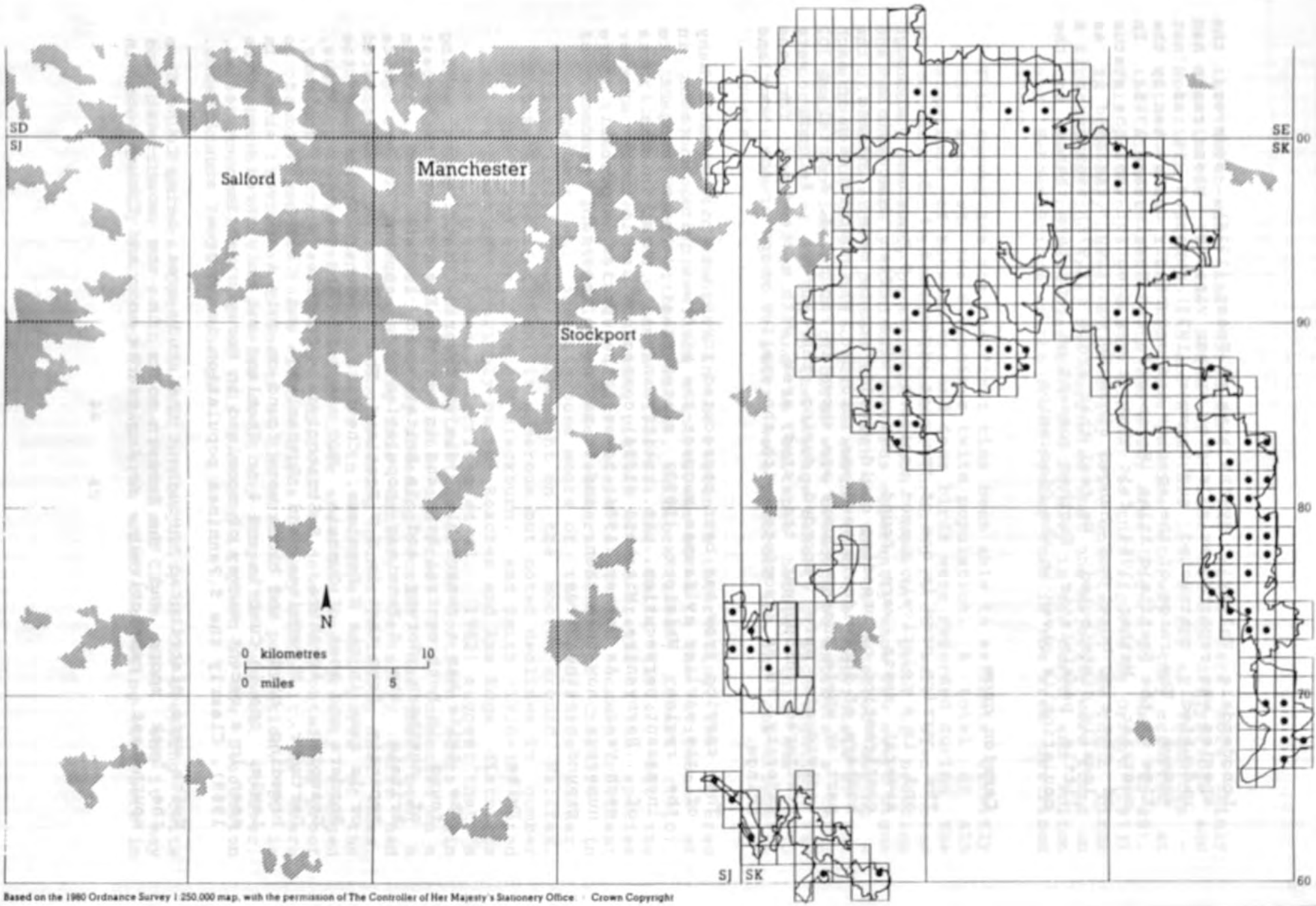


Figure 24. Numbers of Carrion Crows recorded within each 1km-square in the South Pennines study area 1990





Longdendale Valley'. By the time of Frost (1978), however, the species was reported as a 'scarce summer visitor' whose range had undoubtedly contracted and Spencer (1973) reported it as 'not common'. The range of the species had undubtedly contracted by the time of the Sheffield Atlas (Hornbuckle and Herringshaw 1985). In contrast, Mather (1984) felt that it was doubtful that the status of the ring ouzel had changed since Nelson (1907) assessed it as 'locally distributed'. We feel that Frost's (1978) assessment is a little pessimistic. Further comment on long-term change in the poulation is given in the Discussion.

Carrion crow

The carrion crow is one of the most widespread of British birds and is a relatively common resident in the S.Pennines. Although several nests were found, these were often inaccesible and confirmation of breeding could usually not be made. Instead, the numbers of individuals seen was recorded. The numbers seen in each part or whole one-km square are shown in Figure 24. A total of 302 individuals were recorded during the survey. Records were scattered throughout the study area, with a tendency for the majority to be associated with the smaller moors or the moorland fringe.

The carrion crow has been persecuted throughout history and many of the earlier avifaunas suggest the bird was quite uncommon in the region. Whitlock (1893) stated that 'though subject to incessant persecution...it...still manages to exist in most parts of'...Derbyshire. Mitchell (1884) commented that it became scarcer each year. As Mather (1984) notes, the species is probably more numerous now than then, and it may be an important predator of ground nesting birds.

Twite

The twite has a remarkable, disjunct world distribution, being found in both central Asia and in western Europe along the coast of northern Norway and in Britain and Ireland. Even within Britain, the S.Pennines population now appears to be quite separate from that in N.W.Scotland. The bird has now disappeared or is rare in the N.Pennines, Cheviots, Southern Uplands and the Borders and most of Cumbria. NCC moorland bird surveys in Angus, Grampian, Ayrshire, S.Strathclyde, Dumfries and Galloway, Dartmoor, N.Pennines and Sutherland and Caithness found no breeding birds and birds were found on only 4 survey sites in Lewis, one in Cumbria and 4 in Shetland and only three birds were seen in a recent survey of moorland in Morayshire (Shepherd *et al.* 1989). Clearly the S.Pennines population is of great significance.

Twite were distributed throughout the study area, being found from the Leek moors and the Eastern moors in the south-west and south-east, respectively, to Anglezarke moor and Ilkley moor in

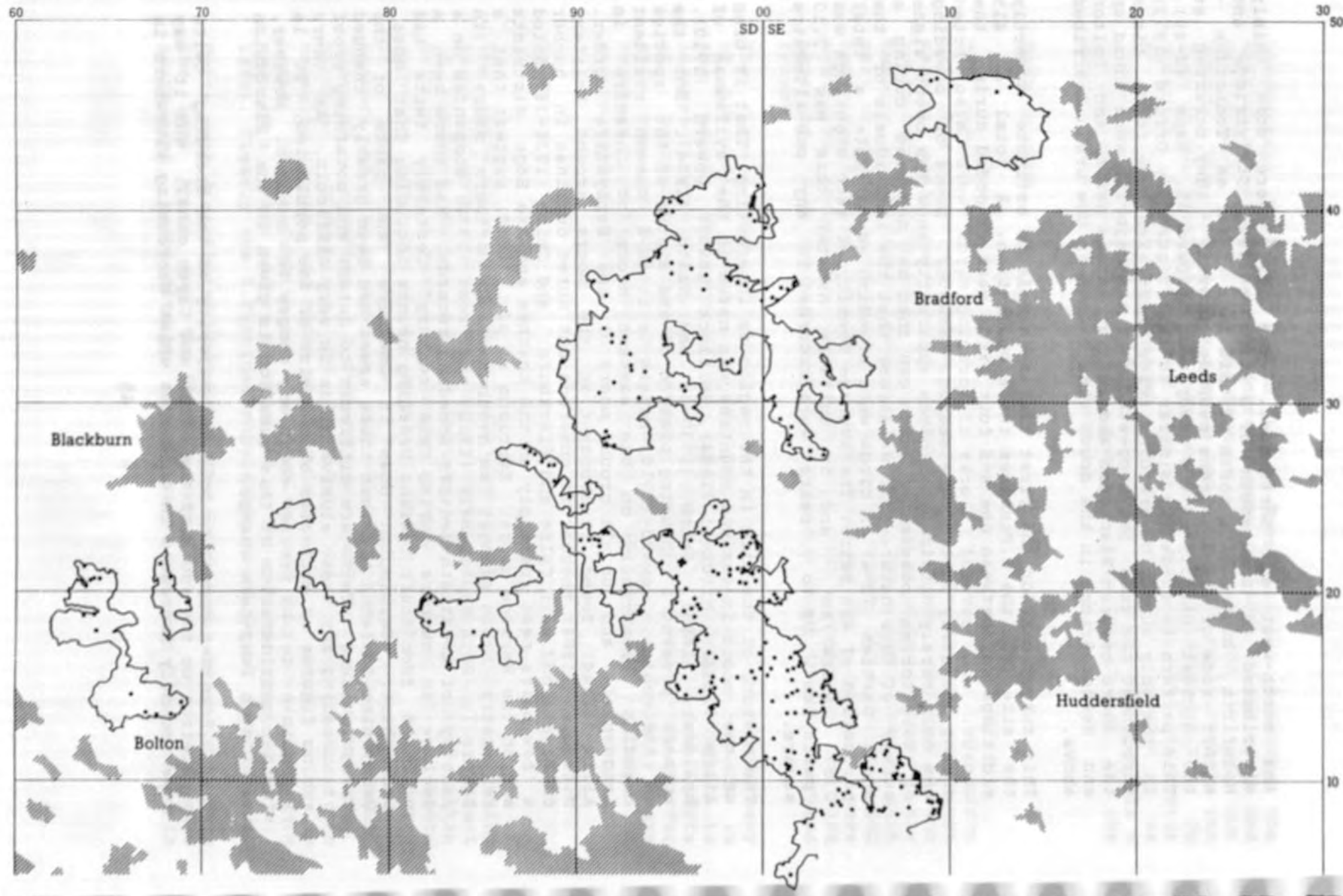
the north-west and north-east. The birds were more thinly distributed to the south of a line between Stalybridge and Holmfirth, but to the north of this line as far as Todmorden - either side of the M62 trans pennine motorway - they occurred at the highest density in the study area (Figure 25, Maps 42-49). This pattern is evidently similar to that figured by Orford (1973) in the only survey of breeding twite undertaken. He found birds throughout the area, but suggested that the majority were found on the moors between Blackburn and Burnley in the north and Bolton and Hebden Bridge in the south rather than in the area described above.

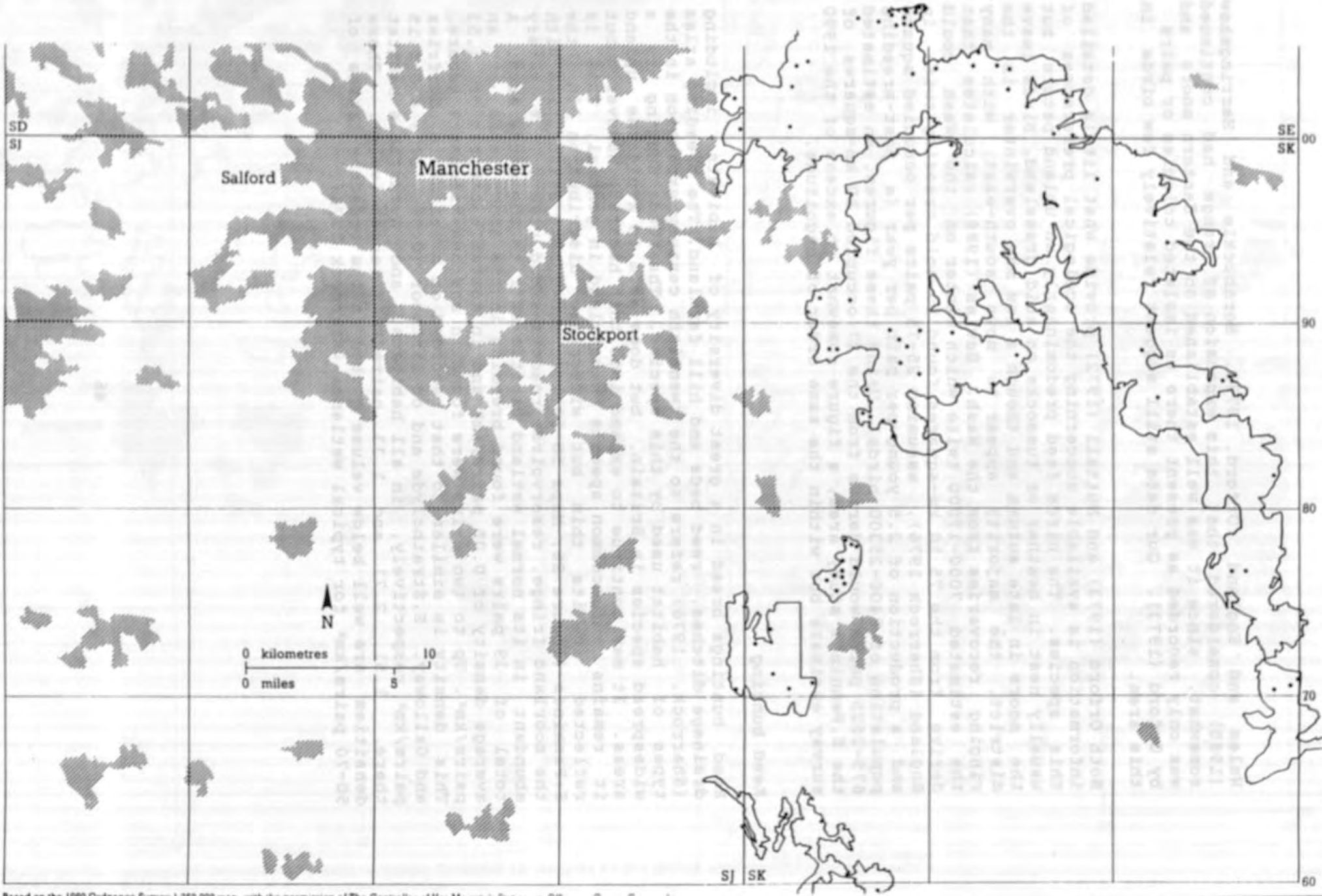
This survey has for the first time been able to estimate directly the size of the S.Pennines twite population. A total of 415 sightings of between one and four birds were recorded during the census, and several flocks of foraging birds were also noted during the early part of the season. However, proof of breeding was only rarely obtained, as birds apparantly show few overt signs of territorial possession which can then be detected during a survey of this nature. If we assume that the individuals or the small parties (2-4) of birds were breeding we estimate a total population of 415 pairs. The average density of such sightings was 0.57 'pairs'/km^2, and in suitable habitat this was 2.13 'pairs'/km^2. Up to 7 'pairs' were recorded in any one-kilometre square.

The history of the bird in the region is interesting. That it bred on the moors in various counties was noted in the avifaunas of Allis (1844), Mitchell (1884), Whitlock (1893), Coward (1910), McAldowie (1893), Smith (1930-38) and Smith (1974), but the authors present a confusing picture of the status of the species in the region. Coward (1910) refers to it as a common resident breeding plentifully on the eastern moors of Cheshire in Longdendale and on all grouse moors of the Derbyshire border. Allis (1844) found it abundant on the moors around Halifax. Mitchell (1884) thought it numerous but noted declines in number on Pendle and near Colne and Blackburn, and Smith (1930-38) noted a 'few pairs nest sparingly on the Roaches and Axe Edge districts and on the Warslow moors. Harrison *et al.* (1982) suggest that 'a few pairs breed amongst the heather of the northern moors' (in Staffs.). Both Hedley-Bell (1962) and Frost (1978) commented on a paucity of twentieth century breeding records. Had there been a decline in numbers during this century? Certainly twite had vanished from their lowland breeding haunts including Chat Moss, Lancashire, Carrington Moss in Cheshire and parts of the Derbyshire lowlands but then these areas had been greatly changed by agriculture. Twite are difficult to detect and obtaining proof of breeding for these elusive birds is very difficult. As there are no figures or estimates of the size of the population, it is impossible to be precise about any chnges in numbers. However, further consideration of this question is given in the Discussion section on long-term change.

