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MIDLAND MAMMALS SURVEY I.

Feral Muntjac Deer (*Muntiacus spp.*) in the West Midlands, with special reference to Warwickshire.

By T. J. PICKVANCE and J. S. R. CHARD

INTRODUCTION

Two species of muntjac deer, the Chinese (*Muntiacus reevesi*) and the Indian (*M. muntjac*), were introduced into England at Woburn Park, Bedfordshire, about the beginning of this century, according to P. Stainer, the present Steward at Woburn Park. Later they were kept at Whipsnade and at least two private zoos (Crowland Abbey, near Wellingborough and at Broxbourne, Herts.). During the last half-century, muntjac have been reported in Bedfordshire, Northants., Warwickshire, Bucks., Herts., Berks., Cambridgeshire, Huntingdonshire, Essex, Leicestershire, Middlesex, Norfolk, Oxon., Staffordshire and Suffolk. Only in the first five counties named can it be stated as certain that the deer are established as a regularly breeding species at the present time.

The muntjac's successful colonisation of a wide area of the country has taken place very largely without the knowledge of its human inhabitants. Our purpose in writing this article is to draw the attention of naturalists and others to the presence of this small deer, and to indicate some of the problems involved in recording the muntjac's distribution and habits. The muntjac is unlikely to become the object of measures of extermination. Unlike the larger species of deer it does no harm to trees, and from places where it sometimes becomes a nuisance, such as market gardens and allotments, it can be excluded by wire netting. Control will not prove difficult as it is easily caught, and, being a creature of habit in its movements, is not difficult to shoot. Its small size and retiring habits aid its unobtrusive spread. Thus an increasing number of naturalists will be able to study this species, which has a particularly interesting form of territorial behaviour.

The main part of this article deals with records of the muntjac's colonisation of Warwickshire. These are typical of those gathered during surveys made with a view to determining not only

the present distribution of the animal but the rate and direction of colonisation and the past history of the movements which have taken place.

At the end of the article will be found suggestions for making records which will add to our knowledge not only of the distribution of the muntjac, but also of its natural history.

DESCRIPTION

The following brief description gives a rough idea of the appearance of the muntjac, and should be supplemented by reference to the *Field Guide to British Deer*, Ed. F. J. T. Page, (Mammal Society 1958). G. K. Whitehead's *Deer* (Country Life 1950) should also be referred to.

The colour varies greatly from silvery-grey to foxy-red, with yellow or brown tones in some individuals. The male has short antlers on long hairy pedicles, and two curved tusks, or tushes, in the upper jaw. The tail is bushy and white underneath. The head is held in a characteristically low position. The following measurements which are based upon only a few specimens, have been kindly supplied by F. J. T. Page.

		Indian	Reeves'	Hybrid
Height:	Buck	22″	17″—19″	19″—20″
	Doe	21″	15″—17″	17″—19″
Antler length:	Buck only	5½″—6″	4″	5″

The antlers of the buck are probably cast in January and February. In the doe, antlers are represented by tufts of black hair. Few of the Indian species were introduced into this country; if it still exists it must be very rare. In practice it is likely that only the dimensions given for the hybrid will prove useful.

HABITS

Exploration is mainly by wandering bucks, usually young ones, and takes place in the late summer and early autumn. Muntjac travel long distances alone, perhaps several miles during one night They travel through standing corn or move along overgrown hedge-bottoms. When harvest time comes and the leaves fall they find themselves cut off and have to take up new quarters. Once they find the right kind of habitat they settle down and become very secretive. Very few people suspect the presence of these solitary animals. As the rut approaches each buck marks out his territory and may eventually be joined by a doe.

Colonisation can only be said to have taken place when breeding is established, and even then it may not be permanent. Colonies frequently die out in a hard winter (in Hazelborough Forest, for instance, in 1947, 70 muntjac were found dead in the rides alone), or they may be dispersed through disturbance. In any case the habitat usually changes: for example, the canopy of a developing

wood may shade out the bottom cover and then, if there are no other suitable areas near, the deer move on, or fail to breed successfully.

The muntjac is very secretive and conceals itself in low undergrowth. It is difficult to see and dislodge from its hiding place. Usually it betrays its presence only by footprints or, in woods where it has established itself, by well trodden paths. The sure signs of successful colonisation are not the presence of the odd deer or the odd track, but numerous well-worn and regularly used runs in dense undergrowth.

Although muntjac may turn up anywhere while on the move, they have a definite preference for woods with a dense tangled undergrowth of briars, brambles, thorns and other scrub. It is mainly in such areas that they settle permanently and breed successfully. This is partly because they need cover for protection and partly because they feed extensively on berries, fruits and seeds. Their survival depends a good deal on how fat they can get on such food in the autumn and before the rut. The result of this preference is that their main distribution follows the heavier or the more basic soils —clay, marl and limestone formations rather than sands and gravels.

COLONISATION OF THE WEST MIDLANDS

From Woburn Park the deer distributed themselves in all directions. By 1933 or 1934 muntjac were found to be in occupation of Salcey and Yardley Chase, south of Northampton, and also of Hazelborough Forest, between Towcester and Brackley. The woods at Rockingham, north of Kettering, were presumably colonised originally from this Salcey-Yardley Chase stock, prior to 1940.

Due west from Hazelborough the muntjac continued through the north of Oxfordshire into east Warwickshire, where entry must have been made prior to 1941. In that year they were found to have colonised Walton Wood and most of the other woods in the Kineton area.

Farther north the deer reached Staffordshire: T. J. Flemons reported that a young buck was shot in January or February 1941 in Needwood Forest in the Duchy of Lancaster woods south of Sudbury and Marchington.

WARWICKSHIRE

Probably the Kineton area was the approximate limit of their advance in 1941. One of us (J.S.R.C.), in the course of duties with the Home Timber Production Department, inspected most woods situated north and west of Kineton and did not notice signs of the presence of muntjac. Owing to the dependence of the observer of tracks, etc, on weather and other conditions, this negative evidence must be treated with some reserve.

The next earliest record is of several muntjac being seen, and one shot, in Ryton Wood, some fifteen miles from Kineton, in a

north-westerly direction, probably in 1943 but possibly one year earlier or later. This report from T. J. Nott of Rugby is notable because the shooting rights in the wood had been held for many years previously by C. J. Ivens, also of Rugby, whom Nott partnered during the years in question. In the succeeding years, 8-10 were seen feeding. Here at least the arrival of the deer in numbers was noted, although earlier exploring muntjac may have been overlooked. Occupation of Ryton Wood has been continuous up to the present time.

Then follow a group of records from the Warwick area. In 1947 what was undoubtedly a muntjac, judging by reports of witnesses, was seen by members of the Warwickshire Beagles Hunt at Bannerhill Farm, three miles north-west of Warwick (Official Handbook of the Warwickshire Beagles). That the country between Kineton and Warwick was familiar to muntjac was shown by the presence of tracks in the same year, in Chesterton Wood and Oakley Wood, which lie a few miles north of Kineton on either side of the Banbury-Warwick road (A.41).

In 1951, Wellesbourne Wood, about three miles west of Kineton, was found to have been colonised. As this adjoins Walton Wood, no doubt the deer had been present for some years previously.

In February, 1952, a muntjac appeared in the garden of Cliffe House, Cliff Hill, Warwick (A.Winterbottom) and remained several months until killed on the road. A few weeks later, a fawn presumed to have belonged to the adult animal, was discovered in the same garden. It lived there several months until it also was killed on the road. In 1952, or 1953, the Avon flooded at Boddington Farm, Luddington (C. H. Whitehead) and afterwards a deer was found caught in a bush overhanging the river. Judging by its size and colour it was a muntjac. In 1952 tracks of a single animal were found in the Hay Wood, Wroxall. No signs have been seen in this wood since. In the same year it was found that Bubbenhall Wood, and also All Oaks Wood, near Brinklow, east of Coventry, were already colonised. In 1953 a muntjac was seen in Warwick Park. It remained there from July 1953 - January 1954. Another appeared in the same Park during 1958.

Another report (June 1956) comes from Leamington Spa where a muntjac was discovered at night in the main street. To evade arrest it jumped into the river. Other reports of its willingness to take to the water explain why the plexus of rivers in the Warwick-Leamington district proved no barrier to the muntjac's advance.

