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Pied Wagtail Roosting and Feeding Behaviour

by D. M. Broom, W. J. A. Dick, C. E. Johnson, D. I. Sales and A. Zahavi

***In** winter, when food is often short, many of our common birds travel far from their feeding areas to spend the night in large communal roosts. Although there have been many descriptions of such roosts, it is only recently that their functions have been investigated. A study of Pied Wagtails near Reading has provided new data for this discussion.*

THERE HAS BEEN MUCH DEBATE about the functions of communal roosts, eg Wynne-Edwards 1962, Ward 1965, Murton 1971, Siegfried 1971, Zahavi 1971a, Gadgil 1972, Ward and Zahavi 1973, but there are few detailed studies of the relationship between roosts and the feeding areas that they serve. A roost of Pied Wagtails *Motacilla alba yarrellii* at the sewage purification works at Manor Farm, Reading, Berkshire, is exceptionally suitable for such a study, having up to 2,100 birds.

STUDY METHODS

The roost has been studied since October 1969. During the first four years the birds roosted on the filter-beds and the slow-moving frames of metal girders supporting the water-sprinklers. The area is floodlit at night and the birds are all clearly visible except in thick fog. They have been counted throughout each year, usually at least once a week, partly from the adjacent filter-beds and partly from a hide mounted on one of the sprinkler frames. Checks have shown that such counts have an error of less than 5%. The behaviour of birds at Manor Farm during both day and night has been observed frequently.

Birds roosting on the fringe of the main area have been caught by hand, as described by Zahavi 1971a. Others have been caught in mist-nets, but the most successful trapping method has been a clap-net set on the clinker. Over 3,000 birds were marked with a BTO and three colour rings; seven different colours were used, allowing 4,116 unique combinations. Each bird was weighed, its wing-length measured, and its state of moult recorded. A note on the criteria used for ageing and sexing Pied Wagtails is given in the Appendix.

The birds often feed up to 10 km away, so three other small roosts within this distance have also been watched during the winter; a few birds were trapped at a roost less than 3 km from Manor Farm, and the subsequent retrap and sighting histories show considerable interchange between the two. Feeding areas around Reading were visited and the proportion of colour-ringed birds was recorded. Birds were individually identified by their colour combinations whenever possible. Finally, some search was made for breeding birds, in order to ring the young and identify the adults.