The S.Pennines appear to hold the majority of the breeding twite population to the south of the Forth and Clyde canal, and it may have recently increased in that area whist decreasing elsewhere in

Figure 25. Distribution of breeding pairs of Twite recorded in the South Pennines study area 1990




SD
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SE
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Salford
Manchester
Stockport
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0 kilometres 10
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SJ
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60

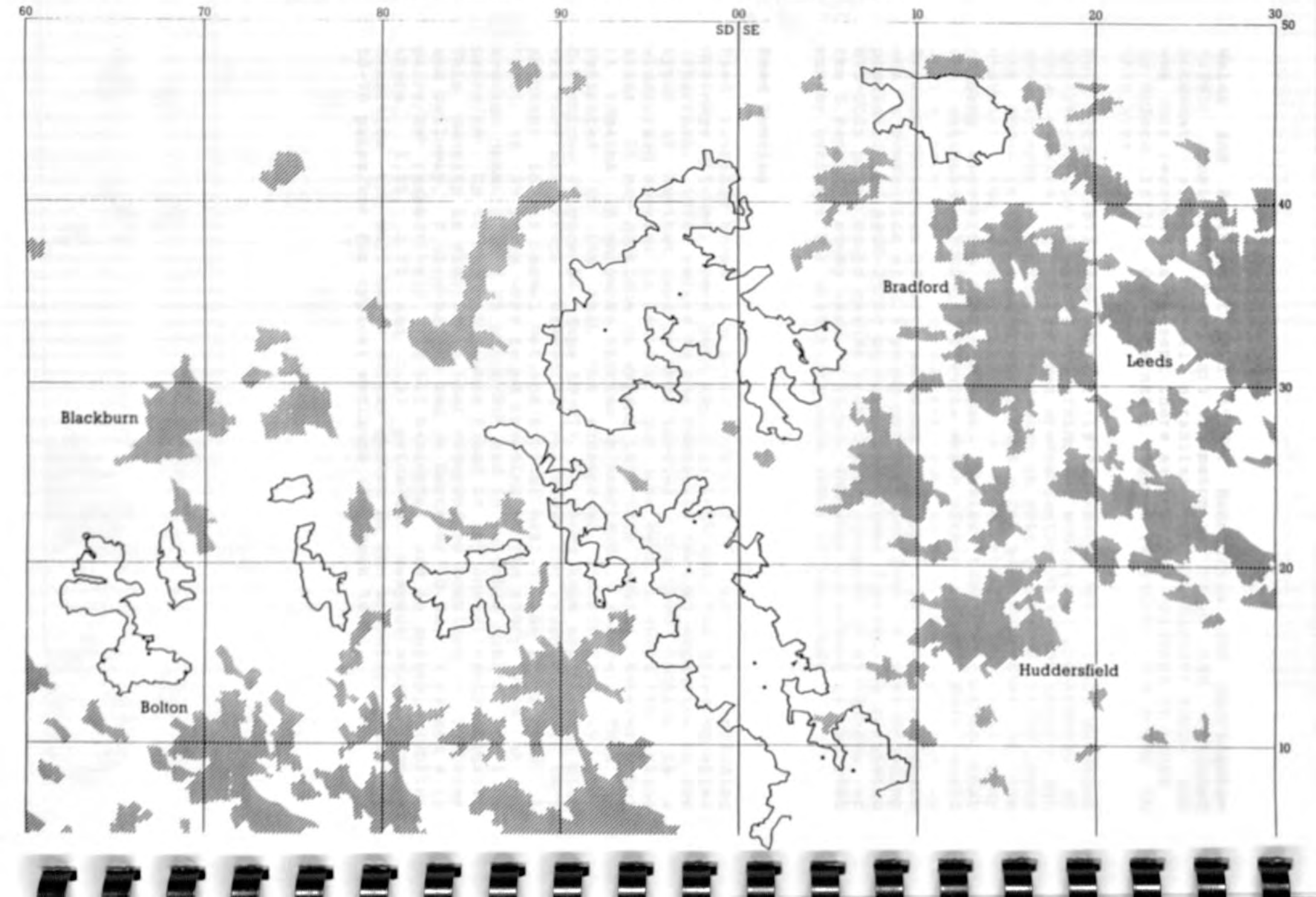
Wales and England (Orford, 1973). Hornbuckle and Herringshaw (1985) considered that this expansion of range had continued somewhat, since it was well established on the Eastern moors and was only recorded as present there as isolated colonies or pairs by Orford (1973). Our data still suggest relatively few birds in this area.

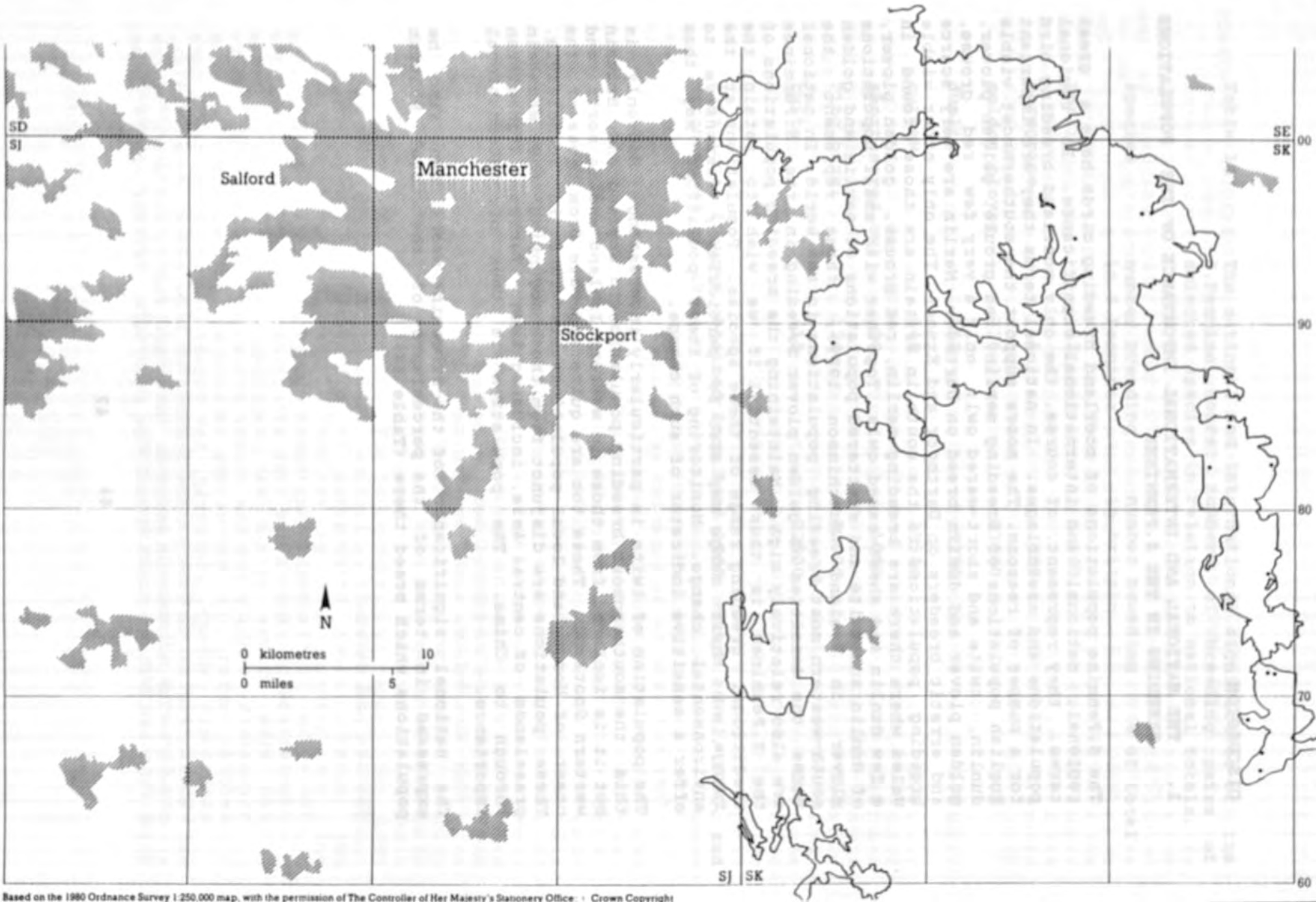
Both Orford (1973) and Nuttall (1972) provide what little detailed information is available concerning the ecological preferences of this species. The birds feed predominantly on upland pature but usually nest in heather or tussocks on acid grassland. Birds leave the moors in late autumn and though a few may overwinter in the district, the majority appear to move south-east, with many ringing recoveries from the Wash. Davies (1988) calculates that the estimated 7000-17000 twite which winter on the Wash could derive from the 75 10 km-squares found to hold breeding twite in England (Sharrock 1976), assuming 25-75 pairs per occupied square and a production of 2.5 young per pair per year (a post-breeding population of 8400-25300 birds). Using these figures, an estimated 675-2025 pairs would derive from the 27 occupied 10 km-squares of the S.Pennines study area, a figure somewhat in excess of the 1990 survey estimate but within the same order of magnitude.

Reed bunting

Reed buntings breed in a great diversity of habitats, including drainage ditches, reed beds and hill farmland. The breeding atlas (Sharrock, 1976) refers to the twentieth century expansion in the types of habitat used by this species. The reed bunting is a widespread species in Britain, but does seem to avoid the upland areas. It may continue to expand into this habitat, however, but it remains an uncommon species on moorland in general. This is reflected in its thin but widespread distribution in the S.Pennines (Figure 26, Maps 50-57). It shows some association with the moorland fringe, reservoirs, roadsides and rivers. It is very abundant in its normal wetland habitat near to the study area. A total of 39 pairs were found breeding in the study area at an average density of 0.05 pairs/km^2 and in suitable habitat of 1.53 pairs/km^2. Up to two pairs were found in any one-kilometre square. This density is similar to that recorded on moorland in Dumfries and Galloway, S.Strathclyde and on Dartmoor (0.06, 0.09 and 0.15 pairs/km^2 respectively, in all habitats, and in suitable habitat there, 1.51, 2.71 and 1.33 pairs/km^2 respectively). These densities are well below values quoted in the breeding atlas of 50-70 pairs/km^2 for typical wetlands (Sharrock 1976).

Figure 26. Distribution of breeding pairs of Reed Bunting recorded in the South Pennines study area 1990





DISCUSSION

1. THE NATIONAL AND INTERNATIONAL IMPORTANCE OF THE POPULATIONS BREEDING IN THE S.PENNINES

The S.Pennine populations of moorland breeding birds have a great regional, national and international significance. In regional terms, they represent, of course, the only moorland breeding bird populations and assemblages. In national terms they are important for a number of reasons. The moors support the southernmost viable English populations of breeding merlin, red grouse, golden plover, dunlin, twite and short-eared owl: only a very few red grouse, golden plover and dunlin breed on Dartmoor. Merlin are very scarce and erratic breeders on Dartmoor and Exmoor. The only other viable breeding populations to the south in Britain are those found in Wales where there are breeding merlin, red grouse, golden plover, a few dunlin and short-eared owls. Together with small populations of dunlin and twite and scattered populations of merlin and golden plover in Ireland (Hutchinson 1989), these represent the south-western most breeding populations in the world. In national terms the densities of golden plover breeding in the S.Pennines are also relatively high. Maintaining the breeding populations of the S.Pennines is thus essential if we wish to retain the traditional breeding range of these species. Populations at the fringe of their range may also be particularly responsive to environmental change. Monitoring of these poulations may thus offer a sensitive indicator of such change.

The population of twite is particularly interesting. Not only is this the southernmost breeding population in England and Britain but it is isolated from those in western Ireland and in north and western Scotland. These too are quite separate from those of the coast of Norway and local populations elsewhere in Scandinavia. These poulations are disjunct from those occupying the mountain grasslands of central Asia, including Iran, Turkey, Afghanistan through to China. The population is thus of international importance.

The national significance of the S.Pennine moors can also be expressed in terms of the percentages of the total British populations which breed there (Table 14)

Table 14 The national and international significance of the S.Pennine Moors: numbers of breeding pairs of selected species in relation to national totals.

species	number breeding in S.Pennines	number breeding in Britain	% of total
merlin	62	600	10.3
peregrine	11	850	1.3
golden plover	736	23000	3.2
dunlin	150	9150	1.6
curlew	645	35500	1.8
short-eared owl	20	1000	2.0
ring ouzel	124	12000	1.0
twite	415	22500	1.8

* National figures obtained from Reed 1985, Mudge *et al.* 1990, and Marchant *et al.* 1990.

2. NON-BREEDING BIRDS OF EXCEPTIONAL CONSERVATION IMPORTANCE WHICH ALSO USE THE S.PENNINES MOORS.

The S.Pennine moors are, in the main, most important as the southernmost English breeding grounds of viable populations of moorland birds such as golden plover, dunlin and twite. The occurrence of these species has been discussed above but some other species of exceptional conservation importance are now absent or breed elsewhere but rely on the moors at some stage of their life cycle. These species will briefly be mentioned here.

Black grouse

McAldowie (1893) stated that this bird was 'not uncommon in moorland districts' in Staffordshire and Whitlock (1893) was sure it used to be numerous throughout the Peak-though by his time it 'could hardly be considered common in any part of Derbyshire'. As Frost (1978) points out, the black grouse is now 'dangerously close to extinction' in Derbyshire, part of a long term local and national decline. Lovenbury, Waterhouse and Yalden (1978) provide population estimates for the Peak District on a county by county basis and derive a total of 66 lekking cocks, confined to Derbyshire and Staffordshire, mainly in the latter county. By 1985 the number of lekking cocks had dropped to some 27 birds (Yalden 1986). Black grouse have declined throughout their British range and have largely beome extinct in the south and east of England. They now tend to be regarded as northern birds, despite comments that they previously outnumbered red grouse in parts of Staffordshire (Smith 1930-39 quoting earlier work). The cause of this decline and the rapid post-war crash in the Peak District population is unclear. The birds require different habitats during the year: birch *Betula* and larch *Larix* in winter and spring, moorland wet flushes in summer and drier *vaccinium*-rich moorland in autumn (Baines, 1990). It seems likely that the decline is associated with the loss of mosaics of such habitats in the uplands (see Lovenbury, Waterhouse and Yalden 1978, Picozzi 1986, Parr and Watson, 1988 and Baines 1990) . Local factors such as disturbance or shooting would attain greater importance as the populations declined.

Raptors and Ravens

There is little doubt that the S.Pennines used to hold viable populations of raptors now lost altogether as breeding birds. The red kite *Milvus milvus* was reported as common during the eighteenth century and the county avifaunas give accounts where records exist. It had become extinct by the beginning of the nineteenth century. Similarly, the buzzard *Buteo buteo*, now a rare winter visitor and very rare breeder in Derbyshire (Frost 1978), was formerly a common breeder on the crags and in the woods of the S.Pennines but was lost around the same time. Several of the older

avifaunas give details of actual or suspected breeding by golden eagles *Aquila chrysaetos* on the cliffs of the S.Pennines and ravens *Corvus corax* certainly bred throughout the area until the early nineteenth century. Ravens are now very rare vagrants to the area. There is little doubt that these birds were all exterminated by game preservers and Victorian collectors of eggs and skins. The birds all require large hunting ranges where they may still be vulnerable to persecution. Many traditional nesting crags are now the haunt of the rock-climber and hill walker and existing viable populations are quite distant. There seems little immediate prospect therefore, of the return of these former breeding species. A long-term conservation strategy for the area might wish to consider their re-instatement as a realistic goal.

Two other raptor species associated with moorlands occur regularly in the study area: the goshawk *Accipiter gentilis* and the hen harrier *Circus cyaneus*. The former now has a sizeable but greatly persecuted breeding population in the moorland fringe conifer plantations of the area. Breeding in the area was first confirmed in 1965 (Hornbuckle and Herringshaw 1985) in a population thought to be derived from escaped or deliberately released falconers birds. Many records of birds hunting the moors were obtained during the 1990 survey, and this habitat is clearly of some importance to this species for foraging. As the species is listed on Schedule 1 of the Wildlife and Countryside Act and is also nationally very rare, we include in this report data available to us on the location of nesting pairs so that measures taken to protect moorland birds in general might be extended to include this species where feasible (Map 58 and Table 25).