Enquiries and visits organised in 1958 established that muntjac are present (in summer 1958) in the following woods: Ryton, Bubbenhall, Weston, Waverley (now being felled), Cubbington (one report; the wood is now much disturbed by humans), Wappenbury and Princethorpe Great Wood. At least the first three of the woods

mentioned are colonised. No reports were received, or tracks seen in Brandon Wood, which now adjoins a housing estate. Nor, up to March, 1958, were there signs of deer present in Meriden Shafts and Close Woods, near Meriden, nor in Arley Woods and Hartshill Hays, near Nuneaton.

From a consideration of the suitability of the terrain it seemed likely that deer would spread in the Alcester direction. No signs were seen in March, 1958, in Weethley and Oversley Wood, near Alcester, nor in Mays Wood at Henley-in-Arden. But more recently E. M. Conder found tracks of a single animal in The Hangings, Temple Grafton, in September, 1958. This is the most south-westerly record which has come to our notice. In July, 1959, a muntjac was reported at Olton, an outer suburb of Birmingham. Its presence in dense scrub was confirmed, the most north-westerly penetration so far noted.

DISCUSSION

Some of the most significant records appear to be the firm footing of the muntjac at Kineton in 1941, when no signs were seen elsewhere, and the appearance of the several animals at Ryton Wood, fifteen miles away, a year or two later. If these two occurrences were connected a rapid rate of spread took place during the war years which has certainly not been maintained since. Events during the war period undoubtedly favoured the muntjac and its dispersal: woods containing ammunition dumps were left undisturbed for several years, enabling breeding stocks to build up; elsewhere felling operations and the quartering of troops in woods dispersed the deer and forced them to find new homes; and the ploughing-up policy resulted in large acreages of corn and other crops, which afforded good cover.

Since 1941 the advance has been very slow; but in this connection account must be taken of the widespread and severe mortality in 1947. The appearance of a single animal near Wroxall in 1952, and another near Temple Grafton in 1958, show that in the succeeding seventeen years the muntjac has reached no further than ten miles due west of Kineton.

The present decade is notable for the taking over by the Forestry Commission of many woods in Warwickshire. The consequent scrub clearing and re-planting has undoubtedly influenced the deer : by disturbing them from settled haunts, and by temporarily excluding them from areas surrounded by rabbit wire during the early years of re-planting.

MUNTJAC SURVEY

In the midland region of England now colonised by the deer, and especially on the borders of this area, there is a need for a distributional survey. The discovery of the haunts of the muntjac

and the history of colonisation are the objects of such a survey. Direct observational studies of scientific value can be undertaken with greater advantage when an extensive survey has brought to notice the most favourable places for observation.

DISTRIBUTION

Whenever possible periodical visits should be made to woods which are ahead of the furthest known point of advance, since only by discovering the year of the muntjac's first appearance in the wood can directions of advance be determined. Once exploration has been detected, the dates of colonisation can be determined by subsequent visits.

If, on first searching a wood, muntjac are found in occupation, further enquiries should be made among local foresters, keepers, or shooting people. The last mentioned have discovered that the muntjac makes excellent venison, so they have good reason to remember the first specimens seen. People living on adjoining land may not see the deer and therefore do not identify the tracks which are still unfamiliar to country people and generally too small to be noticed without a special search.

In every study of colonisation *negative evidence* is as important as positive evidence. The dates when visits to particular woods have yielded no evidence of deer should always be noted. In order that further visits to woods may be arranged where this is desirable, the names and addresses of the owners should be obtained and enquiries made about whether the shooting rights are let. The addresses of the lessees of shooting rights are of course essential and it is important to secure the co-operation of the gamekeepers.

It is also important to know the stage of development of the woodland. Principal tree species should be noted and also the species comprising the undergrowth and the denseness of the latter. Forestry operations should be recorded. Since soil determines the vegetation of a district, notes on local geology and soil types will contribute to a study of the muntjac's habitat preferences.

Where travel by the deer across country is being investigated the general agricultural character of the country should be observed, i.e. whether mainly pasture or arable. Hedges with wide bottoms give covered passage to muntjac which travel along them. The presence or absence of such hedges should be recorded together with any other information which seems relevant.

BIOLOGY

Particular attention should be paid to the following points.

Full information is wanted about times when the males are in breeding condition. The rut is probably in November and December. At this season, territorial behaviour is in evidence and 'fraying stocks' are found. 'Fraying stocks' are young saplings from which

some of the bark has been removed by the deer rubbing, or fraying, with its antlers. Fraying takes place when the antlers are being cleaned of velvet, and also later on when the territory is marked out. When the muntjac buck is in hard horn, i.e., when the antlers have been cleaned of velvet, he frays small saplings beside the runs that he is using and returns to them daily to anoint them with scent. This is produced from glands on the head, two below the eyes and two between the raised bony ribs of the face. Does in season find the territory markers and mating thus results.

Records are required of dates on which bucks are seen in hard horn; when *fresh* fraying stocks are found; and also when the antlers are cast, together with, in each case, an assessment of whether the animal is young, middle-aged or old. Little is known about the territorial requirements of the muntjac.

The extent to which the muntjac is truly gregarious is in dispute. Unlike the red deer, which forms herds, and the roe, which sometimes forms bevy (i.e., small groups of related individuals, such as buck, doe and yearling doe of the previous season, which remain together throughout the year), the muntjac has not been shown to exhibit true gregariousness. Buck and doe, or doe and fawn, may be found together and occasionally larger groups up to about a dozen are observed. The last mentioned may be assorted animals which have casually come together at feeding grounds. The test of true gregariousness comes when a group is disturbed. A mixed group breaks up in no particular order, whereas in a herd or bevy precedence is established and the individuals maintain contact during flight. More observations are required: the size, age and sex composition of groups should be recorded whenever possible, and the probable reasons for the association adduced.

Once a general idea of the habits of muntjac has been obtained in any particular wood, and the main runs have been located, opportunities for closer observation can be secured, with the permission of the owner, by putting down rock salt at some key point which can be overlooked from a suitably placed 'high seat', suggestions for constructing which will be found in the *Field Guide to British Deer*. The salt should be placed in an opening just off one of the main runs, and replenished as it is used up. Other seats can be erected to overlook main feeding areas, or at the junctions of rides.

CONCLUSION

Information about muntjac in Warwickshire, and also in Worcestershire where its appearance may soon be expected, should be sent to T. J. Pickvance, Department of Extra-mural Studies, University of Birmingham. Records of deer in other counties should be sent to the Hon. Secretary of the Deer Group of the Mammal Society, F. J. T. Page, 77 Surrey Street, Norwich, who writes: "The presence of the muntjac at distances of between fifty

and a hundred miles from established breeding areas, suggests that colonisation can be suspected in places that have hitherto remained undetected. For example, the southward spread through the Chilterns into Berkshire is likely to have progressed well south of the Thames, and breeding should be expected in suitable woodlands around Newbury. Penetration into Leicestershire from the south is known to have reached Charnwood Forest, but no reports from that district have been received since 1955, though a year later one was received from Uppingham. In Staffordshire and Oxfordshire a survey would probably yield information of much interest. Up to the present time the remaining midland counties, into which a gradual infiltration can be expected, and from which no reliable records have been received, are: Derbyshire, Gloucestershire, Nottinghamshire and Worcestershire. Additional information is desired from Cambridgeshire, Essex, Huntingdonshire, Middlesex, Norfolk, and Suffolk".

ACKNOWLEDGEMENTS

Our thanks are due to the foresters and naturalists who have sent in reports and the members of the Midland Mammals Survey Groups at Birmingham and Warwick, and students of the University of Birmingham Department of Zoology who took part in the Survey; and especially to F. J. T. Page, who, beside contributing valuable information, read, and offered useful criticisms of this article.

BIBLIOGRAPHY

The forests and woods referred to in this article are marked on the Ordnance Survey maps, scale 1: 25,000. Their grid references are as follows:

100Km. Square SP, except where otherwise indicated:—All Oaks Wood, 450785; Arley Wood, 280910; Brandon Wood, 395765; Bubbenhall Wood, 370715; Chesterton Wood, 340575; Close Wood, 255845; Cubbington Wood, 350695; The Hangings, 135540; Hartshill Hayes, 320945; Hay Wood, 210715; Hazelborough Forest, 655425; Mays Wood, 145645; Meriden Shafts, 260835; Needwood Forest, SK c.130290; Oakley Wood, 305595; Oversley Wood, 105565; Princethorpe Great Wood, 390710; Rockingham Forest TL 010935; Ryton Wood, 380725; Salcey Forest, 805515; Walton Wood, 285515; Wappenbury Wood, 375705; Waverley Wood, 355710; Weethley Wood, 045555; Wellesbourne Wood, 270535; Weston Wood, 355700; Yardley Chase, 845560.