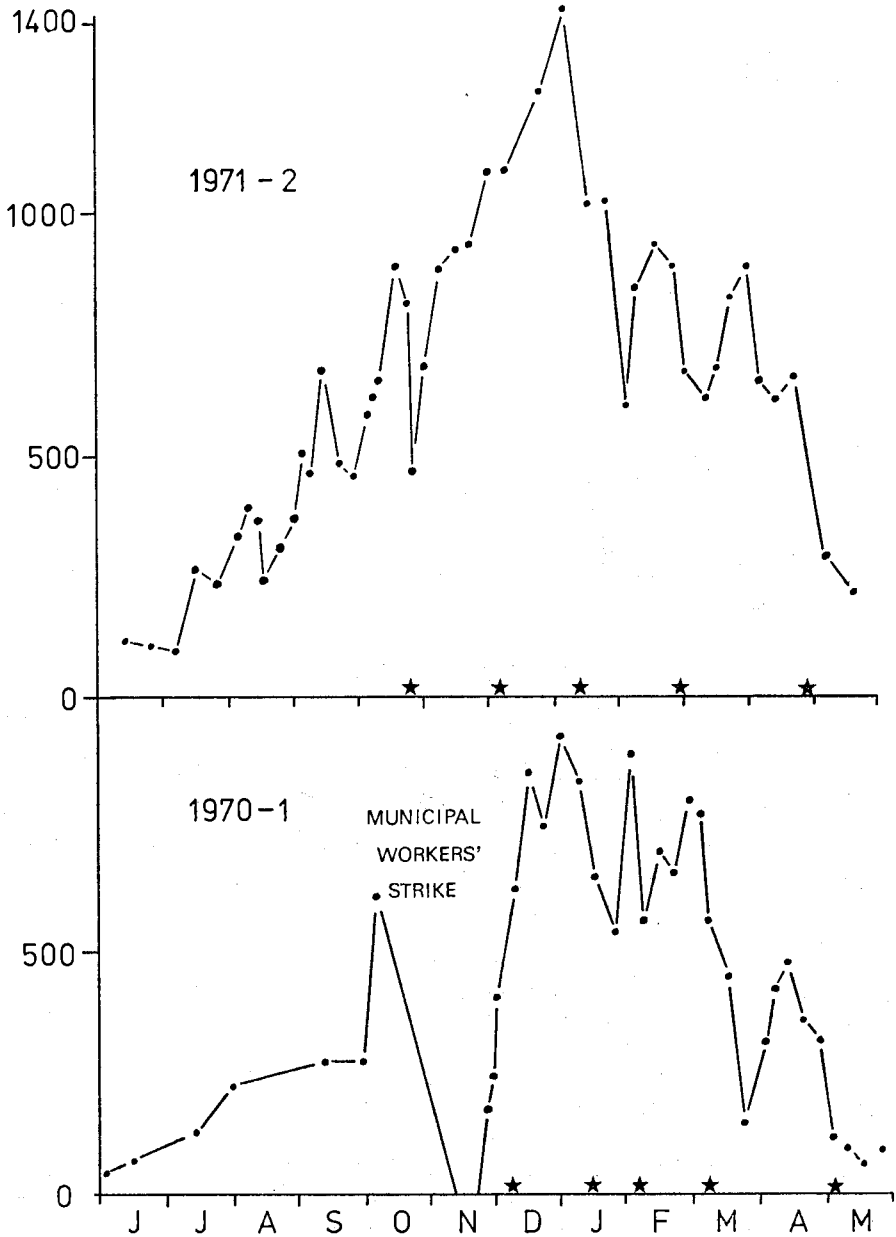

Figure 1. Counts of Pied Wagtails at the Manor Farm, Reading, roost from June 1970 to May 1972. Dates of clap-net catches are marked by asterisks along the baselines. The steep drop in November 1970 was during the municipal workers' strike, when the flood-lights were switched off.

RESULTS

Numbers at the roost

Ringing recoveries show that birds which spend the period between November–March in Reading breed either locally or north of Reading. Seven birds have been recovered more than 100 km north, including two in Scotland. This pattern agrees with that found by Davis (1966) for Pied Wagtails recovered before the end of September 1965. We also consider that there are far fewer wagtails present in the Reading area in summer than in winter. Counts of Pied Wagtails using the roost over a period of two years are shown in Figure 1. From these and other data we can outline the main events of the year at the roost.

Winter and passage visitors start to arrive at the end of September and a few Yellow Wagtails *Motacilla flava flavissima* also use the roost at this time. The main passage occurs in October. Winter numbers reach a peak in December or early January. All the birds have a partial moult during February when they acquire the black throats of the breeding plumage. Many leave in March and early April. Summering birds, together with migrant Pied Wagtails, Yellow Wagtails and small numbers of White Wagtails *Motacilla alba alba*, use the roost during April.

Most, if not all, of the birds in the roost at the beginning of the summer breed locally. Almost all females caught have had brood-patches, and two had bulging bellies as if about to lay eggs. A male which was known to be breeding about 2½ km away, and two other males which were breeding closer to Manor Farm, have been caught in the roost in May. The proportion of females caught on different occasions was very variable so the presence or absence of a particular female may be determined by the stage reached in the breeding cycle. The first juveniles appeared at the end of May. Most birds finish breeding during July and start a complete moult. Primary moult takes about 57 days, not 76 as stated by Baggott (1970), who used an inappropriate method of analysis (Haukioja 1971). Half of the population has finished moulting by mid-September, and almost all by the end of September.

Dates of clap-net catches at Manor Farm are marked on Figure 1. The period of disturbance of one hour during which the clap-net was fired and birds were extracted was sufficient to cause a drop of about 200 in the roosting number on subsequent nights, a return to the previous level taking about two weeks. A different sort of disturbance occurred at the time of the municipal workers' strike in 1970 when the floodlights, which are normally kept on all night, were switched off for six weeks. The 600 birds previously at the roost left and did not return until the lights were on again. At first most of the birds apparently used a temporary roost about 3 km west, but this was abandoned after a few weeks, perhaps because of the attentions of a Sparrowhawk *Accipiter nisus*. Many then shifted to a site 11 km northwest of Manor Farm, which they used until the strike was over.

The roost in relation to feeding areas in winter

Observations in winter on the proportions of ringed birds present at many different feeding sites up to 35 km from Reading indicate that almost all the birds

feed within 12 km of the roost. Only two have been seen more than 15 km away in a winter when they were known to be roosting at Manor Farm.