Whitlock (1893) beleived that the hen harrier *Circus cyaneus* 'must in former times have been a very common Derbyshire bird' and Frost (1978) reports the last nest in that county in the late 1800's. McAldowie (1893), Spencer (1973) and others all report breeding in their counties. The hen harrier was exterminated most successfully by game preserving and collecting interests and only bacame of annual occurrence in the Sheffield area again after 1963. Several of these birds, and those wanderers before them, were also killed but a pair did nest, though unsuccessfully in 1976 (Hornbuckle and Herringshaw 1985). Each year winter roosts on the east moors of Broomhead, Big Moor and East Moor hold a varying number (usually single figure) of birds and together with two roosts in the north Pennines, constitute the only roosts in the Pennines as a whole (Clarke and Watson 1990). The Derbyshire Bird report for 1989 details the numbers of birds recorded at these roosts throughout that year. A cessation of persecution could presage the re-colonisation of the S.Pennines by this species and the continued expansion of the goshawk population.

Dotterel

There is no evidence that the dotterel *Charadrius morinellus* has ever bred in the S.Pennines, but the species is well-known as a passage migrant. Whitlock (1893), McAldowie (1893) and Smith

(1930-38), amongst others, all report the bird to be regular in small numbers, and they were often shot. During the twentieth century records appear to be almost annual with small trips in scattered but apparently traditional localities such as on Pendle (outlying immediately north-west of the study area) and the Crowden and Woodhead Moors and on Houndkirk Moor. Beeley Moor in Derbyshire has recently become a regular resting place for this species in spring (Derbyshire Bird Report 1989). The birds occur in remote places for brief periods only and it is likely that more than those recorded actually visit the moors during the passage periods. The S.Pennine moors are thus of importance for foraging birds during passage. We found no dotterel in the study area but a trip of 12 was located adjacent to it on the Big End of Pendle (SD 8040) in May 1990.

3. LONG-TERM CHANGE IN THE DISTRIBUTION AND ABUNDANCE OF SELECTED MOORLAND BREEDING BIRDS IN THE S.PENNINES

Valuable as the county avifaunas are, the information contained within them is rarely quantitative and cannot usually be used to identify anything other than gross changes in distribution and numbers over time, such as the disappearance from or colonisation of the county by a breeding species.

In order to identify and assess changes with time, the results of more detailed surveys which covered one or a group of species or which were confined to particular parts of the 1990 study area have been used. Particular use has been made of the National ten-kilometre square atlas (Sharrock 1976) and local tetrad atlases for birds in the Sheffield area and Greater Manchester.

Ten breeding species have been selected for investigation: merlin, peregrine, red grouse, golden plover, dunlin, curlew, short-eared owl, wheatear, ring ouzel and twite. Seven of these can strictly be regarded as moorland birds, as in this area, few, if any breed away from the unenclosed land of the moors. Of the remaining species, curlew and wheatear breed as commonly on hill farmland in the vicinity of the moors. The precise locations of peregrine (and merlin) nests are usually known, allowing us to distinguish those nesting on the moors from those elsewhere. Other species could not be chosen because they breed in numbers in other habitats and a record of their presence within any ten-kilometre square or tetrad, for example, could refer to its breeding in that habitat rather than on the moors. Any changes detected using data for theses species might thus have little relevence to moorland breeding populations.

The approach adopted here is to compare data collected in the 1990 survey with that available from previous surveys for the ten species. Like is compared to like, as far as possible eg (presence of at least one breeding pair per 10km^2) but it must be borne in mind that widely different methods were adopted in the previous surveys and that this will have affected the likelyhood of (uncommon) species being detected.

Merlin

A total of 62 occupied merlin territories were locatedin 1990 with breeding in twenty-two 10-kilometre squares. Breeding of merlin in the Atlas survey period, 1968-1972 was confirmed in 10 squares, probable in two and 'possible' in a further 14 squares in the study area. The distribution of merlin thus appears to have changed little over the intervening period (Figure 27). Newton, Robson and Yalden (1981) carried out the first detailed study of merlin numbers in the Peak District. They obtained records for 57 former territories in the Peak, and evidence suggested that occupancy of each in any one year was high. During the 1950's the population crashed and many territories were left unoccupied in

subsequent years. As few as 4-5 were in use between 1978 and 1980. The decline was in parallel with those of the peregrine and sparrowhawk and was associated with organochlorine poisoning. Loss of heather moorland and increased disturbance were not responsible for the decline but once the numbers of pairs were so low, it is possible that human persecution through keepering and egg-collecting etc. prevented any recovery of numbers. As the area is now heavily disturbed and remote from other succesful merlin populations, the authors suggest that any recovery might be very slow indeed. Fortunately, the recovery may well have been more rapid than they envisaged, as there now exists a healthy population of merlin in the S.Pennines, with some 30 pairs located in 1990 in the Newton, Robson and Yalden study area.

Peregrine

Peregrine 'probably' bred in only a single 10-kilometre square of the 1968-1972 breeding Atlas within the 1990 study area. Breeding was 'possible' in a further square. This contrasts with the presence of breeding pairs in 1990 in eight 10-kilometre squares. such an increase is in line with the national recovery of this species in recent years, following on from the cessation of much of the pesticide usage originally responsible for their population crash. However, many more apparantly suitable nesting crags exist within the study area, and were these not so disturbed by those involved in a variety of recreational pursuits, the peregrine population of the S.Pennines might be much greater.

Red grouse

It is possible to compare the distribution of red grouse as recorded in the 1990 survey with survey data at the 10-kilometre square, tetrad and one-kilometre square levels as recorded by previous surveys in the S.Pennines. Red grouse probably or were confirmed as breeding in all the 10 km-squares overlapping with the 1990 survey area in 1968-72 (Sharrock 1976). In 1990 records of grouse were obtained in all but five of these squares; these contained very small areas of moorland (Figure 27). The distribution of grouse by tetrad in the Sheffield area appears to have changed very little in the period between the 1975-80 survey of the Sheffield area (Hornbuckle and Herringshaw 1985) and that in 1990, with breeding at least possible in 72 of the 80 tetrads in 1975-80 and in 68 in 1990 (Figure 28). Similarly in Greater Manchester: breeding was at least possible in 22 of the 37 tetrads containing moorland in 1980-83 (Holland *et al.* 1984) and in 23 in 1990. The distribution of tetrads with grouse was also very similar (Figure 29).

Between 1969 and 1972, Yalden (1972) surveyed the distribution of reg grouse in the Peak District National Park and presented his data in terms of numbers recorded per one kilometre square. These data have been converted in Table 15 to the numbers of

one-kilometre squares occupied in each of the occupied 10 km-squares and are presented with the appropriate data from the 1990 survey.

Table 15 The number of one-kilometre squares occupied within each ten-kilometre square of the 1990 study area, as recorded by Yalden (1972) and the 1990 survey.

10km-square	Number of 1km-squares occupied (Yalden 1972)	1990	X^2
SD 9000	3	3	
SJ 9090	3	5	
SJ 9070	8	5	0.52
SJ 9060	12	1	
SE 0010	1	7	
SE 0000	58	81	3.48
SE 1000	27	37	1.27
SK 0090	51	54	0.04
SK 0080	26	26	----
SK 0070	26	24	0.02
SK 0060	36	10	
SK 0050	4	2	14.02
SK 1090	91	93	0.00
SK 1080	26	25	0.00
SK 2090	41	38	0.05
SK 2080	55	42	1.49
SK 2070	11	18	
SK 2060	12	9	
SK 3070	0	0	0.00
SK 3060	6	3	
Total	497	483	0.17

There is a highly significant correlation between the two sets of data ($r=0.94$, $n=20$, $p<0.0001$) suggesting little overall change in the relative number of squares occupied in the 10km-squares over the intervening period. Chi square analysis suggests the only significant difference between the data for the two periods is in the Leek Moors area (SK 0060, $P<0.001$). However, suitable moorland in this area is very fragmented and the actual areas surveyed differ somewhat between the two surveys. A comparison at a finer level is, however, precluded since grouse counts were not made in one kilometre-squares containing less than 10% moorland. Overall, the total number of squares in which red grouse were observed is remarkably similar (no significant difference between counts, $P>0.05$). No attempt has been made here to compare values for population size. This is because the survey methods differed in the two studies, Yalden's was conducted over several years and grouse populations may show great changes in population size with time which are unrelated to any long-term change in population levels (Lawton 1990).

Golden plover

There appears to be little difference between the distribution of golden plover in 1968-72 as recorded by presence or absence in the ten-kilometre squares of the National atlas (Sharrock 1976) and that assessed in 1990 using the results of the present survey (reproduced in Figure 27). Breeding was confirmed or probable in 30 10km-squares in 1968-72 and in 27 in 1990. A contraction from the north-west and the south west of the range and expansion into the eastern part of the study area is apparant but the data are too few to allow any categorical statement concerning this (only one breeding pair is required to make the difference between absence from a 10km-square and confirmed breeding). The much finer detail in the Sheffield tetrad atlas (Hornbuckle and Herringshaw 1985), collected during 1975-80, records confirmed or probable breeding in 48 tetrads, compared to 49 in 1990 (Figure 28). The pattern of distribution shown by both maps is very similar, but again an expansion of range into the eastern moors is apparant. Further to the north, a number of tetrads containing moorland which were part of the Greater Manchester recording area were also surveyed in 1990. Breeding was confirmed or probable in 17 tetrads in both 1980-83 (Holland *et al.* 1984) and in 1990 (Figure 29). The distribution of records is also similar, with most from those tetrads with moorland to the east of Manchester.

Yalden (1974) presented a detailed survey of both the distribution and numbers of golden plover in the Peak District National Park in 1970-73. He estimated a total population of 380-400 pairs in thirteen ten-kilometre squares and 214 one-kilometre squares. In 1990 we found 456 pairs in fourteen ten-kilometre squares (none bred in one containing 2 pairs in 1970-73 and 6 and 2 pairs respectively, bred in squares containing none in 1970-73) and 242 one-kilometre squares. Yet again, these data indicate a spread into the eastern moors in the period between the two surveys. Table 16 presents Yalden's data and that from the present survey in terms of the numbers of one-kilometre squares occupied by golden plover within each ten-kilometre square of the study area. There was an extremely strong correlation between the numbers of one-kilometre squares recorded as occupied within each 10km-square as recorded by the two methods ($r=0.97$, $n=15$, $p<0.0001$). The data from the two surveys were compared by chi-square analyses for each ten-kilometre square (or group of squares where insufficient observations were made). These indicated that there were significantly different numbers of squares occupied in two areas, the Leek moors/Goyt's Moss area, and the Eastern moors area. Reference to the data suggests that there had been a decline from 33 to 18 occupied squares in the former and an increase from 12 to 36 in the latter area. However, four of the squares in which Yalden (1974) found golden plover were not surveyed in 1990. The loss in occupied squares is not then be statistically significant. In the remainder of the study area, both the number and distribution of occupied squares are remarkably similar in 1970-73 and in 1990 and no differences were statistically significant.

Table 16 The number of one-kilometre squares occupied by breeding golden plover within each ten-kilometre square of the 1990 study area, as assessed by Yalden (1974) and the 1990 survey.

10km-square	Number of 1km-squares occupied		X^2
	Yalden (1974)	This study	
SJ 9060	2	0	
SJ 9070	3	3	
SK 0060	9	3	3.84*
SK 0070	19	12	
SK 0080	10	14	0.38
SK 0090	31	33	0.07
SE 0000	53	53	
SE 0010	1	3	0.09
SK 1080	8	9	0.00
SK 1090	53	58	0.14
SE 1000	13	18	0.52
SK 2080	7	16	
SK 2090	5	13	11.02**
SK 2070	0	5	
SK 2060	0	2	

Squares pooled to give sufficient sample size are bracketed.

* $p<0.05$ for the Leek moors/Goyt's Moss area
** $p<0.001$ for the Eastern moors area.

An approximate comparison of the numbers of pairs of golden plover in each 10km-square is also possible, as Yalden (1974) plotted his data for each 1km-square as occupied either by 1, 2 or 3+ breeding pairs (for comparisons here, 3+ pairs is given the value of 3 pairs). Again there is a highly significant correlation between the numbers of pairs per 10km-square as recorded by the two surveys ($r=0.98$, $n=15$, $p<0.0001$). Chi-square analyses (Table 17) indicated that there were significant differences in the numbers recorded in two areas: Leek moors/Goyt's Moss and on the Eastern Moors. These areas held 8.7% of the total Peak District National Park population in 1990. The data suggest that numbers on the Eastern Moors have increased whilst they have declined in the Leek Moors/Goyt's Moss area. In fact, the exact overlap of the two surveys in the Leek Moors area involves only 5 one-kilometre squares, holding ten pairs in 1970-73 and six in 1990. Differences in the area surveyed resulted from the highly fragmented nature of moorland in this area; the 1990 survey did not survey small isolated patches of moorland.

Table 17 The number of pairs of golden plover breeding in each 10km-square of the 1990 study area as assessed by Yalden (1974) and the 1990 survey.

10km-square	Number of pairs recorded by		X^2
	Yalden 1974	This study	
SJ 9060	2	0	
SJ 9070	5	6	3.89*
SK 0060	18	6	
SK 0070	31	25	0.45
SK 0080	12	23	2.86
SK 0090	57	66	0.52
SE 0000	101	120	
SE 0010	3	4	1.58
SK 1080	10	13	0.17
SK 1090	94	110	1.10
SE 1000	31	31	----
SK 2080	15	27	
SK 2090	8	17	10.45**
SK 2070	0	6	
SK 2060	0	2	

Squares pooled to give sufficient sample size are bracketed.

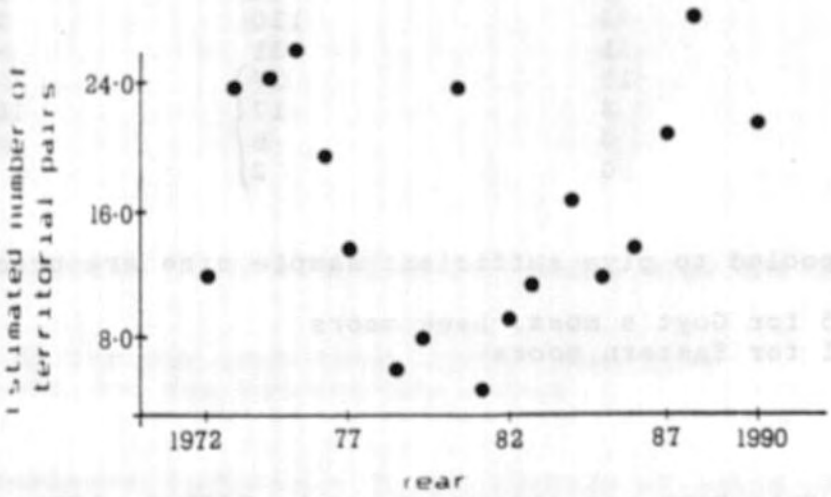
* $p<0.05$ for Goyt's moss, Leek moors
** $p<0.01$ for Eastern moors

Part of Peak Park was also surveyed by RSPB in 1981 (RSPB 1982) and they compared their data with that of Yalden's (1974) for each of six areas, A-F (Table 18).

Table 18 Numbers of pairs of golden plover recorded by Yalden (1974), RSPB (1982) and this study (1990) in six areas of the Peak District National Park.

Area	Number of pairs recorded by		
	Yalden 1974	RSPB 1982	This study 1990
A	23	42	19
B	16	12	16
C	44	52	41
D	11	17	8
E	48	20	39
F	41	16	35
Total	183	159	158

Plot 5. The estimated number of territorial golden plover pairs on the Snake summit plot studied by D.W.Yalden 1972-1990.



RSPB (1982) commented upon an apparant decline in numbers in the south of their study area and a slight increase in the north. In contrast, our data suggest some recovery, if the decline was real, and that there is little difference within the core area of the golden plover's distribution, between the numbers recorded in 1970-73 and those recorded in 1990. Further comparisons are probably not of value, as each study has employed quite different survey techniques: that of Yalden (1974) approximates to that used in 1990 but the RSPB study used 250m-wide transect counts.

Further north, the RSPB carried out a survey of some 69km² of moorland in the Forest of Trawden using 250m-wide transect counts. They recorded 69 pairs of golden plover breeding in 38 1km-squares. In contrast, the 1990 survey recorded 147 pairs breeding in 55 1km-squares in the same study area. As the methods of collecting the data differ, it is not possible to draw conclusions from such a comparison, but it may indicate a significant increase in both the range and the number of golden plover breeding in the Forest of Trawden during the last decade. Data are not available to indicate how typical or otherwise these years are for the area.