Some records of muntjac throughout the Midlands will be found in R. S. R. Fitter's *The Ark in our Midst* (Collins 1959). Certain of the records mentioned in this article are validated by private communications which will be deposited at the Birmingham Museum.

MIDLAND MAMMALS SURVEY II

Mammals of Worcestershire: A Revised List

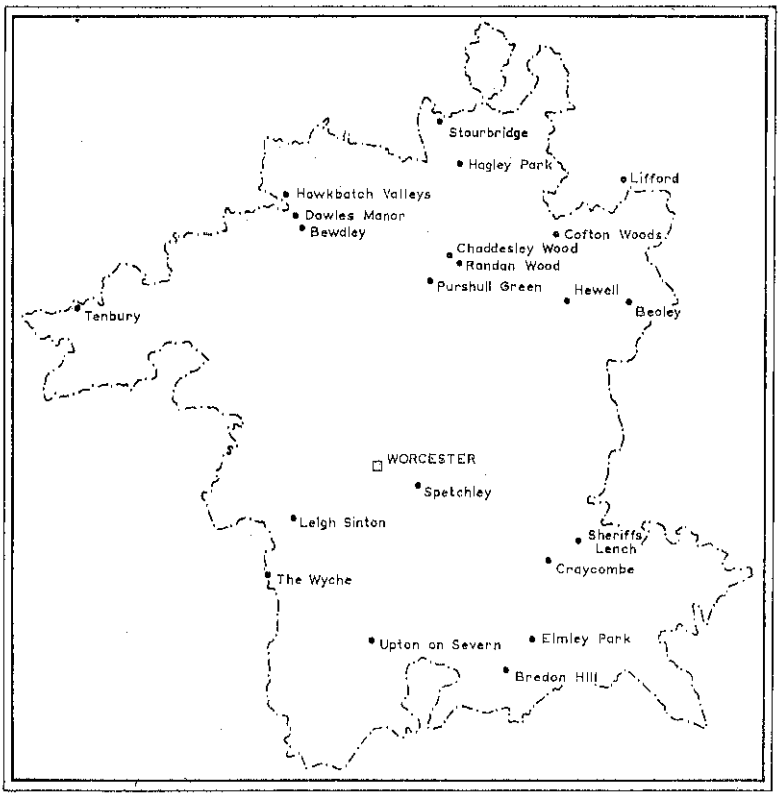
By T. J. PICKVANCE and F. FINCHER

Nearly half-a-century has passed since the last annotated list of Worcestershire mammals was published. Altogether four such lists exist, covering 125 years. Two of them, Hastings' (1834) and Tomes' (1901) attempted comprehensiveness; the others by de Hamel (1886) and Forrest (1913), which were compiled when the British Association for the Advancement of Science paid visits to Birmingham, dealt with that part of Worcestershire within 20 miles of the city.

Despite the fact that several species have disappeared from the county during the past century our own species list is longer than those of earlier authors, for several reasons. Not only have new species been distinguished, such as the yellow-necked field mouse, *Apodemus flavicollis,* but others, like the grey squirrel, *Sciurus carolinensis,* have made their appearance in the county. Whereas previous compilers had to rely largely on their own observations, we have been able to supplement our own knowledge by information from the staff of the Severn River Board, the pest control officers, and naturalists, including members of the Midland Mammals Survey groups who have also assisted in collecting and mapping records. Observers' names are given in brackets after the record. Modern transport and improved roads have both facilitated our task and made it more exacting. It is no longer permissible for naturalists to speak of those mythical areas, the "remote localities", where early compilers of mammal lists could with some excuse allow species unfamiliar to them at least to survive, if not to flourish.

Since the boundaries of administrative areas are subject to alteration from time to time, it is necessary to treat "Worcestershire" as a term requiring definition. Earlier changes undergone by the county boundary are shown in a map supplement to Amphlett and Rea's *Botany of Worcestershire* (1909). Except where otherwise stated, the present list has been compiled from observations made during the last decade in Worcestershire, as defined in 1959, *see Map,* p. 10.

Table I summarises the five faunal lists. Like previous compilers we have added notes on the status of individual species. It is to be regretted that our knowledge of most British mammals is still so scanty that their status must be dismissed with brief comment. Only in a few cases, where the animals have somewhat similar habitats, e.g. pygmy and common shrew, weasel and stoat, long-tailed field mouse and field vole, do the remarks possess any comparative value.



LIST OF SPECIES

INSECTIVORA

1. Hedgehog, *Erinaceus europaeus* L. Common.
2. Common Shrew, *Sorex araneus* L. Common.
3. Pigmy Shrew, *Sorex minutus* L. Occasional.
4. Water Shrew, *Neomys fodiens* Schreber Probably frequent in suitable streams.
5. Mole, *Talpa europaeus* L. Common.

CHIROPTERA

In compiling the following notes on bats we have rejected sight records of bats in flight.

6. Noctule *Nyctalus noctula* (Schreber) Noted at Sheriffs Lench, Randan Wood and Purshull Green.

7. Leisler's Bat *Nyctalus leisleri* (Kuhl) No record more recent than Tomes'.
8. Pipistrelle, *Pipistrellus pipistrellus* (Schreber) Appears to be one of the most numerous species.

   (Daubenton's Bat, *Myotis daubentoni* (Kuhl) Tomes included Daubenton's bat in his list, but all the localities he cites are in Warwickshire.)
9. Whiskered Bat, *Myotis mystacinus* (Kuhl) Appears to be widespread.
10. Natterer's Bat, *Myotis nattereri* (Kuhl) a single specimen seen in Randan Wood.

    (Bechstein's Bat, *Myotis bechsteini* (Kuhl) Although no specimen has, so far as we know, been taken within the county, Bechstein's bat almost certainly occurs here because it was taken at Nash Court in Shropshire, which is only 2½ miles north of the border town of Tenbury).
11. Long-eared Bat, *Plecotus auritus* (L.) One of the three most widespread species.
12. Barbastelle, *Barbastella barbastellus* (Schreber) A single specimen was taken at Sheriffs Lench 1955 (Beryl Aldred). Tomes (1901) included this species but the two localities mentioned by him are in Warwickshire. Forrest however refers to Tomes finding a barbastelle at Upton-on-Severn. The first record was made prior to 1853 by H. E. Strickland at Craycombe, as noted in his private copy of Hastings' list.

    (Greater Horseshoe Bat, *Rhinolophus ferrum-equinum* (*Schreber*) There is still no confirmation of Hastings' acceptance of this species but one possible sight record of the bat in flight has been reported (A. J. Harthan).)
13. Lesser Horseshoe Bat, *Rhinolophus hipposideros* (Bechstein) One recent record of a single specimen has been established at Sherriffs Lench (N. Bomford). The only other reliable record is J. Steele Elliott's at Dowles Manor in 1904, referred to by Forrest (1913). All the localities mentioned by Tomes in Bell (1874) are in neighbouring counties. (†).

LAGOMORPHA

14. Rabbit, *Oryctolagus cuniculus* (L.) Myxomatosis reached Worcestershire in July 1954. During the following 12 months, rabbits, which had been abundant, disappeared in most districts or became exceedingly scarce. Since then there has been a partial recovery of numbers, together with recurrence in some areas of the disease.

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† Since writing the above a summer colony of 100—200 has been discovered near Upton-in-Severn (1959) by A. A. Vickers.

15. Hare, *Lepus europaeus* Pallas In different districts the fortunes of the hare have fluctuated but in general the hare was more widespread in the years immediately following the 1939-45 War than it was in the 1930's. Since 1954, a further increase has taken place, probably due indirectly to the enormous reduction in the number of rabbits, which has meant that less shooting of both species has taken place, and partly also to a series of long breeding seasons caused by mild autumns and winters.