The results of our most extensive survey, shown in Figure 2, confirm this. On 22 January 1972, 43 possible feeding sites were visited by 22 observers, and the proportion of birds from Manor Farm is shown for each site where more than eight birds were seen. Of the 200 birds feeding at Manor Farm on this day, about 26% were colour-ringed. This figure agrees well with the proportions in a catch of 122 birds at the roost two weeks earlier, and is counted as 100% in Figure 2. With the exception of one at Marlow, all colour-ringed birds were within 15 km of the roost. The exception may well have changed its wintering area, as it was transported from Hampshire to Hertfordshire in January 1969, spent the following winter near Reading, but has not been recorded there since April 1970.

This survey confirmed earlier observations that some feeding sites clearly had a lower proportion of colour-ringed birds than had the roost; the population at these sites must thus have come from two or more roosts. Observations at most of the important feeding areas show that birds depart in the evening in more than one direction. This is true even at Manor Farm which is both roost and feeding site. Thus, catchment areas for the various roosts overlap, and the

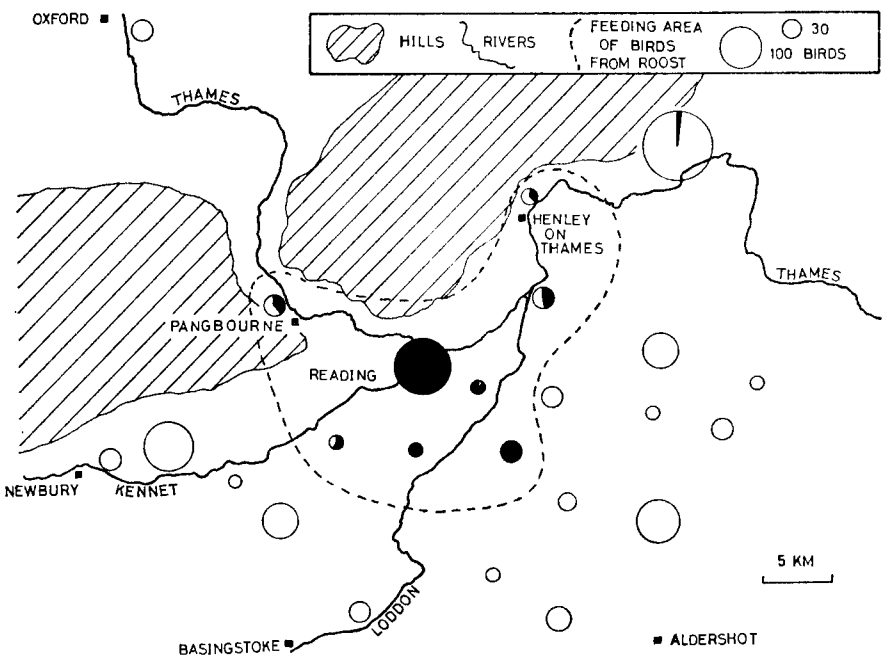

Figure 2. Counts of Pied Wagtails at feeding sites with ratio of ringed birds at roost counted as 100%. Filled segments of circles show the proportion from the roost.

amount of overlap seems to be greater than in most other species that have been studied (eg Starling *Sturnus vulgaris*, Wynne-Edwards 1929, 1931; Rook *Corvus frugilegus* and Jackdaw C. *monedula*, Burns 1957; Cattle Egret *Bubulcus ibis*, Siegfried 1971).

The boundary marked by the dotted line on Figure 2 is based partly on the data shown and partly on large numbers of other observations at many places inside and outside the boundary. Colour-ringed birds have scarcely ever been seen outside this area of about 250 sq km. Allowing for the overlap between roosts, a rough estimate of the density of wagtails feeding inside this area in January was about eight per sq km (almost certainly between four and twelve per sq km). The birds are not uniformly distributed; perhaps a third are concentrated near a few feeding sites, usually sewage farms, and for this reason it is difficult to estimate density directly.

From our rather sparse data we have no evidence that birds use more than one feeding site in one winter. Where birds have been observed in successive winters, several have shifted feeding sites. This unfaithfulness may be related to the fact that very few birds show territorial behaviour in winter, in contrast to the situation in Israel (Zahavi 1971).

Pre-roost gatherings

Pre-roost gatherings of Pied Wagtails occur near feeding areas and near roosts. They are formed in open places where the birds can be easily seen from the air and are usually also conspicuous from the ground. The gathering places at various feeding areas and at the six roosts that we have found in the Reading area have included roofs, fences, trees, roads, railway lines, and open land with little or no vegetation.