The S.Pennines is one of the very few (less than 4 ?) areas for which a continuous run of survey data is available for golden plover on a British moorland study area. Between 1972 and 1985, Yalden (1986) made counts of breeding pairs on an area of moorland on the snake summit, Derbyshire. Between 1972 and 1977 the average count was of 20 pairs but this fell to an average of 11.5 pairs between 1978 and 1985, with as few as 5 pairs occupying the study plot in 1981. The decline was associated with increased disturbance on the plot, as the Pennine way runs through the site and the area is adjacent to the summit of the main east-west running snake (A57) road, allowing free access to the moors at this point. In support of this contention, 24 pairs bred on the plot in 1980 when the moors were closed during the incubation period because of fire risk in the dry spring. Survey continued and data for the site are given in Yalden and Yalden (1991) and for 1990 by D.W.Yalden (pers. comm.). The data for the entire period are shown in plot 5, below. This confirms the decline in pairs breeding during the early 1980's but since then, a time during which disturbance has continued (and may have increased), the numbers of pairs breeding has again increased. There is no significant linear correlation between the year of survey and the number of breeding pairs of golden plover (Spearman Rank Correlation = -0.008, n=18, NS). The data suggest a fluctuating number of breeding pairs, similar to that demonstrated for greenshank by Thompson and Thompson (1988) in Sutherland. They also illustrate the problems which may be encountered in attempting to compare survey data from isolated years to look for evidence of long-term change, even when survey may have been very intensive. Finally, the data graphically illustrate the need for the establishment of a long-term monitoring scheme for upland breeding birds in aiding an understanding of population change in these species.

In summary, this review of available data suggests that there is

no evidence for a major change in either the distribution or numbers of golden plover breeding in the S.Pennines over the last 20 years. An extension of range into the Eastern Moors is, however, indicated, but the numbers of birds involved are only a fraction of those found in the S.Pennines.

Dunlin

Dunlin were recorded as breeding or probably breeding in 21 10km-squares in 1968-72 (Sharrock 1976), compared to 17 in 1990 (Figure 27); in 20 tetrads in the Sheffield area in 1975-80 (Hornbuckle and Herringshaw 1985) compared to 14 in 1990 (Figure 28) and in 7 tetrads in the Greater Manchester area in 1980-83 (Holland et al 1984) compared to 9 in 1990 (Figure 29). Given that the older information constitutes data derived from more than one season, there is little evidence for any major shift in the distribution of dunlin betweeen these surveys and that of 1990. Yalden (1974) published a map of the distribution of dunlin in the Peak District National Park and estimated the size of the population based on fieldwork conducted in 1970-73. Dunlin bred in 96 1km-squares and in a total of eleven 10km-squares. The total population was estimated at 140 pairs (though Yalden maps 158+ records). The results of the 1990 survey for the same area gives a population estimate of 88 pairs, occupying 51 1km-squares in 7 10km-squares (Table 19).

Table 19 The number of one-kilometre squares occupied by dunlin within each 10km-square of the 1990 study area as assessed by Yalden (1974) and the 1990 survey.

10km-square	Number of 1km-squares occupied		X^2
SK 0060	1	0	
SK 0070	2	0	
SK 0080	3	2	0.25
SK 0090	30	16	
SE 0000	17	29	
SE 0010	1	1	
SK 1080	1	0	
SK 1090	27	20	
SE 1000	9	3	3.82
SK 2080	4	2	
SK 2090	1	0	

Data for squares in each half of study area pooled separately to obtain sufficient sample sizes for analysis.

There was a highly significant correlation between the estimates of both surveys of the numbers of 1km-squares occupied per 10km-square ($r=0.97$, $n=11$, $p<0.0001$) but differences in the numbers of squares occupied were not significant for either the western section or the central-eastern section of the study area (data from adjacent squares pooled to achieve sufficient sample sizes). The differences in the numbers of birds breeding were significant (Table 20): the correlation between estimates for each 10km-square by each survey was highly significant ($r=0.96$, $n=11$, $p<0.0001$) but differences in numbers for the two sections of the study area were also significant. In short, fewer birds were observed in the 1990 survey and although they occupied fewer 1km-squares, these diferences in distribution were not statistically significant. It should, however, be borne in mind that the earlier data might be expected to show a greater range and higher numbers of breeding pairs, as records for breeding in several seasons are included.

Table 20 The number of pairs of dunlin breeding in each 10km-square of the 1990 study area as assessed by Yalden (1974) and the 1990 survey.

10km-square	Number of 1km-squares occupied		X^2
SK 0060	1	0	
SK 0070	3	0	
SK 0080	3	3	10.22**
SK 0090	29	12	
SE 0000	49	32	
SE 0010	1	1	
SK 1080	1	0	
SK 1090	46	35	
SE 1000	18	3	8.58**
SK 2080	6	2	
SK 2090	1	0	

Data pooled for squares within each half of the study area to obtain sufficient sample size for analysis.

** $p<0.01$ for both sections of the study area.

RSPB (1982) also present maps showing the distribution of dunlin in their Peak District study area. Numbers found in six areas are given in Table 21.

Table 21 Numbers of pairs of dunlin recorded by Yalden (1974), RSPB (1982) and the present study in six areas of the Peak District National Park.

Area	Number of pairs recorded by		
	Yalden 1974	RSPB 1982	This study 1990
A	14	18	6
B	8	0	1
C	17	16	6
D	2	2	0
E	25	9	8
F	9	3	11
Total	75	48	32

These data again suggest an apparant decline in numbers from the time of the RSPB survey.

The 1982 RSPB survey in the Forest of Trawden located 6 pairs of dunlin. Other birds, for which no proof of breeding was obtained were located in 14 1km-squares. This contrasts with the 1990 survey finding of 18 pairs in 11 1km-squares.

Dunlin are extremely cryptic waders during the breeding season and differences in the methods employed between these surveys, together with differences in the timing of visits, means that any apparant changes in both distribution and abundance should be treated with extreme caution.

Curlew

Curlew were confirmed as breeding or breeding was thought probable in all 10km-squares of the study area during surveys for the National atlas (Sharrock 1976). In 1990 breeding was confirmed on moors in all but one of these squares (this square contained only about one third of a square kilometre of moorland). The distributions are mapped in Figure 27. Finer resolution distributional information for the Sheffield area and the Greater Manchester area shows curlew probably or definately breeding in 64 and 17 tetrads respectively, compared to 41 and 23 in 1990 (Figures 28 and 29). It is difficult to assess a species such as curlew, since the earlier surveys recorded curlew breeding in any habitat, whereas we confined our survey to the moors. The patterns, however, suggest no marked change in the distribution of

curlew in the area. The 1990 survey confirmed breeding in many tetrads in Greater Manchester where this was thought only possible in 1980-83. RSPB (1982) recorded only five pairs breeding in their Peak District study area in 1981 (though others were present for which they did not obtain proof of breeding), compared to 26 in 1990.

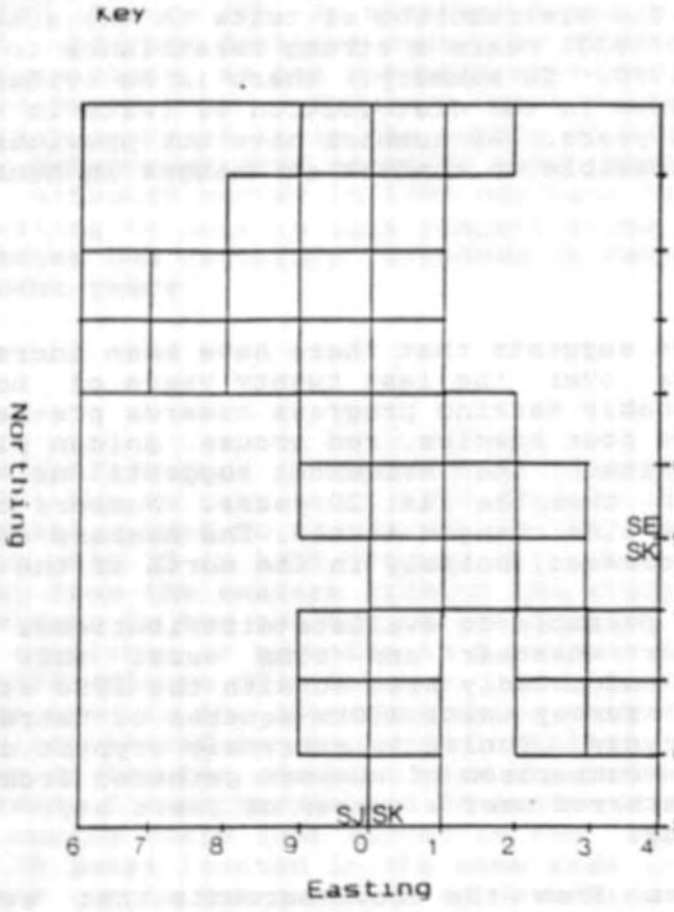
A remarkable increase in numbers appears to have taken place in the Forest of Trawden. In 1982 RSPB (1982) recorded 27 pairs in 61 one-kilometre squares. A further 42 birds were classed as possible breeders only (presence in suitable habitat). The 1990 survey recorded 135 breeding pairs in 72 one-kilometre squares in the same area. It seems unlikely that such a huge difference in apparant status is due to differences in survey methods, but it is possible that 1982 was a poor season, whilst that of 1990 was atypically good for breeding curlew numbers. These findings suggest that the increases noted by the county avifaunas for the present century are continuing.

Short-eared owl

Changes in the numbers and distribution of short-eared owl are very difficult to assess as the birds are very secretive and numbers (and hence distributuion on the moors) may fluctuate greatly between years. For example, 1972 appears to have been an exceptional year with up to eight pairs breeding within the area covered by the Sheffield area atlas. In the following year only three or four pairs bred in the area (Hornbuckle and Herringshaw 1985).

In 1968-72, breeding was confirmed in nine 10 kilometre-squares and 'probable' and 'possible' in a further four and seven squares respectively, compared to confirmed breeding in thirteen squares in 1990. However, it is believed that a number of pairs which actually bred were not located during the survey: for example three pairs bred on the Leek Moors but their locations are not known by us. In the Sheffield area, breeding numbers have been regularly monitored. In the tetrad atlas for that area, breeding was proven in four and probable in a further three tetrads in 1975-80. In the same area in 1990 at least twelve pairs bred, possibly indicating an increase in breeding numbers. A single pair bred in 1990 in the area coverd by the Greater Manchester breeding atlas whereas 2 pairs bred in 1980-83. Given the uncertainty over the completeness of data for 1990 and the fact that numbers breeding may exhibit cyclical change independent of any long-term trends in numbers, we draw no conclusions regarding population trends for this species.

Figure 27. The distribution of selected moorland breeding birds in the S.Pennines according to 10-km squares. Data from Sharrock (1976) on left-hand side and from the 1990 survey on the right.