RODENTIA

16. Bank Vole, *Clethrionomys glareolus* Schreber Widespread; less abundant than the field vole.
17. Field Vole, *Microtus agrestis* (L.) Abundant; occasionally, as in 1957, becoming a plague.
18. Water Vole, *Arvicola amphibius* (L.) Generally distributed in rivers, streams and canals.
19. Muskrat, *Ondatra zibethica* (Linnaeus) Muskrats were introduced into Shropshire in 1929, at Shrawardine, near Shrewbury. Escapes took place and this became the main infestation area in England. Muskrats reached the Severn and entered Worcestershire. Bewdley was the lowest point on the river at which muskrats were caught (Warwick 1934).
20. Long-tailed Field Mouse, *Apodemus sylvaticus* (L.) Very Common. Sometimes (1957) this mouse assumes plague proportions.
21. Yellow-necked Field Mouse, *Apodemus flavicollis* (Melchior) A specimen in the British Museum is evidence that the late J. Steele Elliott was the first to add the yellow-necked mouse to the county list. Enquiries by the Midland Mammals Survey show that it is found wherever competent observers are at work: Randan Wood, Hewell Grange, Sheriffs Lench, Worcester, Bewdley, and Tenbury. Thus it is probably fairly common and widspread. H. E. E. Babb has trapped in many parts of the parish of Clent without securing a specimen although no traps have been set near buildings. In the West Midlands the habitats in which most specimens have been caught are houses with fruit stores.
22. Harvest Mouse, *Micromys minutus* (Pallas) A few recent records from widely scattered areas: Beoley, the Avon valley, Stourbridge and Tenbury.
23. House Mouse, *Mus musculus* L. Very common.
24. Black Rat, *Rattus rattus* (L.) Although no case of infestation has been reported and no specimen caught, it would be unwise to assume that the black rat now never appears in the county. The barges which ply between Stourport and Gloucester may still occasionally convey individuals which are overlooked,

although the river barge traffic is much less now than it was in former years.

25. Brown Rat, *Rattus norvegicus* (Erxleben) Very common.

26. Common Dormouse, *Muscardinus avellanarius* (L.) Tomes was clearly in error when he excluded this species from the county list on the grounds that Worcestershire lies north of its range. A few recent records have been noted in Randan Wood and Chaddesley Wood, and at Leigh Sinton and Sheriffs Lench. No doubt a thorough search of suitable woods would bring others to light.

27. Continental Fat Dormouse *Glis glis* (L.) Vesey-Fitzgerald (1938) reported that a specimen of the introduced edible dormouse was sent to him from an unnamed locality in Worcestershire. An unidentified animal seen at Sheriffs Lench in the same year was possibly another specimen. Owing to the possibility of confusion between this dormouse and young grey squirrels identification in the field is difficult. Other individuals may be living ferally, a possibility rendered more likely since the popularity of *Glis* as pets has increased during the last decade or so.

28. Red Squirrel, *Sciurus vulgaris* L. No systematic enquiry has been made since Monica Shorten's survey in 1945 (Shorten 1946) when red squirrels were reported from 65 parishes. It can hardly be doubted that the species has continued to decrease in numbers: four records are known to us—Hewell Grange, 1955; Hawkbatch Valleys, Wyre Forest, 1955; and the Wyche Cutting, Malvern, 1952 (a dead specimen); only in Cofton Woods ★ do we know of an old established colony which still survives, though now reduced to perhaps a dozen individuals (H. R. Munro).

29. Grey Squirrel, *Sciurus carolinensis* Gmelin The release of grey squirrels in Birmingham in 1912 is regarded as the source of infection of neighbouring counties (Shorten 1954). By the 1930s they had become widespread throughout the county, although the first one seen by H. R. Munro on the Lickey Hills, 9 miles from Birmingham, was in 1937. They have since become a pest as in other parts of the country.

CARNIVORA

30. Fox, *Vulpes vulpes* (L.) Common. Occurs almost everywhere, in town parks and gardens, as well as in the countryside.

31. Badger, *Meles meles* (L.) First-hand accounts by witnesses still living show that Tomes was mistaken in thinking that the badger remained, in the undivided portion of the county, only

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★ Included in Warwickshire in error in Shorten (1954), page 101.

in some wooded localities. Actually it must have been not uncommon then, judging by reports of badger-digging at that period. Today, although setts are absent from certain flat or low-lying areas, or land which is unsuitable for other reasons, badgers are common in some districts such as Beoley Parish and Lench woods, and abundant or even crowded on parts of Bredon Hill.

32. Otter, *Lutra lutra* (L.) The otter is much more widespread than contemporary accounts suggest was the case in earlier times. There is a strong probability however that the otter was as frequently overlooked by naturalists in former years as it is today.

H. A. Devereux, Superintendent bailiff of the Severn Water Board 1922-1957, states that otters are widespread, occurring in the Severn, Avon and Teme, and also in smaller rivers such as the Isbourne, Arrow and Salwarpe. Occasionally they are present in the R. Stour, and its attendant canal, from its confluence with the Severn to Halesowen. It is to be found in brooks such as Badsey, Carrant and Laughern, and notably in the Bow and Shell brooks. The larger pools and reservoirs hold otters regularly (Croome Park) or occasionally (Bittell Reservoir).

The otter still breeds occasionally within the Birmingham city boundary in Lifford reservoir which until 1911 was within the county of Worcester.

33. Pine marten, *Martes martes* L. Although no pine martens have been seen for many years it has now been established that they survived in plantations on the Lickey Hills until at least as late as 1897-1907 (Pickvance 1958). This record is later than that mentioned by Tomes by nearly 60 years.

34. Stoat, *Mustela erminea* L. Frequent.

35. Weasel, *Mustela nivalis* L. Frequent.

36. Polecat, *Mustela putorius* L. Occasional reports of polecats have never been shown to be other than of polecat-ferrets.

37. Wild Cat, *Felis sylvestris* Schreber No record since Hastings'.

PINNIPEDIA

38. "Seals" H. A. Devereux had no records of seals being seen in the Worcestershire Severn, but in the summer of 1959 a seal entered the lock at Tewkesbury. The species was not determined apparently. The seal returned downstream.

UNGULATA

(Muntjac deer *Muntiacus spp.* Up to the present (May 1959) no muntjac deer have been reported within the county, but the species quite possibly occurs. Exploratory spread of the

deer across Warwickshire reached Hay Wood, Wroxall, in 1952 (J. S. R. Chard) and The Hangings, Temple Grafton, in 1958 (E. J. Conder)).

39. Fallow deer, *Dama dama* (L.) Fallow have long been established in Wyre Forest. There they are controlled by the Forestry Commission but during the present decade they have attained such numbers that pest control staff have organised deer shoots. Escapes from Elmley Castle live in near-by woods. Stragglers also occur from Spetchley Park. Survivors of the Hagley Hall herd, which was broken up during the last war, live in small numbers in woods near the Hall.

40. Red deer, *Cervus elephas* L. This deer is represented in the county by the Spetchley Park herd, from which stragglers occasionally occur.

CETACEA

41. Common Porpoise, *Phocaena phocaena* (Linnaeus) The navigation weirs and locks on the Severn effectively check marine mammals. No record of the porpoise in the Worcestershire Severn occurs in the present century apparently.

SUMMARY

41 species of mammals have been admitted on good evidence to past or present faunal lists of Worcestershire. Of these, four residents: the wild cat, pine-marten, pole-cat and musk rat, do not now occur, while the status of another, the black rat, is doubtful. Two vagrants, the "seal" and the porpoise, have been prevented from entering the county.

Of the remaining 34 species, there are reliable recent reports of 33. Leisler's bat has not been taken recently but there is no reason for thinking that it does not now occur. In addition there can be little doubt but that Daubenton's bat and Bechstein's bat have been overlooked. Thus there are probably not fewer than 36 species of wild and feral mammals in Worcestershire.

ACKNOWLEDGMENTS

Besides observers mentioned in the text the following persons have contributed information: C. L. Barnard and A. J. Chellingworth of the Worcestershire pest control staff, A. J. Morrison, W. S. Smith, George Wright. For assistance in collecting and mapping records our thanks are due to members of the Midland Mammals Survey Groups at Birmingham and Worcester, and especially to J. P. Crawford, J. N. and Mrs. C. Hill, D. W. Hildred, Miss Z. K. Potter, K. H. Thomas, and Miss E. Yeld, in addition to those named in the article. We are also indebted to Mr. C. W. Olliver of the Department of Geography, the University of Birmingham, for preparing the map.

REFERENCES

AMPHLETT, J. and REA C. (1909)
The Botany of Worcestershire *Birmingham: Cornish Bros.*

BELL, T., TOMES, R. J. and ALSTON, E. R. (1874)
A History of British Quadrupeds *London: Van Voorst.*

FORREST, H. E. (1913)
British Association Handbook *Birmingham: Cornish Bros.*

DE HAMEL, E. (1886)
British Association Handbook *Birmingham: Hall and English.*

HASTINGS, C. (1834)
Illustrations of the Natural History of Worcestershire *London: Sherwood, Gilbert and Piper.*

PICKVANCE, T. J. (1958)
The Pine-marten in Worcestershire *Proc. zool. Soc. Lond.* 131, *Pt* 2, *pp.* 326-7.