Wagtails start to gather near feeding areas as much as one and a half hours before sunset. Up to 80% of the final number using the gathering place were present 30 minutes before departure started. Some birds sit and preen while others walk around, feeding sporadically, but all remain within visual or auditory contact with the centre of the gathering. Just before departure, some birds from the gathering and some still feeding nearby make circular flights, usually of a few metres only, but sometimes of more than 50 m. The departure to the roosts is spread over an average of 25 minutes. Some in each group, departing for the roost from any pre-roost gathering, give a characteristic call; observers can distinguish this from the normal flight call and, apparently, it often results in other wagtails joining departing groups.

At least one pre-roost gathering is always formed near a roost and is usually occupied for about one hour. Almost all birds use the gathering unless the roost is visible from the air, in which case some birds fly directly to it. These gathering areas are used from year to year and are more constant in location than the roost site itself. During the municipal workers' strike in autumn 1970 the pre-roost gathering at Manor Farm was still formed, although the roost itself was not occupied; this may, however, have contained only birds feeding nearby.

No systematic study of wagtail activities during the pre-roost gatherings has been conducted, but it seems that preening is more frequent and feeding less frequent than during the rest of the day. Some birds peck at grit, others feed sporadically, but the majority just stand together as stated by Zahavi (1971a).

The average distance between birds is far greater than in the roost, but less than when they are feeding. Some display occurs, especially in spring. Calling is more frequent during gatherings but is intermittent and could rarely be termed a chorus. We have seen no aerial evolutions prior to entry into any roost, but birds roosting in reeds sometimes make what seem to be reconnaissance flights from the gathering, out over the roost and then back again. Entry into the roost is different for different roost sites. At sites in dense vegetation there is a tendency for birds to enter *en masse*, often with much calling. At Manor Farm, where the birds roost in the open, the departure into the roost takes longer, with birds leaving the gathering in groups of up to 50.

Post-roost gatherings

In winter the wagtails start to leave the roost about half-an-hour before sunrise and some spend 10-15 minutes at a post-roost gathering before departing to their feeding areas. One such gathering, on a factory roof about 50 m from the roost, was watched during five mornings in February 1972. There were up to 160 birds present, a mean of 13% of the totals at the roost. Arrival started in semi-darkness and occurred later in overcast conditions. The peak arrival time coincided with the first departures. As is shown in Table I, the median time between peak arrival and peak departure was 12 minutes.

TABLE I. ARRIVALS AND DEPARTURES AT POST-ROOST GATHERING OF PIED WAGTAILS

Date	*Dawn*	*Mdn. arrival time (A)*	*Time of last arrival*	*Mdn. departure time (D)*	*Time of first departure*	*D -A (mins)*	*Estimated total time occupied (mins)*
4 Feb 1972	0736	0725	0737	0737	0727	12	45
7	0731	0716	0737	0732	0716	16	50
9	0727	0703	0726	0718	0709	15	45
11	0724	0714	0721	0722	0710	8	40
15	0717	0710	0718	0719	0710	9	40

NOTE: Times are in hours GMT.

Most birds sat in rows on top of the glass windows in the roof, often close to warm ventilator shafts. They preened frequently, especially from five to ten minutes before median departure time. Differences in the proportion preening at different times were highly significant (χ^2 test: $P<0.001$).

There were two clear differences between the behaviour of birds arriving at the post-roost gathering and birds departing. First, the flock size was larger for birds departing than for birds arriving, see Figure 3 (Mann-Whitney U Test: $P<0.001$). Second, only 37% of arriving flocks called, but 97% of departing flocks called as they left the roof. Even if the comparison is limited to birds of the same party size, the departing birds still called more (Table II).

More than 200 birds arrived while it was light and were watched as they flew in. All came from the roost. The directions of departure were much more varied. About 22% flew back towards the roost, which is also an important feeding area; a few flew north towards the hills on the opposite side of the Thames valley; but most followed the direction of the valley to northwest and east-northeast, or flew towards the area between the Kennet and Loddon valleys. These departure directions and numbers correspond well with known feeding areas.

TABLE II. CALLS FROM PIED WAGTAILS ENTERING AND LEAVING POST-ROOST GATHERING.

	Percentage of flocks from which calls heard (sample size in brackets)				
Flock size	*1*	*2*	*3*	*4+*	*All flocks*
Arriving	31(29)	29(24)	44(9)	71(7)	37(69)
Departing	94(16)	91(22)	100(19)	100(58)	97(115)

Behaviour in the roost

Birds arrive in the roost in parties of up to 50 and most settle first on one of the clinker-beds. When disturbed by the moving sprinklers they may move along in front of the sprinklers or may settle on the supporting girders. A few fly over or through the girders. Although there are 12 almost identical filter-beds, each about 200 m x 15 m, the birds are always concentrated in a small area. In 23 out of 30 counts, more than 90% were contained within a moving rectangle measuring 40 m x 15 m. This tendency to occupy a small area is even more marked if the distributors are not moving when the birds arrive. Almost all the birds then settle in a roughly circular area, up to 15 m in diameter, on the clinker-bed.