● = breeding possible

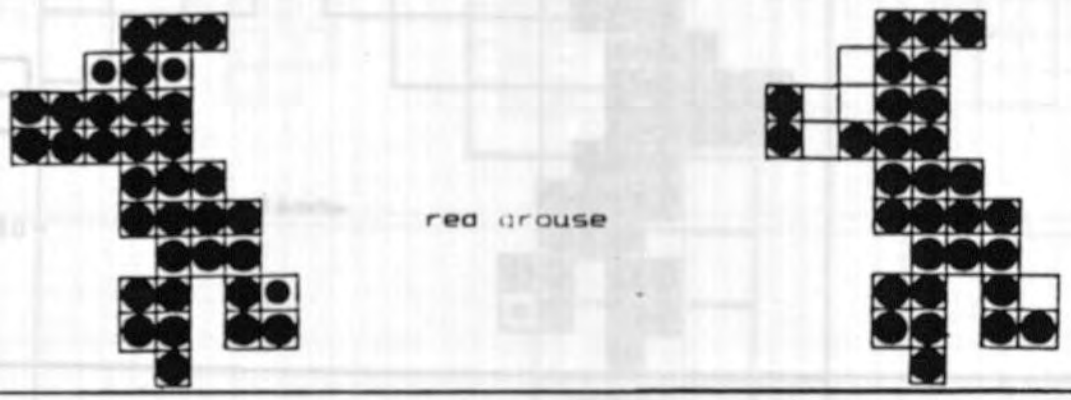
● = breeding probable

● = breeding confirmed

All 1990 data presented as confirmed breeding


merlin

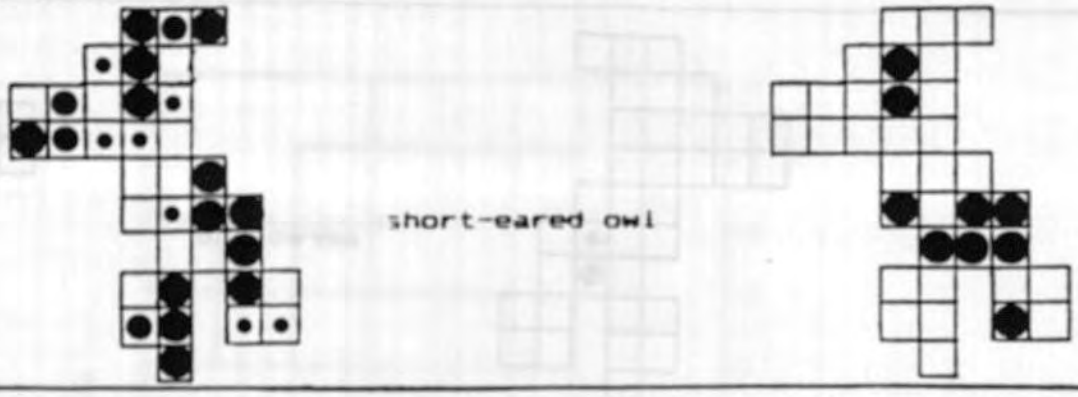

peregrine


red grouse

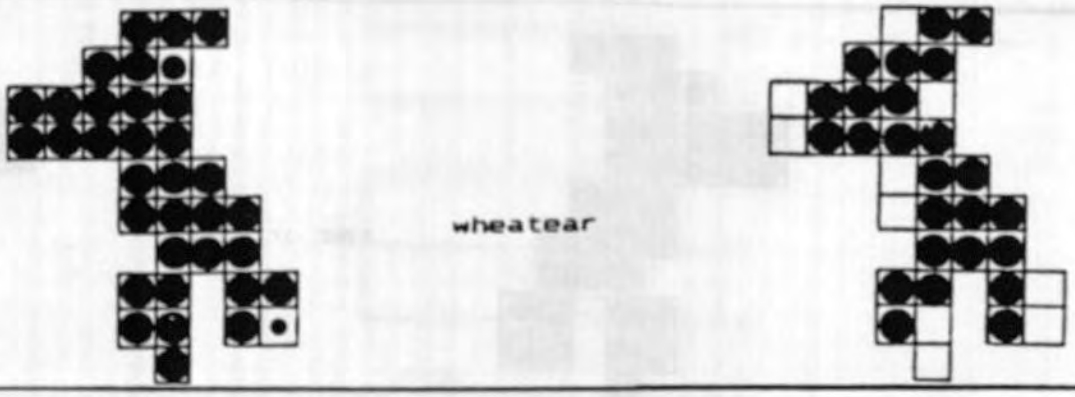

golden plover


dunlin

curlew



short-eared owl

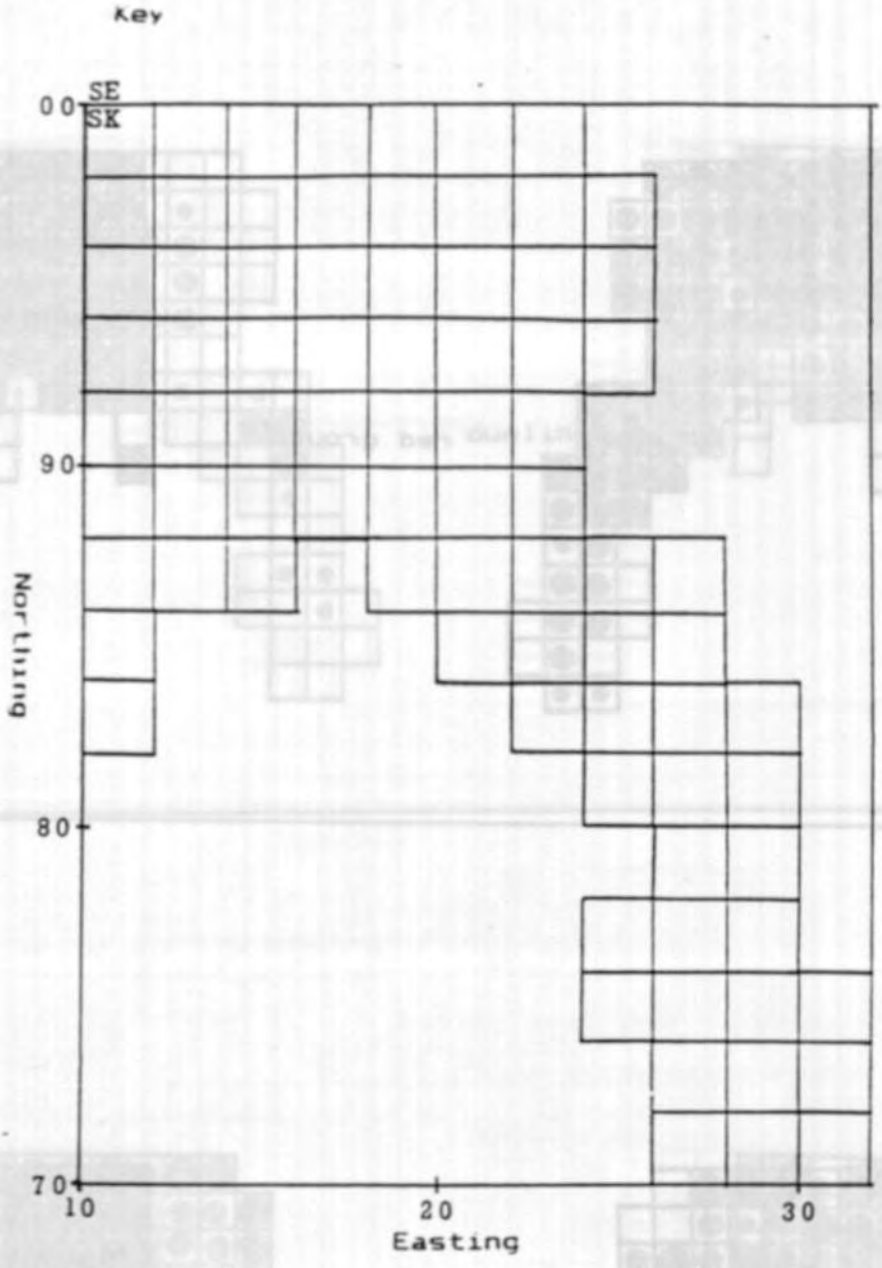


wheatear

ring ouzel

twite

Figure 28 The distribution of selected moorland breeding birds on moorland surveyed in the Sheffield area, according to tetrad. Data on left from Hornbuckle and Herringshaw (1985) and on right from the 1990 survey.