SHORTEN, M. (1946)
A Survey of the Distribution of the American Grey Squirrel (*S. carolinensis*) and the British Red Squirrel (*S. vulgaris leucourus*) in England and Wales in 1944-45. *J. Anim. Ecol.* 15, 82-92.

SHORTEN, M. (1954)
Squirrels *London: Collins.*

SHORTEN, M. (1957)
Squirrels in England, Wales and Scotland 1955 *J. Anim. Ecol.* 26, 287-294.

TOMES. R. J. (1901)
Victoria County History, Worcestershire, *I.* 171-177 *London: Constable.*

VESEY-FITZGERALD, B. (1938)
The Squirrel-tailed Dormouse *Field* 168. 1075.

WARWICK T. (1934)
The Distribution of the Muskrat (*Fiber zibethicus*) in the British Isles *Journ. Anim. Ecol.* III 250-269.

TABLE I

TABLE showing the species of mammals included in 5 county lists for Worcestershire.

		Hastings 1834	de Hamel 1886	Tomes 1901	Forrest 1913	1959
	O. INSECTIVORA					
1.	*Erinaceus europaeus* L., Hedgehog	†	†	†	†	†
2.	*Sorex araneus* L., Common Shrew	†	†	†	†	†
3.	*Sorex minutus* L., Pygmy Shrew	—	0	†	†	†
4.	*Neomys fodiens* Schreber, Water Shrew	†	?*	†	†	†
5.	*Talpa europaeus* L., Mole	†	†	†	†	†
	O. CHIROPTERA					
6.	*Nyctalus noctula* Schreber, Noctule	†	?*	†	†	†
7.	*Nyctalus leisleri* Kuhl, Leisler's Bat	—	?*	†	†	(?)
8.	*Pipistrellus pipistrellus* Schreber, Pipistrelle	†	?*	†	†	†
	(*Myotis daubentoni* Kuhl), Daubenton's Bat	—	?*	†	†	[]
9.	*Myotis mystacinus* Kuhl, Whiskered Bat	—	?*	†	†	†
10.	*Myotis nattereri* Kuhl, Natterer's Bat	—	?*	†	?*	†
	(*Myotis bechsteini Kuhl*), Bechstein's Bat	—	—	—	—	[]
11.	*Plecotus auritus* L., Long-eared Bat	†	?*	†	†	†

		Hastings 1834	de Hamel 1886	Tomes 1901	Forrest 1913	1959
12.	*Barbastella barbastellus* Schreber, Barbastelle	?	?*	†	†	†
	(*Rhinolophus ferrum-equinum* Schreber), Greater Horseshoe	†	—	0	0	?
13.	*Rhinolophus hipposideros* Bechstein, Lesser Horseshoe	—	?*	†	†	†
	O. LAGOMORPHA					
14.	*Oryctolagus cuniculus* L., Rabbit	†	†	†	†	†
15.	*Lepus europaeus* Pallas, Brown Hare	†	†	†	†	†
	O. RODENTIA					
16.	*Clethrionomys glareolus* Schreber, Bank Vole	—	?*	†	†	†
17.	*Microtus agrestis* L., Field Vole	†	†	†	†	†
18.	*Arvicola amphibius* L., Water Vole	†	†	†	†	†
19.	*Ondatra zibethica* L., Musk-rat	—	—	—	—	0
20.	*Apodemus sylvaticus* L., Long-tailed Field Mouse	†	†	†	†	†
21.	*Apodemus flavicollis* Melchior, Yellow-necked Field Mouse	—	—	—	—	†
22.	*Micromys minutus* Dehne, Harvest Mouse	†	?*	†	†	†
23.	*Mus musculus* L., House Mouse	†	†	†	†	†
24.	*Rattus rattus* L., Black Rat	†	?*	†	0	(?)
25.	*Rattus norvegicus* Erxleben, Brown Rat	†	†	†	†	†
26.	*Muscardinus avellanarius* L., Common Dormouse	†	†	0	†	†
27.	*Glis glis* L., Continental Dormouse	—	—	—	—	(?)
28.	*Sciurus vulgaris* L., Red Squirrel	†	†	†	†	†
29.	*Sciurus carolinensis* Gmelin, Grey Squirrel	—	—	—	—	†
	O. CARNIVORA.					
30.	*Vulpes vulpes* L., Fox	†	†	†	†	†
31.	*Meles meles* L., Badger	†	†	†	†	†
32.	*Lutra lutra* L., Otter	†	?*	†	†	†
33.	*Martes martes* L., Pine Marten	†	0	⁞	0	0
34.	*Mustela erminea* L., Stoat	†	†	†	†	†
35.	*Mustela nivalis* L., Weasel	†	†	†	†	†
36.	*Mustela putorius* L., Pole-cat	†	?*	⁞	⁞	0
37.	*Felis sylvestris* Schreber, Wild Cat	†	0	0	0	0
	O. PINNIPEDIA.					
38.	"Seals"	—	—	(?)	—	0
	O. UNGULATA.					
	(*Muntiacus spp.*)	—	—	—	—	[] Fer
39.	*Dama dama* L., Fallow Deer	† (Pk.)	† (Pk.)	† (Pk.)	† (Fer.)	† (Pk. & Fer.)
40.	*Cervus elephas* L., Red Deer	0	—	0	0	† (Pk.)
	O. CETACEA.					
41.	*Phocaena phocaena* L., Porpoise	—	—	0	—	0

KEY

†	Definite record
Fer.	In feral state.
Pk.	In deer parks
?*	No Worcestershire locality given.
(?)	No recent record.
?	Record doubtful.
[]	Probably occurs; no definite record
⁞	Probably extinct
0	Extinct or absent.
—	No reference

OPENCAST COAL MINING AND COLLIERY SLAG-HEAP FLORA IN NORTH WARWICKSHIRE

By G. A. ARNOLD and M. A. ARNOLD.

A preliminary review of the effects on local vegetation through opencast coal extraction in the Tamworth-Atherstone-Nuneaton area in North Warwickshire, and notes on the flora that has colonised colliery slag-heaps.

INTRODUCTION.

1.) Opencast coal mining in rural districts around Tamworth, Atherstone and Nuneaton was extended about 1945 when there was a National Fuel Crisis. During wartime, 1939-45, a site at Dordon was opened up for opencast coal. Since then a few sites in the area have been worked each year. Near Tamworth, the sites are almost invariably agricultural fields, mainly meadows and pastures. Usually each site totals 30-100 acres, but larger sites have been worked. Much of the district worked for coal in the Atherstone and Nuneaton neighbourhoods, however, was Oakwood (*Quercus robur*). All vegetation in these large stretches of land is removed in a matter of a few days by bulldozer and giant scraper machines. The workings are opened up for huge excavators and cranes, going down to 200 or 250 feet below the original land surface. Two or three years or more elapse before the sites are restored to agriculture, or forestry.

LIST OF SITES.

2.) Fig. 1 is a map of the various opencast coal sites that have been worked or are in the course of being worked. The numbers relate to the sites given on the map. Details as follow: —

No.	Locality and name of site	1 k.m. squares		Date
1.	Dordon	2699 2799	2700	Wartime, 1945 onwards.
2.	Bentley Park Wood and Monk's Park Wood	2895 2995	2896 2996	Between 1945 and 1958.
3.	Twogates	2101		1947-1949.
4.	Grendon Wood	2798	2898	Between 1945 and 1958.
5.	Merevale Park	2896 2996	2897 2997	Between 1945 and 1958.
6.	Shuttington (1) (Church Farm)	2504	2505	August, 1950—1952.
7.	Wilnecote (Castle Site)	2100 2201	2101	May, 1953—September, 1954.
8.	Baxterley	2797	2897	Between 1945 and 1958.
9.	Dosthill (1) (Railway)	2100	2199	June 1954—1956.