On the distributors, birds often fight for position, particularly for the more sheltered sites. Some fly straight to these positions on arrival and may occupy exactly the same position for several nights in succession. This tendency has been noted in the Starling (Wynne-Edwards 1962) but few wagtails show it as most prefer a roost position close to other birds to one where they are sheltered but farther from other birds. One was seen defending a sheltered position while most birds landed on the clinker-bed some distance away. A succession of birds

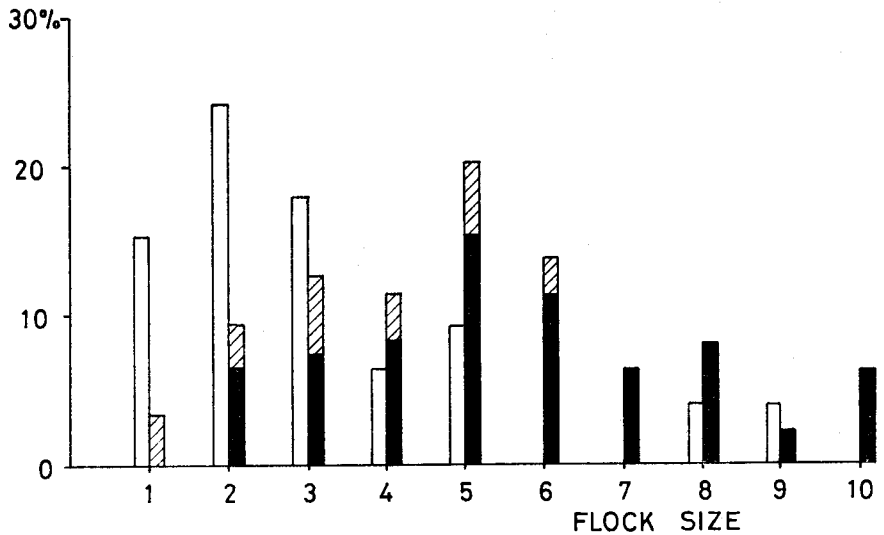

Figure 3. Distribution of flock size for birds arriving and leaving the post-roost gathering.

were repulsed by the defender, and these flew off to join the main roost. Shortly after the last had gone the conqueror left the site he had defended and joined the rest.

The distances between birds on the distributors have been measured accurately on photographs. For a total of 200 birds in March 1972, the median individual distance was 17 cm. The minimum distance was 7 cm and this did not vary whatever the number of birds or the weather conditions. Birds never clumped together, even on the coldest night, −10°C. However, this minimum distance is affected by whether or not the birds are facing each other, being least when they are beak to tail.

The effectiveness of keeping close together as an anti-predator device can be clearly demonstrated when the predator is man. As mentioned by Zahavi (1971a), small groups of sleeping wagtails can often be removed by hand from the sprinklers and girders. If more than ten are close together, it is very unlikely that any will be caught, for some birds in the row will wake and disturb the others when they fly off. This device is not fully efficient, however, since less than a fifth call when they fly off, and we have caught sleeping birds even when nearby birds were awake. If the roost was seriously disturbed after dark, the birds landed in small groups around the sewage farm. Later, when most were asleep, we were able to catch by hand a much higher proportion than normal.

There have been no obvious signs of predation. Foxes *Vulpes vulpes*, Brown Rats *Rattus norvegicus*, a Domestic Cat *Felis catus*, a Barn Owl *Tyto alba*, Kestrels *Falco tinnunculus* and Carrion Crows *Corvus corone* have all been seen at Manor Farm, but no successful predation has been observed. A Sparrowhawk has successfully taken a wagtail at a nearby roost in marsh vegetation. In summer, Kestrels and Carrion Crows have elicited mobbing responses from birds in a pre-roost gathering, but at night the only observed flight reactions have been caused by a Black-Headed Gull *Larus ridibundus* and a wind-blown polythene bag!

The roost in summer

Manor Farm is used throughout the year, so some Pied Wagtails roost communally during the summer. Although most are apparently breeding birds, some fly several kilometres to the roost. Some other roosts near Reading are not used in summer, which suggests that the catchment area of a roost varies with the time of year. Some of the breeding birds within the winter catchment do not use the roost, but there are certainly far fewer birds in the Reading area in the summer, probably about one or two pairs per sq km.