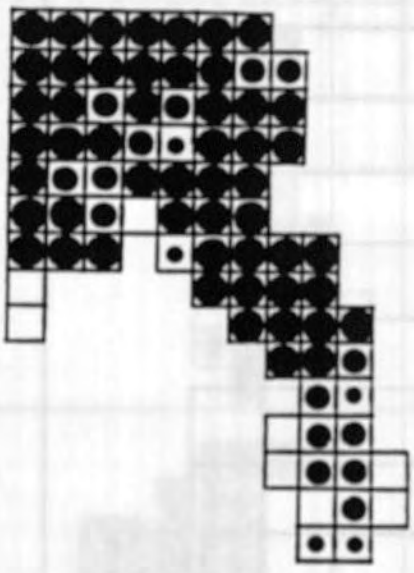


● = breeding possible

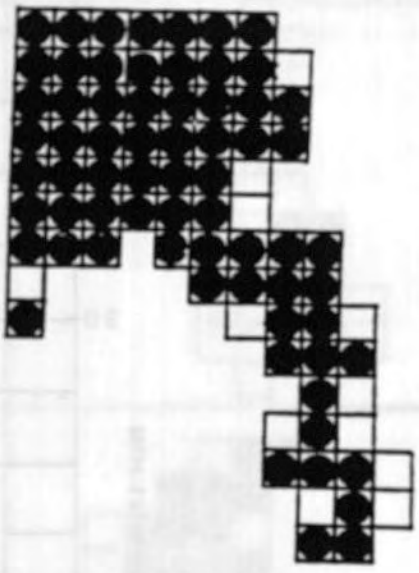
● = breeding probable

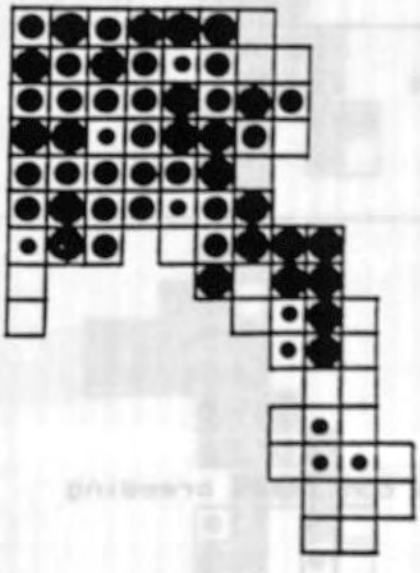
● = breeding confirmed

All 1990 data presented as confirmed breeding

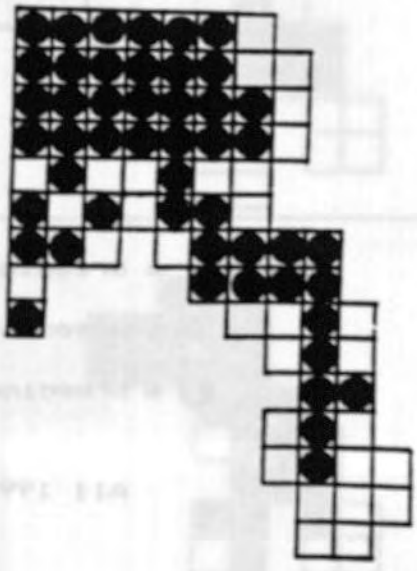


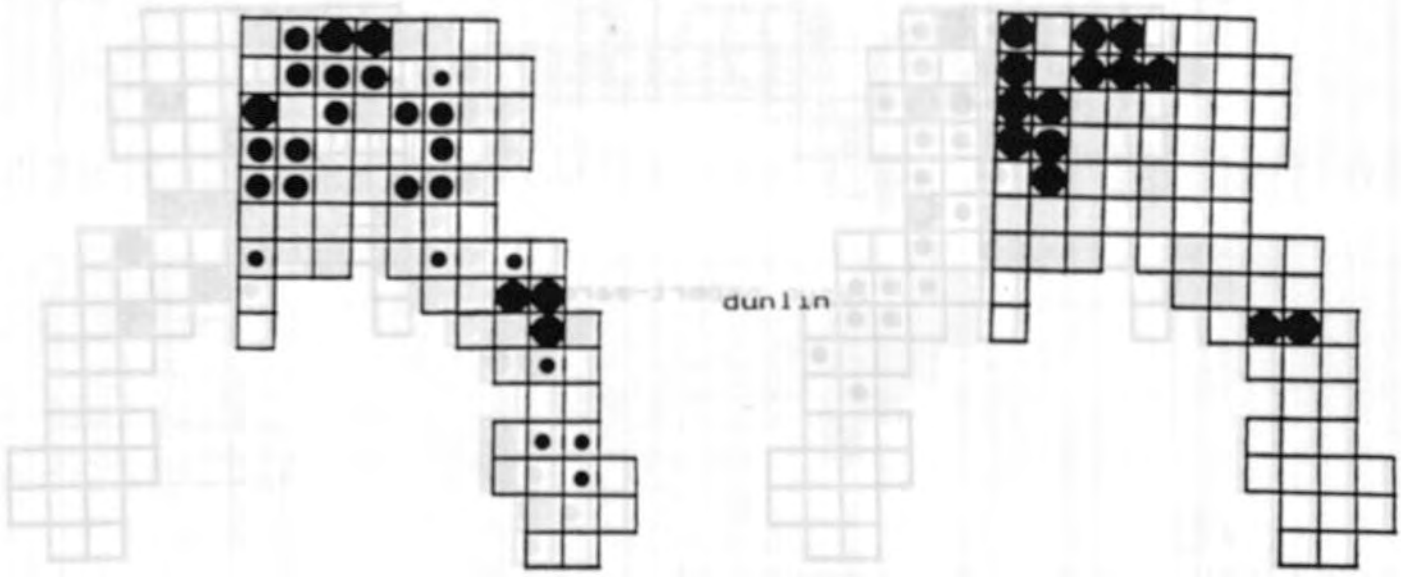
red grouse



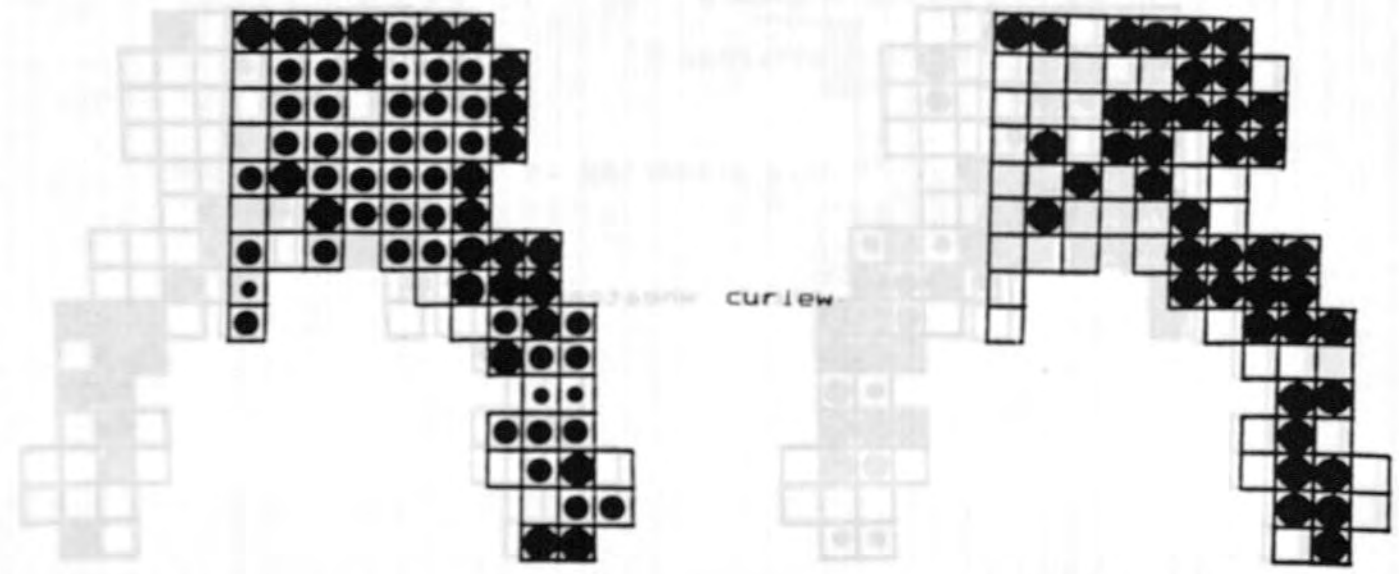


golden plover

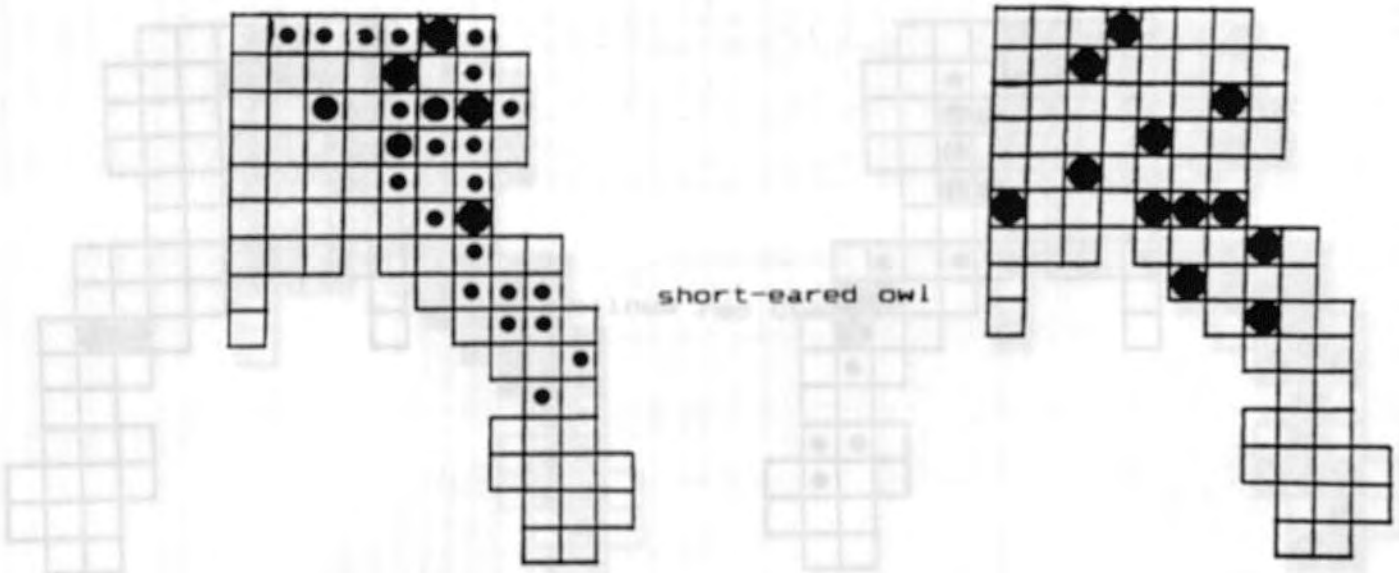




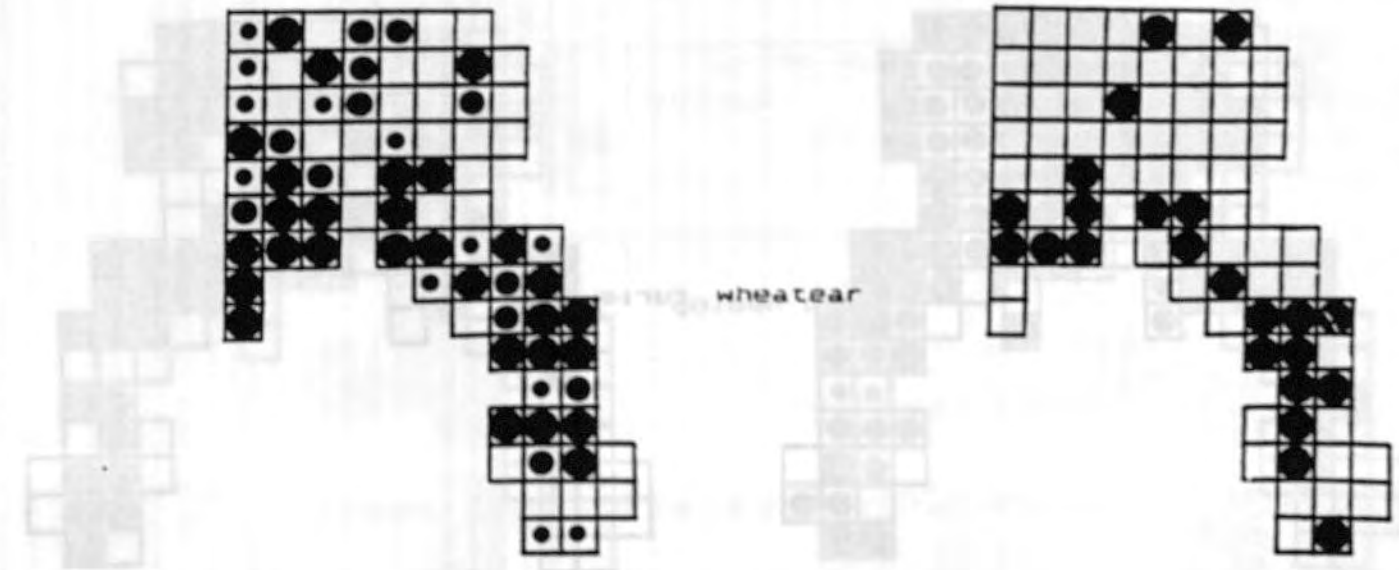
dunlin



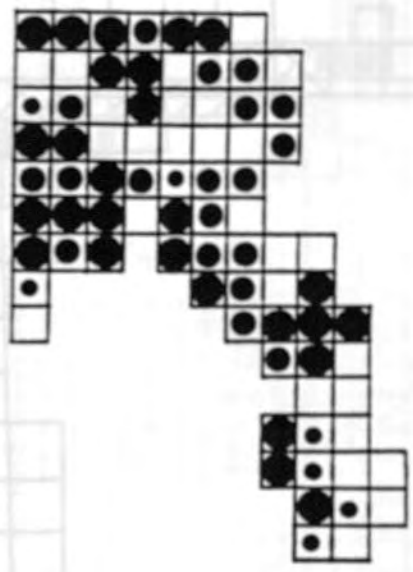
curlew



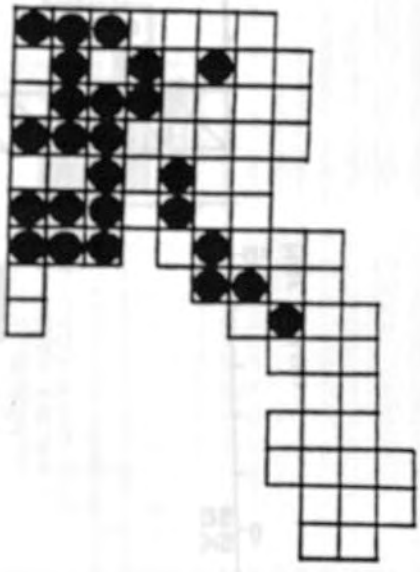
short-eared owl

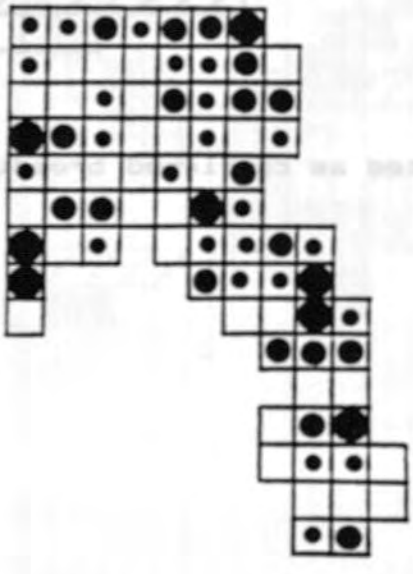


wheatear



ring ouzel





twite

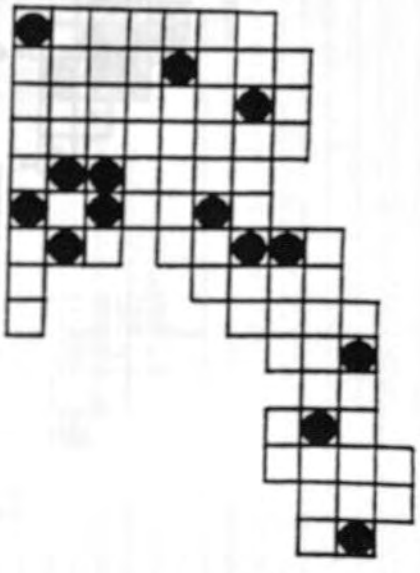
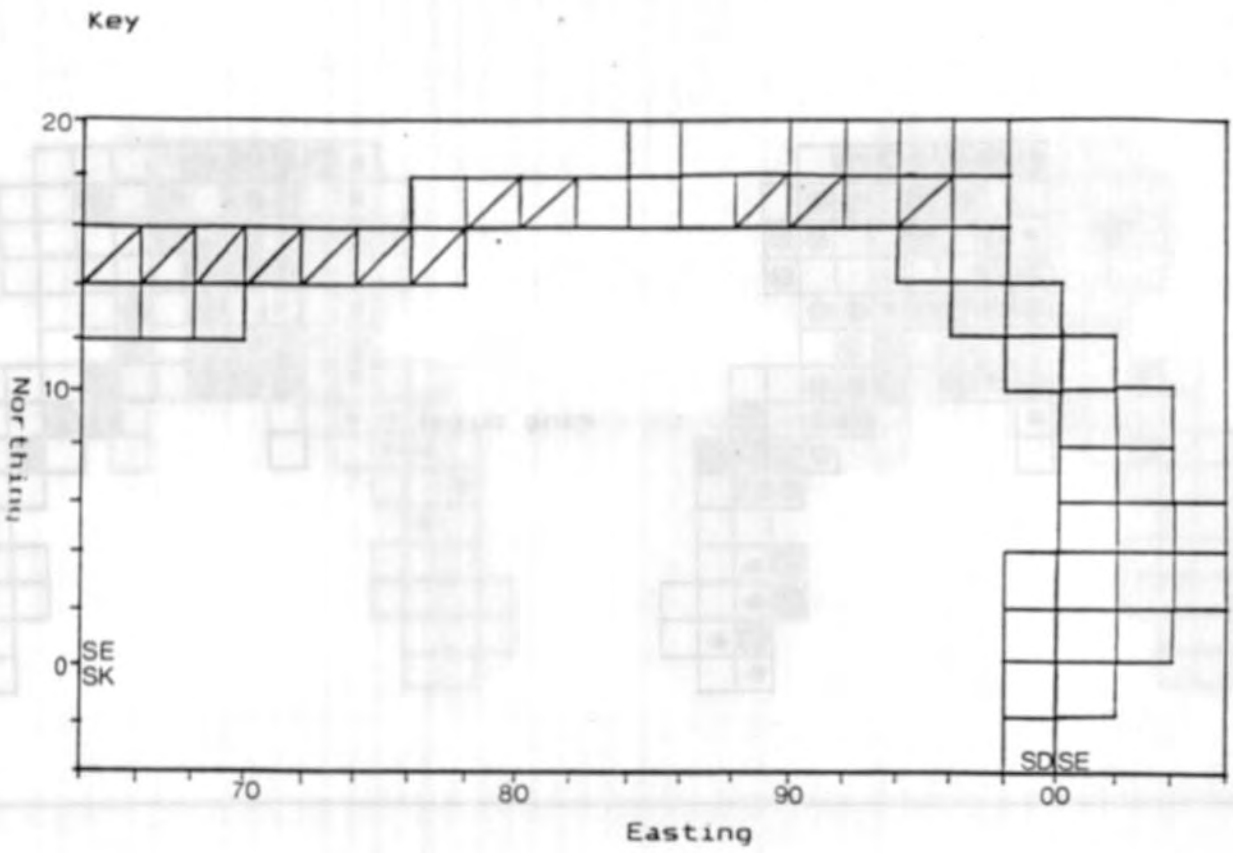


Figure 29 The distribution by tetrad of selected moorland breeding birds on moorland surveyed in Greater Manchester. Data on upper figure from Holland *et al.* 1984 and on lower from the 1990 survey.