No.	Locality and name of site	1 km. squares		Date
10.	Shuttington (2) (Hill Farm)	2405	2505	October, 1955—July, 1959.
11.	Oldbury Farm, Oldbury (1)	2995	3095	Between 1945 and 1958.
12.	Oldbury (2)	3094 3194	3193	Between 1945 and 1958.
13.	Slack's Wood, Ridge Lane, Oldbury (3)	2994	3094	Between 1945 and 1958.
14.	Plough Hill, near Hartshill	3192	3193	Between 1945 and 1958.
15.	Dosthill (2) (Village)	2100	2199	April, 1957—August, 1959.
16.	Polesworth (Abbey Site) This site was scheduled to begin in 1959.	2602		

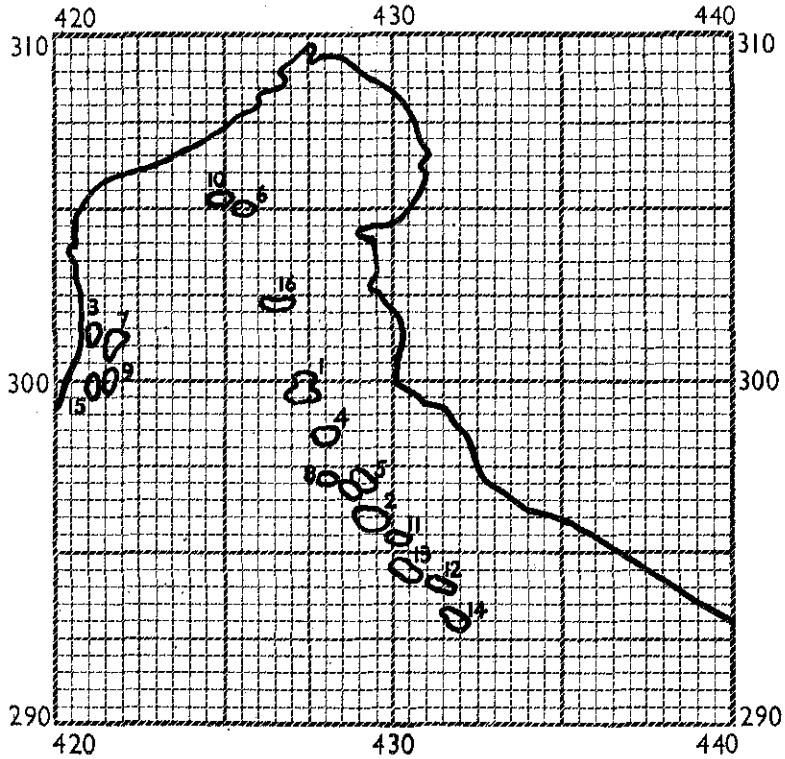

Fig. 1

Much of the area has been prospected for opencast coal. The 1 k.m. squares refer to the method of recording for the Revision of the Flora of Warwickshire (Hawkes and Readett 1954). All these sites that have been worked for opencast coal have been personally known, before, during and after operations by either the authors (Tamworth-Atherstone district) or by local amateur naturalist friends, notably Messrs. D. E. Jebbett and H. Lapworth (Atherstone-Nuneaton district).

Several sites were nearing completion 1958-59, and a 'run-down' in opencast coal production was announced by the National Coal Board in 1959. No new contracts would be let unless circumstances changed to make a reconsideration necessary. The 'run-down' would be achieved in the next few years. However, the Minister of Power, and the National Coal Board decided to go ahead with the Polesworth site, despite much local opposition to the scheme; here 700,000 tons of opencast coal are expected to be extracted from 100 acres in the next 4 years.

Work at the Abbey site at Polesworth included a proposal to divert the River Anker in three stages, within the site. There was a site meeting in October, 1958, with Opencast Executive representatives, the Nature Conservancy (represented by Dr. T. Pritchard, Midland Regional Officer, and Mr. B. H. Grimes, Maps Officer); and local amateur naturalists (G. A. Arnold, H. T. Lees, and several others representing Nuneaton Bird Watchers' Club, who are members of a number of Natural History Societies, mainly Ornithological). The meeting was arranged merely for an explanation by the Opencast Executive to interested naturalists concerned on the likely effect the scheme would have on Alvecote Pools, and not as an objection to the operations unless the existence of the Pools was seriously threatened. About a mile and a half away from the proposed diversion the River Anker flows through Alvecote Pools, a site of special scientific interest. It was agreed between the Opencast and naturalist authorities that precautions involving the laying of gravel on the temporary channels would help counter any possible pollution flowing through the Pools. Naturalists were assured that there would be no alteration of the water level of the River or Pools, and steps would be taken to eliminate pollution from suspended particles of clay and shale in the water, or heavy silting and discoloration of the water—thus severely limiting light intensity.

Two of the largest Opencast Coal sites in North Warwickshire were Oak woodland, Merevale Park, and Bentley Park Wood/Monk's Park Wood near Atherstone; the latter site extending 300 acres. Much of Monk's Park Wood has now been replanted with conifers. Oaks had long thrived on the carboniferous outcrop in the Atherstone -Nuneaton district, for, though semi-natural in that most of the woodland and parkland was tended by man, it was a land-use really unchanged for centuries. Now that a considerable acreage of former

Oakwood has been drastically changed it will be interesting to discover, if Oaks are replanted or regenerate naturally, how well they manage in future.

At Slack's Wood, Ridge Lane, near Oldbury the former woodland has been relevelled as agricultural land. In 1958, cereals were grown for the first time after opencast operations, and one result was that the site attracted pairs of Lapwing (*Vanellus vanellus*) to breed. Lapwings have also nested, and increased, at the Castle site, Wilnecote, since resoration to 30 odd acres of open pasture, which before opencast working were small enclosed fields.

PROGRESS OF OPERATIONS.

3.) When the bulldozers move in and remove the bushes and trees, the topsoil is scraped away and carefully set aside in huge mounds. These mounds of topsoil are quickly covered by pioneer vegetation; there are literally acres of Sheperds Purse *Capsella bursa-pastoris*, Chickweed *Stellaria media*, Groundsel *Senecio vulgaris* and Mayweed *Matricaria maritima ssp. inodora*, these last two often being co-dominant. Some grasses, (*Poa trivialis, Agrostis tenuis, Dactylis glomerata*, and *Holcus lanatus*) become fairly frequent within a few months. Small flocks of finches, in winter feed on the seed heads. Later deeper-rooted and stronger herbaceous plants take hold on the topsoil. Thistles appear and multiply, especially Creeping Thistle *Cirsium arvense* which becomes locally abundant. However, shrubs and trees do not develop within the usual two or three years of the topsoil lying fallow.

Occasionally there is a little growth after a few years on a few sub-soil mounds, but as a rule all sub-soil, 'overburden', clays, and the coal-measure shales remain bare during the few years exposed to light. After the useable coal has been extracted and removed the beds of shale, etc., are replaced more or less as they were before the upheaval. Finally the precious 3 inches to 9 inches of fertile topsoil is spread evenly and sparsely enough to recover the area: a plain reminder of the shallowness of truly fertile soil. This leaves the surface of the land rather flat, as previously most fields were slightly undulating. Drainage being disrupted, redrainage is undertaken where needed, mainly by the use of pipes.

There have been two reports of Archaelogical finds at these local opencast coal sites; some of the sites adjoin the ancient Roman Road, Watling Street. Some ancient coal mining tools were unearthed at Dordon around 1948, and a cannonball flint at Hill Farm, Shuttington in May, 1959. This was a 3" diameter ball weighing 1½ lbs. and identified by Geologists.

As the topsoil is seperated from the lower earth strata, the fertility remains high, and probably gains a little through lying fallow. After relevelling, the land is supplied with artificial fertilisers, (phos-

phates, nitrates, potash, and lime). The pH value of opencast sites after operations, therefore, is similar to what it was prior to the workings. In most of the district the pH approaches neutral—with an average of just over pH 6.0 and spanning about pH 5.5 to pH 7.0. In other words the topsoil of restored opencast fields is really little different in pH reaction from nearby fields; a little acid rather than having a marked acid tendency, but no alkilinity unless in isolated small patches. A sample from a subsoil mound at Hill Farm, Shuttington, containing river alluvial reached pH 7.5—pH 8.0.

PLANT SPECIES LOST.

4.) We cannot say that many uncommon plants have been lost to Warwickshire through opencast coal mining methods in the north of the county. As the Tamworth district sites are mainly on farmland, intensively cultivated, the plants removed in this aggregate of hundreds of acres are mostly the very common agricultural grasses, arable field flora, and all the hedgerows of chiefly Hawthorn (*Crataegus monogyna*), and the common hedgerow timber:—Oak *Quercus robur*, Ash *Fraxinus excelsior*, Elm *Ulmus procera*, Sycamore *Acer pseudo-platanus*, and Hazel *Corylus avellana*, which made up the bulk of the trees. Of course, with these go the rich hedgerow, hedgebank, and ditch flora, including Wild Roses (*Rosa* species) Brambles (*Rubus* species), Campions (*Melandrium* species) and many other plants.