In June, when the first juveniles join, most of the birds collect in the roost area before dusk, but by the end of July, most are again using the pre-roost gathering area. In the morning, birds fly or walk out of the roost and start feeding. Both entry and departure seem to take longer than in winter. In summer the birds are usually all in by 20 minutes after sunset, and some are asleep on the distributors 15 minutes after sunrise. In winter the birds are not all in until at least 30 minutes after sunset, and all are out by sunrise. Most of the features of roosting behaviour in winter apply equally in summer, although the smaller numbers mean that there is less squabbling for preferred places on the distributors.

DISCUSSION

Comparison with other studies

There are many descriptions of communal roosts formed by *Motacilla alba.* Roosts of White Wagtails may be as large as 2,000 in winter quarters (Greaves 1941), and several roosts of over 1,000 Pied Wagtails have been observed between September and April (see references in Boswall 1966). The most frequently found sites are in emergent marsh vegetation (eg *Phragmites, Typha, Glyceria*) although sugar-cane, bushes and low trees may also be found. These are also the usual sites for Yellow Wagtails (Smith 1950). Pied Wagtails often use artificial sites on buildings, in factories or in greenhouses (Boswall 1966, Rappe 1960), often in well illuminated and noisy centres of human activity. The roost at Manor Farm is continuously illuminated but is quieter and is disturbed by fewer people. It is unusual in that some birds are disturbed by sprinklers every five or six minutes, and the other birds are in rows on the moving distributors. Also, at least 30 are killed by the distributor wheels each year. Three other roosts found near Reading are all in marsh vegetation.

Few authors have reported whether or not roosts of *Motacilla alba* have continued in use during the breeding season. Rappe (1960) reported several Belgian roosts of up to 700 *M. a. alba* in spring which were occupied until the middle of May. The Dublin roost of *M. a. yarrellii* was occupied until early July in one year (Moffat 1934), and roosts in May and June have been recorded by Meiklejohn (1937) and Hopkins (1937). Thus many of the larger roosts may be occupied in summer, as the much smaller numbers using them may mean that they are often overlooked.

There is little disturbance during the summer, so the pattern of increase shown in Figure 1 is probably typical of this roost. For the rest of the year, attempts to catch the birds have obviously influenced the numbers present. However, there are indications of influxes at migration times. The winter peak, two months after migration should have finished, is probably also real, and may be caused by birds moving from small roosts around Reading to Manor Farm during November and December. Similar changes early in the winter have been reported for several species, eg Starling by Wynne-Edwards (1962), the weaver *Quelea quelea* by Ward (1965) and Pied Wagtail by Moffat (1931). In spite of this, even at the end of the winter, not all the birds that sometimes roost at Manor Farm are to be found there on a particular night.

Post-roost gatherings have not been widely recorded, but this may be due in part to the time of their occurrence. Boswall (1966) mentions that some birds from the Dublin roost flew to adjacent buildings at dawn in ones and twos. The average party size during the main departure was 6.7. This is a similar pattern to that observed at Manor Farm where birds arrived at the post-roost gathering in ones and twos and left in larger flocks.

Ward (1965) described dispersal from the large roosts of *Quelea quelea.* A large number of birds flew off out of sight but others flew only a few hundred metres, settled on prominent trees or bushes for a while, and then flew up in groups to join waves of birds passing overhead. Ward (1972) has also described what may be analogous behaviour in sandgrouse (Pteroclidae) at watering places. The function of such gatherings is discussed below.

Functions of communal roosts

Four distinct functions have been proposed to explain communal roosts and the associated social behaviour. The two traditional reasons given are those of shelter and the need to guard against predators. Wynne-Edwards (1962) has suggested that the behaviour at pre-roost gatherings is a form of epideictic display, responses to which help the birds to avoid over-exploiting their food resources. He has also suggested a similar function for the communal roosts of bats and insects. Ward (1965) suggested that communal roosting would allow birds which had had difficulty in finding food to accompany birds which had obviously fed in a good area when they returned to it next day. Murton (1971) pointed out that this was an extension of the principle of feeding by 'local enhancement' (Hinde 1959, Armstrong 1971).

A warm roost site, sheltered from the wind, is certainly important for birds in cold weather (eg Kendeigh 1961, 1969) and, if there are few suitable sites, this could cause large numbers to roost close together. The Pied Wagtail roosts near Reading are all sheltered from the wind and are in sites that are warmer than their surroundings. However, at Manor Farm the wagtails are aggregated in a small part of the large area of clinker-beds despite, for many of them, intermittent disturbance from moving distributors. This 'clumping' is not like that of Wrens *Troglodytes troglodytes* in cold weather, as the birds are never close enough together to influence each other's environment. At a nearby roost in *Phragmites* the birds usually roosted close together, using only a small part of an apparently homogenous area. Thus, although the wagtails choose warm and sheltered sites, this alone does not provide an adequate explanation of communal roosting.