= non-moorland tetrad

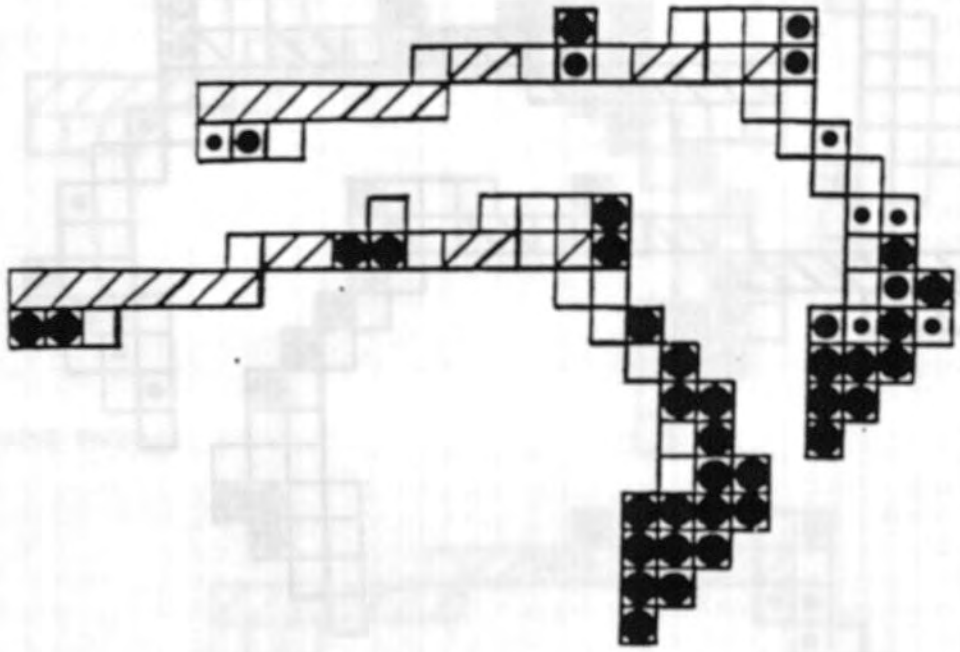
= breeding possible

= breeding probable

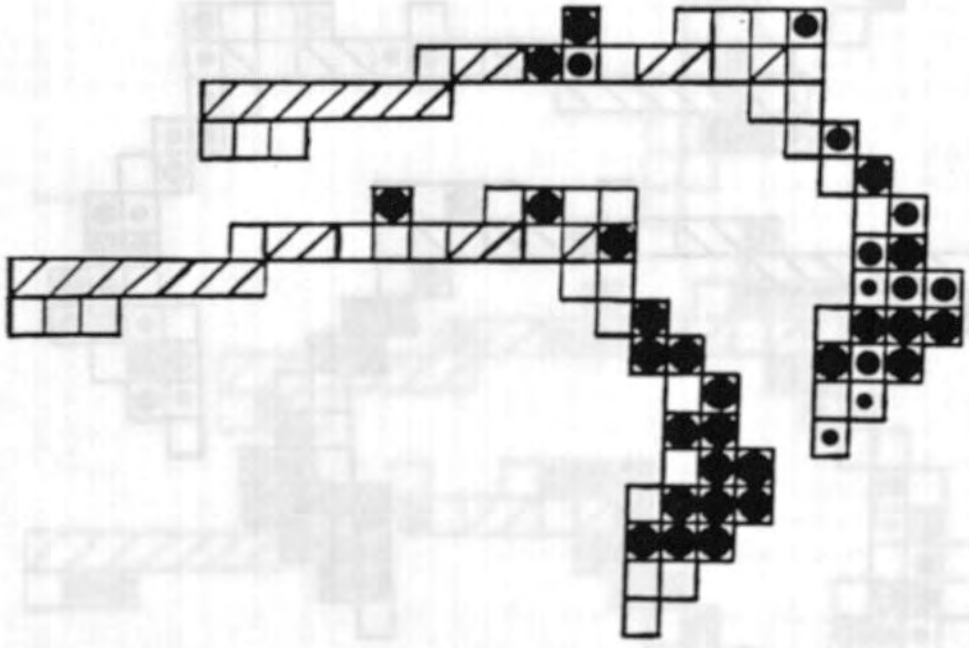
= breeding confirmed

All 1990 data presented as confirmed breeding

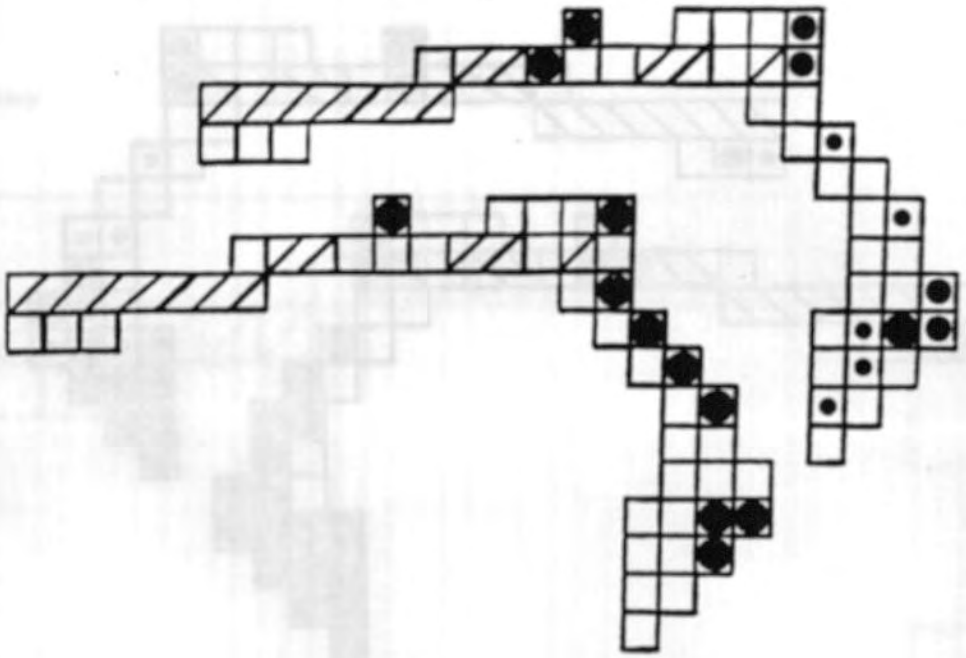
red grouse



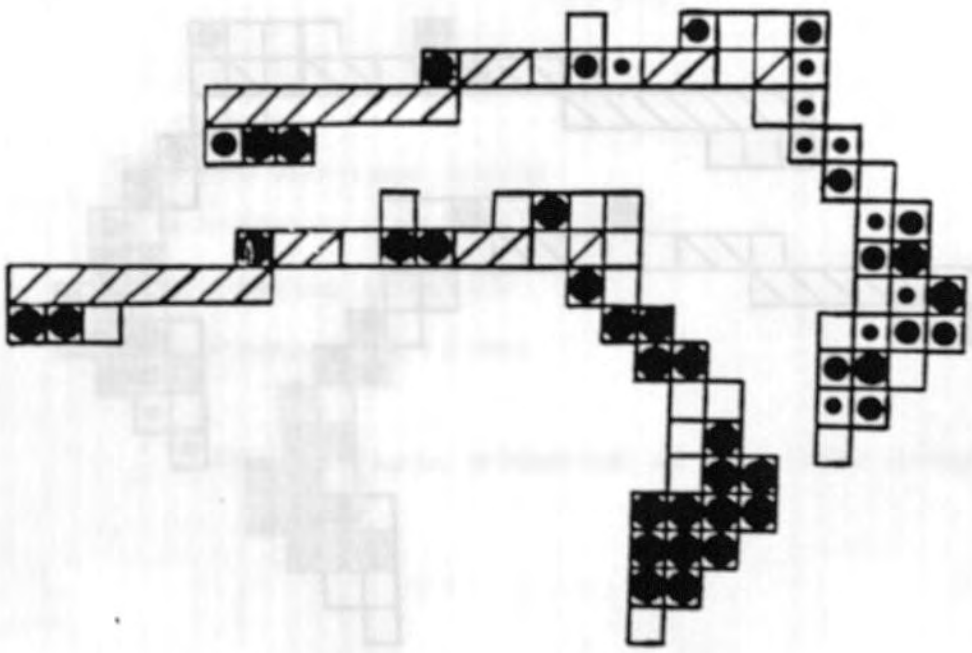
golden plover



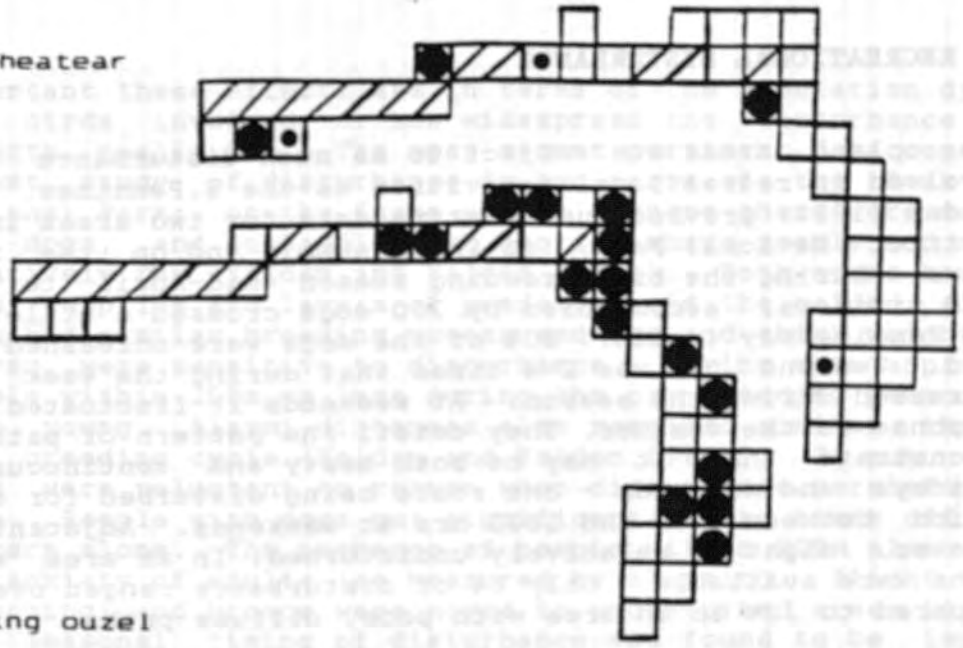
dunlin



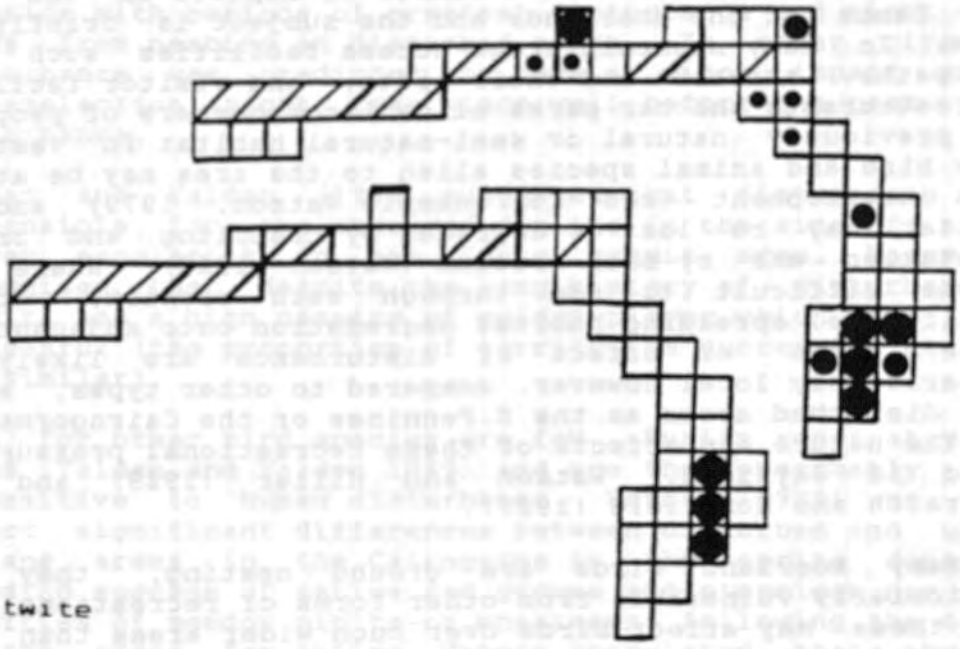
curlew



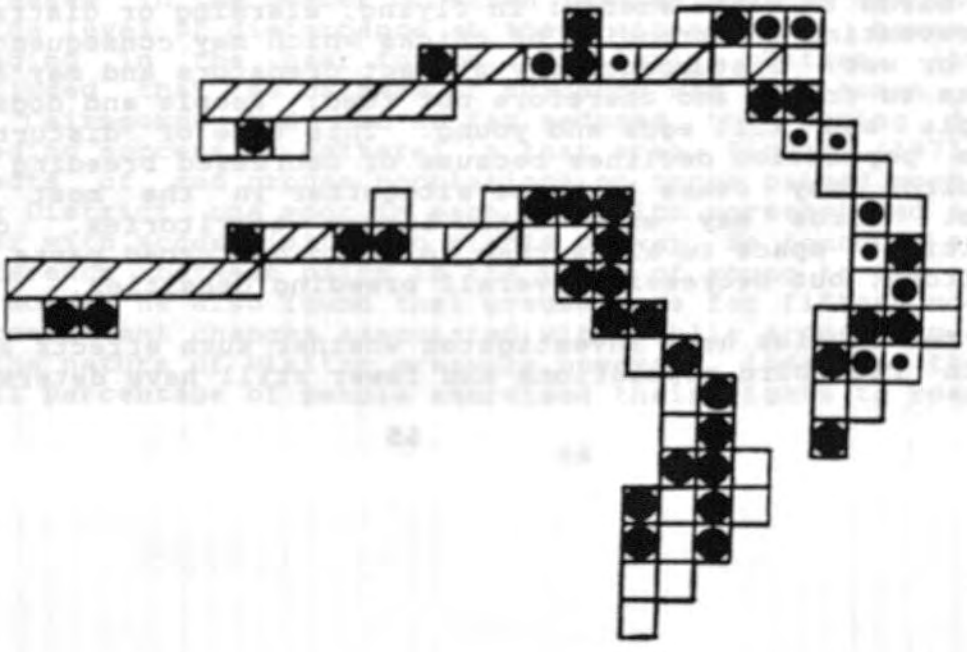
wheatear



ring ouzel



twite



4. RECREATIONAL DISTURBANCE

Few upland areas are subject to as much disturbance from those involved in recreational activities as the S.Pennines. Yalden and Yalden (1988) provide quantitative data for two areas in the Peak District National Park, at Snake summit and on the Saddleworth Moors. During the bird breeding season (mid-April to mid-July), 7800 visitors, accompanied by 300 dogs crossed a stile to or from the Pennine way (north). 60% of the dogs were unleashed and 25 ran wild. Weekend use was 2-4 times that during the week and usage increased during the season. At weekends it fluctuated greatly in response to the weather. They detail the pattern of path usage and demonstrate that it may be both heavy and continuous at peak holidays and weekends - one route being disturbed for 67% of the period between 0900 and 1800 hrs at weekends. Adjacent moorland however, might be relatively undisturbed. In an area where good paths were available, only 8% of disturbance ranged over the moor compared to 32% in an area with poor, diffuse paths.

Such visitor pressure has a number of impacts on the vegetation and fauna of the moorlands and the subject is briefly reviewed here. In many mountain areas access facilities such as roads, footpaths, ski-tows and chair lifts, and visitor facilities such as restaurants and car parks allow large numbers of people access to previously natural or semi-natural habitat in vast numbers. Many bird and animal species alien to the area may be attracted by such development (see for example Watson, 1979) and valuable habitat may be lost or degraded by trampling and bruising of vegetation and by soil erosion (Watson 1985). Where footpaths become difficult to use through such erosion, others may proliferate, spreading habitat degredation onto adjacent moorland. These types of effect of disturbance are likely to be comparitively local however, compared to other types, even within such disturbed areas as the S.Pennines or the Cairngorms. Reviews of the nature and effects of these recreational pressures can be found in Bayfield, Watson and Miller (1989) and Thompson, Galbraith and Horsfield (1987).

As many moorland birds are ground nesting, they are also particularly vulnerable from other forms of recreational pressure and these may affect birds over much wider areas than the more localised disturbance noted above. The very presence of humans can lead birds to waste energy: in flying, alarming or distraction and in preventing the brooding of chicks which may consequently become cold or wet. Disturbance may attract predators and may also cause chicks to crouch and therefore not feed. People and dogs may also trample and kill eggs and young. This type of disturbance may cause population declines because of decreased breeding success, or birds may cease to breed altogether in the most disturbed areas. Birds may also take larger territories, containing sufficient space to allow them to avoid disturbed parts of their territory, but decreasing overall breeding densities.

Very few studies have investigated whether such effects are found within real bird populations and fewer still have determined how

important these effects are in terms of the population dynamics of the birds involved or how widespread the disturbance and its effects really are. The most recent pertinent data come from a recent study of disturbance in two parts of the Peak District National Park; on the Snake summit, where there were many people and dogs, and on Saddleworth moors, where people and dogs were relatively few (Yalden and Yalden 1989a). Both areas had similar food supplies and levels of predation and the golden plovers at each had similar breeding sucess and egg and chick weights. Golden plover were sensitive to disturbance, flying when approached by people within 200m or less during the pre-breeding period and when with young. Alarmi distances also remained similar throughout the breeding cycle (Yalden and Yalden 1989b). If put off eggs, they were reluctant to return when disturbance persisted in the area. People with dogs put significantly more birds off eggs than walkers alone. The presence of people within 200m also increased the anxiety of adults (as measured by alarming, flight and chick crouching) and broods were moved to undisturbed areas if possible. The seasonal timing of disturbance was found to be important - where easter was early and the spring cold, bird nesting would coincide with periods of greatest disturbance and might discourage birds from nesting in disturbed areas. In other circumstances, disturbance was predicted to have a minor impact since nest site-selection might take place well before the peak period of disturbance.

Yalden and Yalden (1989) suggested that disturbance might be responsible for the observed decline in the size of the golden plover population in the Snake summit area. However, they recognised that despite the long history of disturbance, Snake summit has a high density of golden plover which are frequently successful (the proportion of territories successful at both sites was similar).

Data for other bird species are few. Dunlin react at very short range (Yalden and Yalden 1989) and are thus presumably relatively insensitive to human disturbance. Watson (1979) was unable to detect significant differences between disturbed and undisturbed montane areas in the Cairngorms in the spring densities and breeding success of native red grouse and ptarmigan nor in spring densities of meadow pipits or wheatears, following the development of the areas for skiing. Watson speculated that the alarming increases in the number of alien species and the continuing rise in the level of disturbance at these sites might, however, prove damaging in the near future. Similarly, Watson, (1988) also concluded that the balance of evidence was that human impact in the Cairngorms had not so far reduced the spring density or breeding success of dotterel in that area. Picozzi (1971) compared aspects of red grouse populations on three paired moors in the Peak District, one moor in each pair with unrestricted access, the other with acces limited to rights of way. He found no significant difference between pairs in the ratio of young to old grouse on the moors. He also found that grouse bags for fifteen moors showed no consistent changes associated with public access. An assessment of the nature of visitor pressure however, indicated that only a small percentage of people exercised their rights to roam from the

major paths on land where unrestricted access had been negotiated. Hudson (1982) has made similar observations on red grouse in northern England, finding no consistent relationship between perceived disturbance levels and the size of grouse bags.

Disturbance was implicated in the desertion of a small number of merlin territories in both Northumberland (Newton, Meek and Little 1978) and in the Peak District (Newton, Robson and Yalden 1981) but it, and open access, were not considered to be major factors in the decline of this species, although as the birds became less common, they apparantly avoided the more disturbed areas. The main period of decline had taken place prior to the great increase in recreational disturbance. Haworth and Fielding (1988) found that 70% of their study area in the Forest of Trawden was subject to some form of disturbance. They found, however, that recreational disturbance did not emerge from their analyses as a factor important in determining choice of breeding sites. The data obtained during the present survey also provides no evidence for a decline in the status of golden plover and other species in the Peak District National Park over a twenty year period during which the intensity and extent of recreational disturbance in the Park has increased enormously. It is certain that the merlin, at least, has increased greatly in number.

In contrast to the findings of these studies, Holland, Robson and Yalden (1982) found that common sandpiper densities were lowest along shores used intensively by anglers. They suggested that this was because these areas were preferred feeding areas for chicks until fledging. Yalden (1984) found that though the number of common sandpipers breeding in the Derwent valley had remained stable between 1979 and 1982, changes in the siting of territories could be related to changes in the pattern of human disturbance in the same period. Watson *et al.* (1988) report a dramatic decline between the 1930's and the present, of the numbers and species diversity of waders breeding around Loch Morlich in Speyside. They attribute the declines to the large increase in recreational disturbance at the site in the same period. In the Forest of Trawden, Haworth and Thompson (1990) found that whilst moorland breeding waders (golden plover, dunlin, redshank and curlew) all avoided areas of high potential disturbance, the breeding distribution of other species including merlin, short-eared owl, ring ouzel and twite was not related to the level of potential disturbance.

This brief review clearly demonstrates that any effects of recreational disturbance are largely unevaluated. What evidence is available suggests it may be important in some circumstances, locations or for certain species. Although many studies find no effect, disturbance may be having an effect on some unmeasured factor. The mere persistance of birds in a disturbed area is not proof that disturbance has no impact. As the birds may be long-lived and strongly site faithful, they may continue to attempt to breed despite having a complete breeding failure each year. It may also be possible that levels of recreation have not yet reached levels above which the associated disturbance has a clearly measurable effect on bird population dynamics. There is a

suggestion from available data that disturbance associated with lakes and rivers may be particularly damaging. This may be due to disturbance being more persistant here, with anglers and sunbathers spending many hours in the same position. A comprehensive review of the subject has been recently completed (Sidaway 1990) and provides further information and comment on the subject of recreational disturbance to breeding (and other) birds.

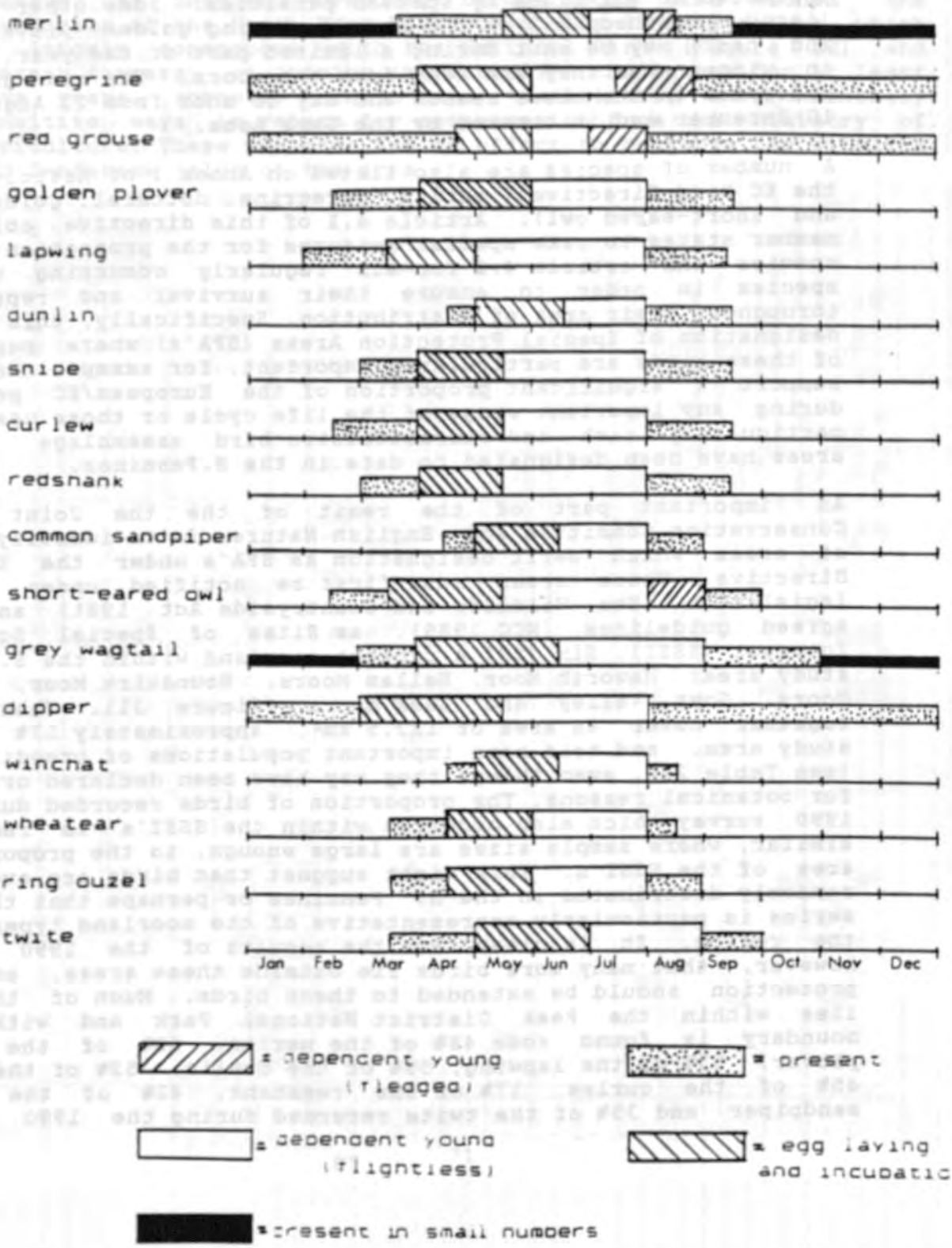
It may be the case that, in context with other factors such as overgrazing, cessation of moorland management, afforestation, burning and organo-chlorine poisoning, that recreational disturbance is likely to be only a minor factor determining population levels and success in moorland breeding birds. Similarly, recreational disturbance may continue to be a problem in a minority of moorland areas - the Pennines, Cairngorms and Cumbria in particular. These are not reasons however, to decide to take no action or precautionary measures to minimise the impact of recreational disturbance. A number of practical measures can be implemented. It seems sensible to adopt Yalden and Yalden's (1989) recommendations that dogs be kept on leads, that access points to the moors are limited and that footpaths are adequately surfaced to prevent proliferation of smaller trails where walkers attempt to avoid poor quality surfaces. Rock-climbers currently avoid certain crags used by nesting peregrines under voluntary restrictions on climbing negotiated between the British Mountaineering Council (BMC) and NCC, RSPB etc. The BMC has recently attempted to review the subject of peregrines and rock-climbing (King 1989). The population of peregrines breeding in the S.Pennines is very small and many suitable nesting sites, perhaps used intensively by climbers, exist but are unoccupied, despite a nationally large increase in numbers. It is possible that a restriction on the use of crags for climbing and other recreational activities in the early part of the season (early February to end April) might enscourage prospecting peregrines to settle and breed. A return to the traditional range and number of breeding peregrines might then be fostered if restrictions were then maintained should birds nest. Though such restrictions may be unpopular it should be possible for interested parties to identify and agree upon a series of crag sites in the S.Pennines which are to be 'set-aside' for peregrine nesting or for climbing and other recreation. Choice of sites for peregrines could be guided by information contained in Ratcliffe (1980), for example high crags remote from areas of recreation and with little current climbing activity might be selected. Restrictions could be lifted for any year when peregrines failed to settle or nest by some agreed date (eg May 1st). They should then be re-instated by February 1st, to allow prospecting birds to settle.