The opencast coal sites at Bentley Park Wood, near Atherstone, and at Shuttington, near Tamworth, (parts of Alvecote Pools) are both nature Conservancy Sites of special scientific interest, and these are two localities where, inevitably, some damage has resulted to local native flora. Bentley Park Wood was not only a beauty spot, but an area of considerable tree value, containing many acres of mature natural Oakwood, some of the last relics in the district of ancient forest. The felling of much of this and neighbouring Oakwoods (*Quercus robur*) seems to have exterminated pairs of Wood Warblers (*Phylloscopus sibilatrix*) as a very localised breeding bird, and probably of Nuthatches (*Sitta europaea*) and Lesser Spotted Woodpeckers (*Dryobates minor*) too. Unfortunately, no investigation of entomological changes is known.

Typical Oakwood flora existed at Bentley Park and Merevale Park before the coming of opencast mining, though it is not known if the plants recorded by Bagnall (1891) for these areas (see Appendix 1) existed until then. It will be interesting to note the recolonisation of vegetation at these woodland sites in the future.

At Alvecote Pools, primarily of great ornithological interest, there is an outstanding flora. After subsidence from deep coal-mining a series of shallow pools developed (mainly 1940-1950) with the River Anker flowing through the three largest; and providing an expansive hydrosere habitat of still and flowing water. A part

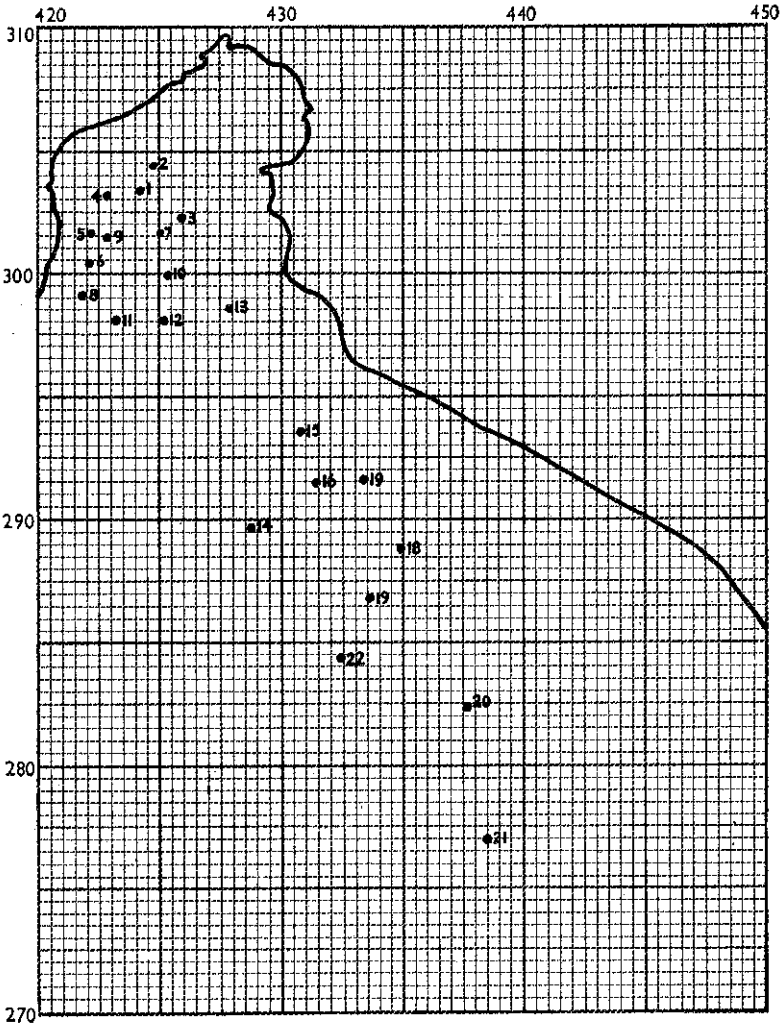

Fig. 2

of the river between Amington and Shuttington bridge continues to subside after winter flooding.

When the deep-mining coal seams have been worked and the supporting pit-props are withdrawn the 'roof' caves in at places. This causes subsidence to the surface of the land. Around Alvecote, the hollows so formed are about 6 feet deep and have filled with floodwater from the River Anker. Opencast coal seams lie near the surface, sometimes just a few feet below the surface of the earth.

Special machinery has been developed to extract coal by the opencast system. In general, outcrop coal seams lie over the deep-mining seams (c.f. Figs. 1 and 2). Therefore the opencast method has been employed in open, unpopulated country, but workings do go very close to villages.

Alvecote Pools now cover 100 acres. Here, rich aquatic vegetation, with reed-swamp, water-meadows, tracts of marshland, and incipient peat and acid bogs, have developed. All holding much interest to the botanist: over 400 vascular plants have been recorded in the last few years. Since 1946, Alvecote Pools has attracted 163 species and sub-species of birds, many rare to Warwickshire and inland. A total of 67 species have nested and a further 10 species have probably nested. Representations by naturalists in 1949 (Royal Society for the Protection of Birds: West Midland Bird Club), and in 1955 and 1958 by the Nature Conservancy, met with understanding by the Opencast Coal Authorities and exceptional destruction to the habitat was avoided, though some loss was inevitable.

Bagnall (1891) listed a number of marsh and aquatic plants for Alvecote, Shuttington, and the River Anker. However, no record is known of flora there between that time and the first of the opencast schemes in the area. In 1950, damp meadowland adjoining a 10 acre pool near Church Farm, Shuttington, was removed. The 10 acre pool was saved and with it the immediate periphery.

Two shallow pools of about 3½ and 3 acres were drained, coal extracted from beneath, and the site relevelled for agricultural use (with the prior agreement of the Nature Conservancy) during the operations 1957-58 at Hill Farm, Shuttington. Disturbance to nesting and resting birds, naturally, is increased with all the giant machines operating in a bird sanctuary, but, throughout, many outstanding birds continued to visit and reside at Alvecote Pools. At other sites in the district we have noted flocks of large birds, wild geese wild swans, and large gulls, descend from high-level flight, call strongly, and apparently take a closer inspection of the huge craters in the earth—which sometimes contain floodwater at the bottom of the opencast mines. However, the habitat is unsuitable and the flocks do not alight.

Pre-opencast flora was not adequately surveyed before the draining and filling in of the 3½ and 3 acre pools at Shuttington but included quite dense aquatic and marsh vegetation: —

Callitriche species (loc. abund.)
Ranunculus sp. (Section Batrachium) including *R. hederaceus* (freq.)
Polygonum hydropiper Water Pepper (freq.)
Valeriana officinalis Valerian (occ.)
Gnaphalium uliginosus Cudweed (occ.)
Chrysanthemum leucanthemum Oxeye daisy (occ.)
Rorippa islandica Marsh yellowcress (freq.)

Polygonum amphibium Water bistort (loc. abund.) which was much used by Great Crested Grebes (*Podiceps cristatus*) as anchorage for nests
Bidens cernuus Bur marigold (loc. abund.)
B. tripartitus (loc. abund.)
Eleocharis palustris Common Spike rush (loc. abund.)

In addition there were: —

Carduus crispus Welted thistle (occ.)
Hieracium species Hawkweeds (Section Euvulgata) (freq.)
Crataegus monogyna Hawthorne (ab. in hedgerows)
Fraxinus excelsior Ash (occ.)
Arum maculatum Cuckoo pint (rare)
Quercus robur Oak (freq.)
Salix viminalis Willow (occ.)

In July, 1958, Miss C. M. Goodman found at the side of this opencast coal site a fair-sized patch of Bearded couch grass *Agropyron caninum*. It was found also on the opposite side of the road, and may have been overlooked previously, though Bagnall (1891) recorded it at nearby Amington. Perhaps this, and other plants, have been introduced by the opencast machinery using the road. Appendix 11 gives a list of plants found on the topsoil dump at Hill Farm, Shuttington.

Operations at this Hill Farm site caused the 10 acre pool across the road (saved from destruction in 1950) to drain away in November, 1958, through underground seepage. Previously this 'closed' pool had maintained a remarkable constant water-level. However, the loss of this valuable and interesting stretch of freshwater proved temporary, for in February, 1959, the seepage was blocked by the opencast contractors and the pool then refilled naturally. The bountiful fish, aquatic plant and animal life, including water-birds, then began returning to the pool.

ANIMAL LIFE.