By acting as wagtail 'predators', we saw that the tendency to roost close together provided some protection for the wagtails, though the birds did not use this protection efficiently by always calling when disturbed. At sites in marsh vegetation, pre-roost gatherings are always in conspicuous places and there is a tendency for birds to enter the roost *en masse*. Thus one function of the pre-roost gathering is in helping the wagtails to roost close together. It may also provide some protection from predators while important maintenance activities such as preening are carried out. However, there is little evidence of predation pressure on the Manor Farm roost and, perhaps partly as a result, the potential anti-predator defences are inefficiently used. In spite of this the birds continue to roost communally, ignoring all other sheltered sites at Manor Farm. Thus shelter and predation alone may not provide an adequate explanation of wagtail roosting behaviour.

Support for the idea of roosts as food information centres comes from the existence of a post-roost gathering. This may provide protection from predators while preening is taking place, but there seems little reason why such maintenance activities should not take place at the roost, as indeed they do in summer. If birds that have had difficulty finding food on the previous day follow other birds to new feeding areas, one would expect departing party sizes to be larger than the arriving party sizes, as is indeed the case. However, we have yet to record a bird in more than one feeding area in the course of a particular winter, although we have recorded birds in different feeding areas in different years.

If birds in the roost can obtain information about food, the peak in numbers at the end of December, when food might become short, is to be expected, but we do not know how much food is available to wagtails at this time. This theory does not help to explain why breeding birds should continue to use the roost in early summer. Much more work remains to be done on the relation between a roost and the exploitation of food in its catchment area.

Wynne-Edwards (1962) suggests that winter dispersal in relation to food is connected with the roost by epideictic display at the post-roost gatherings. Wagtail behaviour before the roost does not seem to fit his description of such a display, as the birds sit around quietly, usually preening. Further, there may be several gatherings at a roost, each hidden from the others. This would make it more difficult for the birds to assess the numbers at the roost. Thus, if the roost is connected with dispersal for food, the information centre theory seems much more likely to be correct.

In conclusion, this study offers some support for Ward's theory of communal roost function. Given that the birds are to roost communally for such a reason, site selection and the distribution of individuals within the roost are influenced by shelter and predation factors.

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SUMMARY

A roost of Pied Wagtails *Motacilla alba yarrellii* near Reading, Berkshire, together with feeding sites and other small roosts near Reading, have been studied for five years. Up to 2,100 birds have been recorded at the main roost, Manor Farm, and coloured rings have been used so that all marked birds can be individually recognised in the field. The roost is used throughout the year. Some, probably most, of the birds present in summer breed locally.

The feeding area, which has a radius of about 12 km from the roost, has been mapped. There is some overlap of feeding areas with those for adjacent roosts. The feeding distribution in winter is clumped, and averages about eight per sq km. The density in summer is much less.

Pre-roost gatherings near feeding sites and near roosts are described. Their probable function is to help the wagtails to roost close together, thus reducing the chance of predation. A post-roost gathering near the roost is described. Its function may be to help wagtails to find food.

The functions of communal roosting for Pied Wagtails are discussed. Considerations of shelter and predation, although important, apparently do not provide an adequate explanation of the behaviour. Our observations lend some indirect support to the idea that the roost serves as an information centre.

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APPENDIX

Ageing and Sexing Pied Wagtails

Although Witherby *et al.* (1938) give an accurate description of the differences between first-year and older birds, and between males and females, Cornwallis and Smith (1960) seem to have overlooked this, and their description is misleading. Svensson (1970) seems to have followed them as he is apparently correct for ageing *M. a. alba* but not for *M. a. yarrellii*. The errors in Cornwallis and Smith were first pointed out to us by C. J. Mead.

In both subspecies, all birds except juveniles have a complete moult during July, August and September, while juveniles have a partial moult at this time. The latter therefore have feathers of two different ages in their wings in autumn, so that there is usually a contrast between the dark inner and the browner outer greater coverts or between the tertials and the secondaries. A few juveniles moult neither tertials nor greater coverts, but these can usually be identified by the rather brown and abraded appearance of the primaries, and the contrast between the dark median coverts and the brown greater coverts.