An extension to this idea is that of sanctuary areas. These have long being discussed and Yalden and Yalden (1989) recommended their adoption, particularly in relation to protecting areas of high golden plover density and good breeding success in years when disturbance is likely to be most severe at the critical time of year. However, for most species, sanctuary areas might be better regarded as a temporal rather than a spatial management tool. This is because most of the moorland breeding birds are only present on

the moors for a short period of time in the spring and early summer (Table 30). In general, birds arrive between early March and mid-April, depending on the species and weather, and after display, nesting and rearing of young move off the moors from early June until few are left with young by mid-July. An appropriate time scale for restrictions on open access would be between March 1st and July 1st, perhaps allowing a two week period either way for unseasonally warm or cool conditions which might advance or retard the breeding cycle. Selecting areas where such restrictions might operate is likely to be more difficult, as objections to the proposals will surely be offered from some quarters, though the Rambler's Association has aknowledged the desirability of sanctuary areas where it can be demonstrated that restrictions are necessary to safeguard bird populations. Ideally, areas with a high density of breeding birds and a high species diversity should be selected and those which are relatively less used for recreation should be selected to avoid damaging conflict between interested parties. Demonstrating an essential need for each and every sanctuary will be impossible. It will, therefore, be particularly important to monitor the impact that such restrictions have on the breeding range, number and performance of the moorland bird species in comparison to control areas with no such restrictions, if it is to be demonstrated that maintainence of restrictions is justified. A major part of the initiation of the sanctuary area process will be to educate the public, and particularly those whose recreation is disturbed, in the arguments for their creation. Holland and Yalden have produced a leaflet for distribution to anglers entitled 'Save Our Sandpipers' and its type could profitably be emulated by those wishing to conserve moorland breeding birds.

Figure 30 Chart to show periods when moors are used by selected moorland breeding species and main periods of major activities during breeding cycle.

Data obtained from Cramp and Simmons (1977-1988) and from county bird reports and refer to main periods, not extreme dates.



5. PROTECTION CURRENTLY AFFORDED TO THE BREEDING BIRDS OF THE MOORS

All wild birds, their nests and eggs are, with few exceptions, legally protected at all times (RSPB 1989). A more limited number, some of which were recorded during the 1990 survey, are listed on Schedule 1 of the Wildlife and Countryside Act 1981 (dotterel, goshawk, merlin, peregrine and litle ringed plover) and are thus protected at all times by special penalties. Some other species, listed on Schedule 2 of the Act (including golden plover, snipe and teal) may be shot during a limited part of the year, usually in winter when they are away from the moors. The red grouse is protected in the close season and may be shot from 12 August until 10 December and is covered by the Game Acts.

A number of species are also listed on Annex 1 of Article 4.1 of the EC Bird Directive (merlin, peregrine, dotterel, golden plover and short-eared owl). Article 4.1 of this directive obliges EC member states to take special measures for the protection of these species and article 4.2 for all regularly occurring migratory species in order to ensure their survival and reproduction throughout their area of distribution. Specifically, this requires designation of Special Protection Areas (SPA's) where populations of these birds are particularly important, for example those which support a significant proportion of the European/EC population during any important stage of the life cycle or those used by a particularly rich and characteristic bird assemblage. No such areas have been designated to date in the S.Pennines.

An important part of the remit of the the Joint Nature Conservation Committee and English Nature, is to identify a suite of areas which merit designation as SPA's under the EC Birds Directive. These areas must first be notified under national legislation (The Wildlife and Countryside Act 1981) and under agreed guidelines (NCC 1989), as Sites of Special Scientific Interest (SSSI). Six SSSI's protect moorland within the S.Pennines study area: Haworth Moor, Hallam Moors, Houndkirk Moor, Eastern Moors, Goyt Valley and Leek Moors (Figure 31). These moors together cover an area of 123.5 km^2, approximately 17% of the study area, and hold some important populations of breeding birds (see Table 22), even though they may have been declared originally for botanical reasons. The proportion of birds recorded during the 1990 survey which also occurred within the SSSI's is remarkably similar, where sample sizes are large enough, to the proportionate area of the SSSI's. This might suggest that birds are evenly or randomly distributed in the S. Pennines or perhaps that the SSSI series is particularly representative of the moorland types within the region. It is clear from the results of the 1990 survey, however, that many more birds lie outside these areas, and that protection should be extended to these birds. Much of the area lies within the Peak District National Park and within its boundary is found some 48% of the merlin, 62% of the golden plover, 53% of the lapwing, 59% of the dunlin, 53% of the snipe, 45% of the curlew, 17% of the redshank, 42% of the common sandpiper and 35% of the twite recorded during the 1990 survey.

The National Park was designated in 1949, the first in Britain, in order to conserve the natural beauty of this extensive tract of country and to afford opportunities for outdoor recreation. In doing this the Peak Park Joint Planning Board (PPJPB), as the Park Authority, has to balance the needs for wildlife and landscape conservation with those of the interests of forestry, agriculture, tourism and the social and economic needs of the local community. Full details of the management plan for the Park are found in the Peak District National Park Plan (PPJPB 1978). Very similar numbers of moorland breeding birds occur also within the boundaries of the North Peak Environmentally Sensitive Area which is largely contiguous with the National Park (Figure 32) and wherein farmers, on joining (voluntarily) the scheme for at least five years, agree to farm in more traditional, environmentally sensitive ways in return for compensation from the Ministry of Agriculture. These measures are an effort to conserve the wildlife and landscape value of the area.

Figure 31 Existing SSSI's within the 1990 study area.

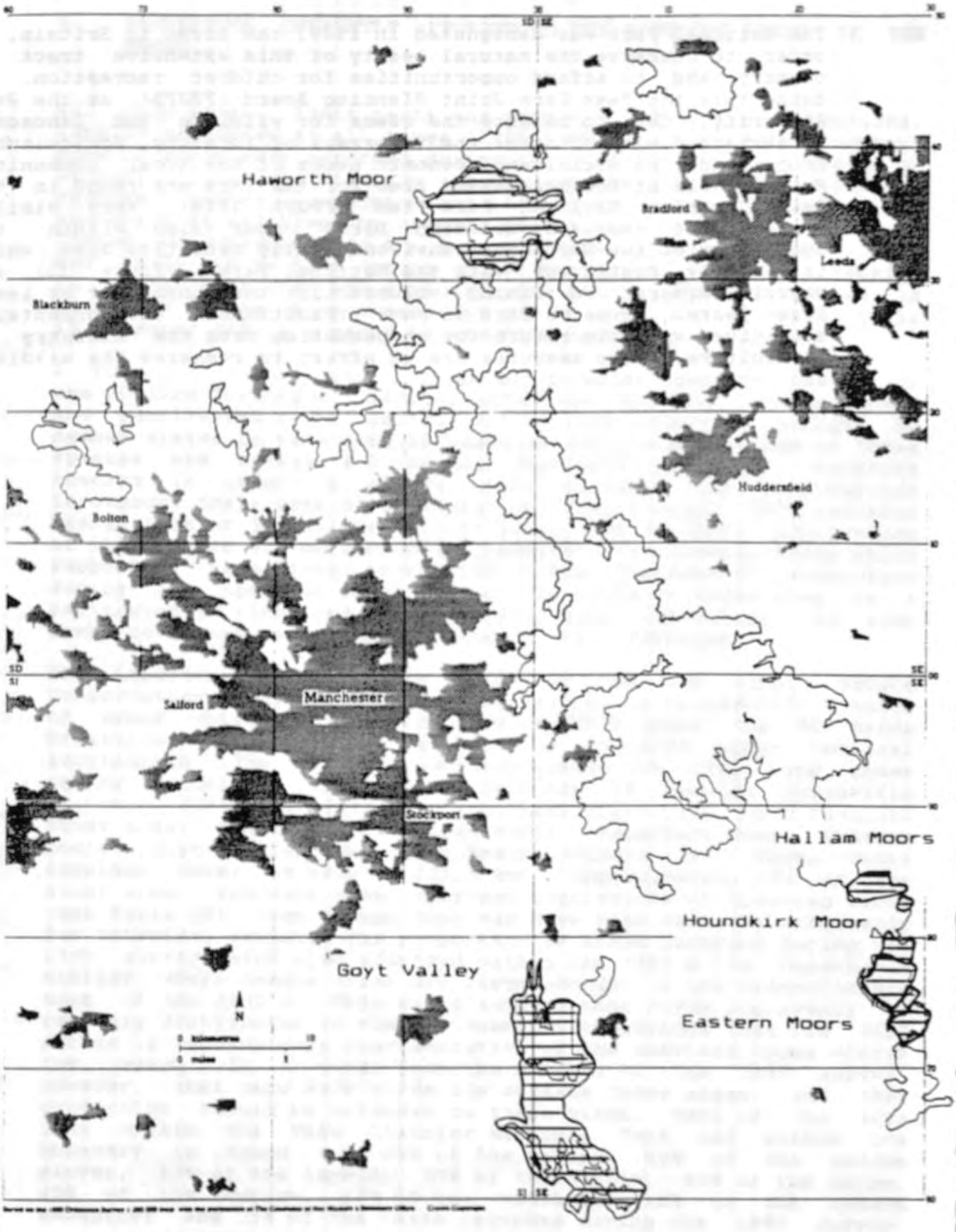
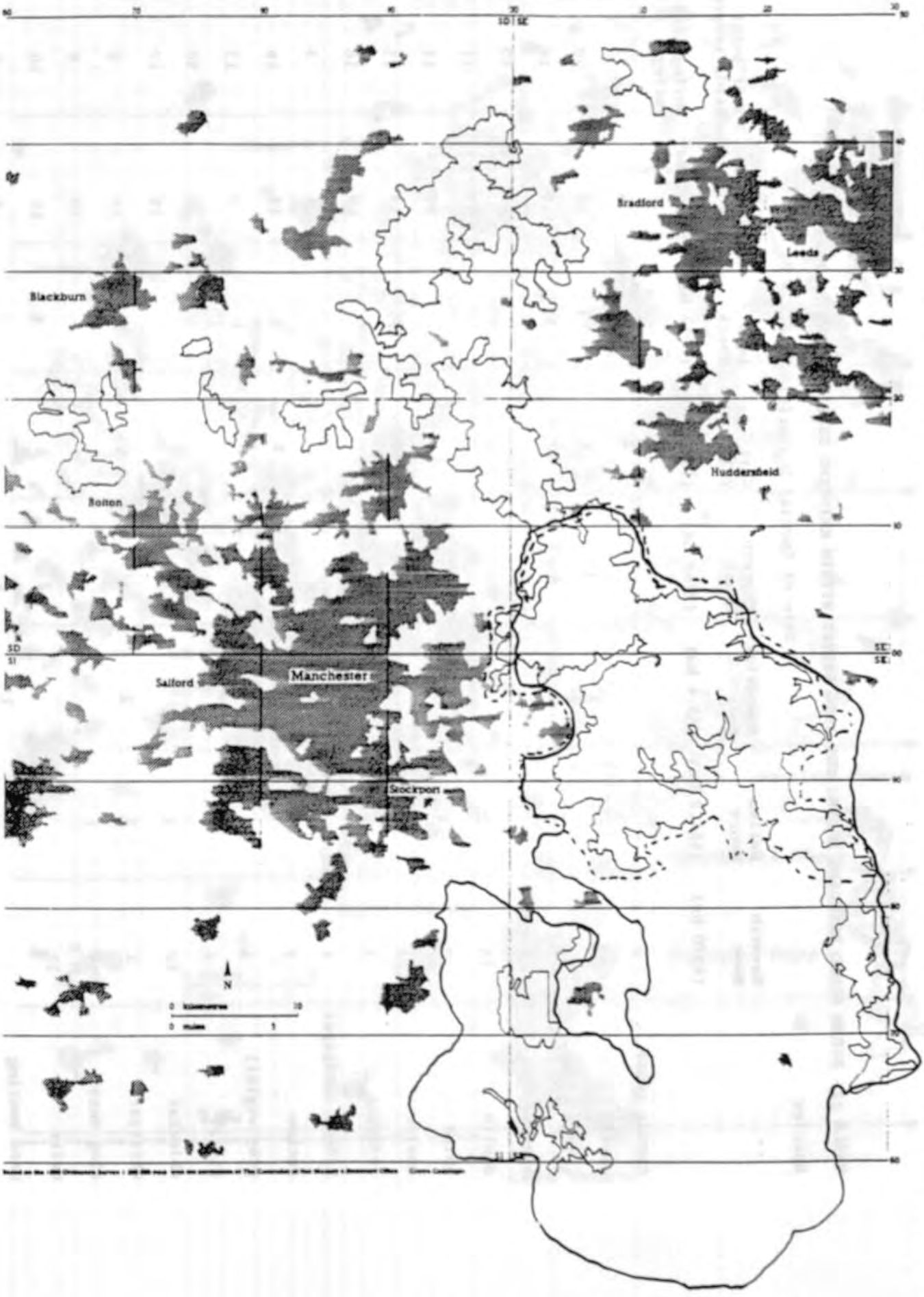


TABLE 22- BIRDS FOUND BREEDING DURING THE 1990 SURVEY WITHIN EXISTING SSSI'S IN THE S. PENNINES

Species	Site of Special Scientific Interest							
	Haworth Moor (4570 ha)	Hallam Moors (464.2 ha)	Houndkirk Moor (29.4 ha)	Eastern Moors (2166 ha)	Goyt Valley (1324 ha)	Leek Moors (3797 ha)	Total area (12350 ha)	% of total birds recorded during 1990 survey
canada goose	1			1	2		4	21
merlin	12	2	1	1	1	1	18	29
golden plover	79	1		6	12	21	119	16
lapwing	8		1	6			15	10
dunlin	15	2					17	11
snipe	8	1	1				10	11
curlew	84	3		13	16	27	143	23
redshank	7	1					8	18
common sandpiper	1						1	3
cuckoo	2			4	3	3	12	18
grey wagtail	1					1	2	13
dipper	2						2	50
whinchat	12	2		2			16	17
wheatear	1	3	2	5	1	2	14	9
ring ouzel	8	1			1		10	8
twite	30			2	2	6	40	10
reed bunting			1	1			2	5

Figure 32 The study area in relation to the Peak District National Park (solid line) and the North Peak Environmentally Sensitive Area (dashed line).



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