In February all birds have a partial moult which usually involves greater coverts and tertials, so the criteria above no longer apply. However, the first-winter birds tend to have much more faded, browner primaries; the contrast between typical first-year and adult primaries seems to be greater for males than for females. Retrap histories suggest that, with experience, most birds can still be correctly aged.

Sexing is based mainly on the darker mantle of males compared with females. This character varies with age and time of year, but first-winter females have at most one or two dark feathers and adult males are almost entirely black. The average wing-length

of males is about 4 mm greater than the average for females of the same age, so this character provides a valuable check on the plumage criteria.

The methods outlined above have been checked by recording moult details in late summer and February, by retrap histories, by presence or absence of a broodpatch in summer, and by observing behaviour in the field. C. J. Mead (pers. comm.) has also carried out independent checks of these methods at three greenhouse roosts in Hampshire, including the dissection of 34 Pied Wagtails that had been previously sexed on plumage characters. One observer was correct for 32 birds and another for 33 birds. This agrees well with our own checks which suggest that 5% will be sexed incorrectly on plumage characters.

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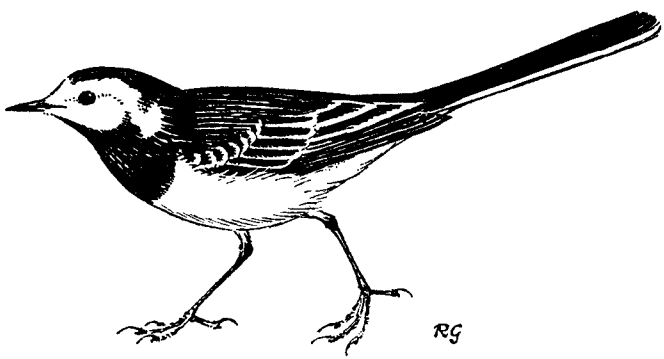

WHITETHROATS, ORGANOCHLORINES AND ARBOVIRUSES

IN ADDITION TO CLIMATIC FACTORS, poisoning with organochlorine pesticides and an arbovirus infection have been suggested as alternative explanations for the recent decline of the Whitethroat *Sylvia communis* and some other small migrants throughout much of northern Europe (Watson 1969, Berthold 1973, Winstanley *et al.* 1974). Four Whitethroats were collected under licence on their arrival in Kent in May 1974 for investigation. They were found to contain less than 0.5 ppm DDE and 0.1 ppm dieldrin, wet weight, and no viruses could be isolated while all sera failed to inhibit haemaglutination at a 1: 2 dilution against 8 HA units of Nyando, Zika, O'Nyong Nyong, Germiston, Sindbis, Semliki Forest, Bwamba, Wesselsbron, Pongola, West Nile, Ntaya and Spondweni virus. We are grateful to the various people who helped to obtain these birds.

Four is of course an extremely small sample, but it should have been enough to reveal a general contamination of British Whitethroats with chlorinated hydrocarbons at the level considered to be responsible for the decline of some predators. The levels found are roughly comparable with those reported in Sedge Warblers *Acrocephalus schoenobaenus*, another declining species, arriving in North Wales in the spring of 1963, well before the decline started (Prestt and Ratcliffe 1972), and Whitethroats arriving in Sweden in the spring of 1971, where these levels appeared insufficient to have a detectable effect on breeding success (Persson 1971, 1972, who expresses her analytical results in terms of lipid levels, which tend to be much higher). It seems likely that the decline in the proportion of *pulli* ringed in Britain from 9%, 8% and 6% in the years 1967, 1968 and 1969 to 3% in 1970 and 1971, evident in Table I of the report by Winstanley *et al.* (1974), must have some other cause.

It seems doubtful whether an arbovirus (arthropod-borne virus; see Hoogstraal 1973) infection could be detected so easily, though if the incidence of five infected birds out of 54 caught in Cyprus in 1968 and reported by Watson *et al.* (1972) is representative, it seems possible. Sindbis virus was also isolated from a Reed Warbler *Acrocephalus scirpaceus* and subsequently from various domestic animals in Czechoslovakia in July and August 1971 (Ernek *et al.* 1973, 1974); and West Nile virus, whose antibodies are widely distributed in the local human population and domestic animals, was also isolated from a mosquito there the following summer (Labuda *et al.* 1974). If many wintering passerines became concentrated around a limited number of waterholes by a drought in Africa, this might provide ideal conditions for the spread of virus diseases by biting insects. Clearly a watch should be kept for sick birds, or for people who develop unexplained fevers after handling birds or their ticks, for further investigation. These viruses deserve to be treated with respect, as some of them can cause a fatal encephalitis in man as well as other animals.

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