5.) Other forms of wild-life as well as plants obviously undergo profound changes, and the ecology of opencast coal sites before, during and after operations is quite intriguing. Moths and butterflies (*Lepidoptera*) Bees (*Bombus* species), Wasps (*Vespa* species), and countless other pollinating insects are at least temporarily expelled from large areas when the land is sterile for a number of years. Many common birds, for instance Blackbirds (*Turdus merula*), which formerly populated every few yards of the furlongs of hedgrow, no longer find nest or roost sites. Amongst the bird population of agricultural land Linnets (*Carduelis cannabina*) have suffered as much as, if not more than others, in a severe reduction of numbers. Food supply and shelter for birds, insects, and animals during or after opencast operations are drastically altered on a large scale. This

includes small mammals: Hedgehogs (*Erinaceus europaeus*), Moles (*Talpa europaea*) and Shrews (*Sorex*) for instance, which, no doubt, had their influence on the land; along with burrowing, minute invertibrates in the soil, now temporarily disrupted. So that immediately after restoration the soil tends to be 'solid', very compact and not easily friable, with some deficiency in aeration and drainage.

Timber on the farms formerly added beauty to the countryside, and provided some commercial value. Shelter from the weather for cattle and crops is no longer there; for, after restoration to agriculture, the opencast sites have taken on a prairie-like appearance, quite a contrast to small enclosed fields. (c.f. Christian 1958). There is a possibility that in future some trees or 'cover' will be replanted in accordance with the provision in the Opencast Coal Act, 1958 (Nature Conservancy Report 1958). This requires the Minister of Power and the National Coal Board 'to pay full regard to wildlife and the beauty of the countryside when carrying out their functions and duties under the Bill'. To conform with modern agricultural practice, however, fields should not revert to small enclosures of land. Some replanting is taking place at Shuttington in 1959.

RESTORATION OF LAND.

6.) Grasses are sown as soon as the surface has been relevelled, as leys or 'permanent' pasture, with the typical grasses of meadow and pasture (*Dactylis, Cynosurus, Alopecurus, Festuca, Lolium, Poa, Agrostis, Phleum,* and *Anthoxanthemum* and the clovers, *Trifolium pratense* and *T. repens*). Shortly, the land is suitable for grazing by cattle. In wet weather, there are some patches of boggy land here and there, but these are comparatively few. Cleft fencing (or 'chain' fencing) is erected in place of leafy hedgerows. Up to now, there has been no replanting of hedgerow timber on farmland, and this coupled with the total abolition of hedgerows is a cause of concern to the naturalist after opencast operations, as many forms of useful wildlife are excluded. In particular there is nothing to arrest the soil should erosion occur on the new wide open plains as at the Dordon site. It remains to be seen what flora colonises the base of great lengths of wooden fencing, and how long before the non-permanent fences decay. At the restored Wilnecote site Broom *Sarothamnus scoparius* is springing up along the fences four years after erection, and it is possible hawthorn will return naturally.

Restoration of the land to agriculture, in the most recent years, has been quite effective in its objective of getting grass to grow luxuriantly. However, the earlier sites (before legislation in 1951) were not really so well maintained. The topsoil was not kept apart, so that a mixture of clay, shale, and slag, from layers deep below the earth were deposited on the surface. The site at Dordon is the poorest in the district in this respect; much barren ground, ill-drained, some eroded and deficient in recolonisation by natural or sown vege-

tation. In the soggy places in less-well restored land, grow rushes (*Juncus species*) and farmers complain of difficulty in growing crops. The natural contours of the land have been altered.

In the agricultural sites restored a few years only (some of them very recently re-sown or in the course of being relevelled), there is little to be said, as yet, of how plant life is adapting itself to the changed environment. Familiar wildflowers of the meadow are re-appearing in places and in some quantity, including:—Daisy *Bellis perennis*, Creeping buttercup *Ranunculus repens*, Common buttercup *R. acris*, and Dandelion *Taraxacum officinale* agg., and in due course a host of other species should make a welcome return. On grassland, after just a few years, it is noticable that leguminous plants are slow to return, *Trifolium*, *Lotus*, *Lathyrus*, and *Vicia*, and especially clovers which after being sown tend to peter out. The land is generally too heavy and wet for ploughing, in the early years after restoration, and up to now only one or two restored fields have been ploughed, but no doubt more will become arable land as time goes on. Heavy manuring is undertaken on grassland to encourage nitrogenous plants, and sometimes twice as much fertiliser is used as with normal fields. Subsequent to relevelling, the land takes a number of years to resettle as the ground is subject to sinking, and as a result the 'development' of part of the sites into housing estates or industrial premises is also delayed. Where conifers are planted, these replace former oak woodland, and the response and rate of growth of these should be interesting. So, altogether there are fascinating prospects for the botanist, comparing results with the conditions before operations.

It is hoped that the liaison which has been established between local amateur naturalists, the Nature Conservancy, the Regional Opencast Executive, and agricultural interests will help to reduce to a minimum the harmful effects to useful wildlife.

SLAG-HEAP FLORA IN NORTH WARWICKSHIRE.

1.) There are many disused collieries and mine-shafts, as well as those in use, in the Tamworth-Atherstone-Nuneaton areas in North Warwickshire, where coal-mining is the staple industry. From these deep mines, coal measure shale and slag was dumped on the surface of the land near the pit-heads, covering many acres. Most of the slag-heaps were formed at the end of the 19th century or at the beginning of the 20th century. For dozens of years these slag-heaps lie as barren grey slopes, mostly medium-sized mounds 20-50 feet high though there are also 'shallow mounds' and 'tall mounds' (Rees 1955). In the last two or three decades, and especially in very recent years, a proportion of the slag-heap area has become covered or partially covered by rough vegetation for it has been customary to think 'nothing would grow there'. There is no doubt that these North Warwickshire spoil-heaps are gradually gaining in fertility; as in the

Black Country, Staffordshire (Rees 1955), and in Nottinghamshire (Christian 1958).

Fig. 2 is a map depicting the North Warwickshire Collieries with slag-heaps (a list is given in Appendix III). We are familiar with many of these in the Tamworth District.

Samples from the surface of these shale and slag-tips have been taken recently at several places. Readings obtained are pH 5.0 or thereabouts as an average. The lowest reading is about pH 4.0 and all fall short of pH 7.0, so that alkaline conditions are unknown. No pH recordings are known for the past. We find that with the colonisation and progression of vegetation the acidity is less pronounced. Rees stated that plant activity on similar spoil-heaps in the Black Country, Staffordshire, had an amelioration on soil reaction.

Near Tamworth, these higher values seem, in part, to be due to some mosses which now exist on some dry and damp banks. Indeed, here and there, this appears like incipient peat conditions—slow decaying stems of moss. These, through the years, pile up into thin layers and doubtless make way for higher plants to gain a footing; though some grasses and herbaceous plants germinate without moss foundations. The germination here of moss on slag-heaps is in contrast to findings in the Black Country where 'it is noteworthy that bryophytes play no role in succession' (Rees 1955).

The vegetation climax or pre-climax on slag-heaps in North Warwickshire will be worth watching. To-date, on these particular spoil-heaps, no trees have developed by natural means. Oak (*Quercus*) and Birch (*Betula*), probably the climax species, as yet, are not known. The slag-heaps here are away from woodland, but introduction by birds and animals of acorns and other fruits is quite feasible as there are some hedgerow trees in the neighbourhood. Nevertheless, a large proportion of slag-heap acreage still remains devoid of any vegetation. In bare, loose shale banks at Pooley Hall Colliery, near Alvecote Pools, a colony of up to 50 pairs of Sand Martins (*Riparia riparia*) breed regularly. The vegetation that has arisen on local slag-heaps affords food and shelter for small mammals, including the Rabbit (*Oryctolagus cuniculus*)—isolated retreats where the virus Myxomatosis probably failed to penetrate—and the scrub is a nesting haven for a number of resident and summer migrant small passerine birds.

Dr. Rees has listed a number of factors regarding plant requirements in such conditions:—

1. Adequate moisture for seed germination.
2. Availability of major and minor nutrients.
3. Stability of substratum for root hold.
4. Suitable aspect and degree of exposure.
5. Freedom of the atmosphere from heavy industrial pollution.
6. Freedom from heavy metal excesses.

SOME PROMINENT SLAG-HEAP PLANTS.

2.) Prominent amongst plants on local slag-heaps are rough grasses, (*Poa trivialis, Deschampsia caespitosa, Lolium perenne, Dactylis glomerata, Agrostis tenuis, and Holcus lanatus*). Several other grasses grow in occasional places. In damp hollows at the base between mounds (not to be confused with open pools caused by mining subsidence) there grow species of Rush (*Juncus effusus, J. conglomeratus, J. inflexus, J. articulatus,* and *J. bufonius*) and a few sedges (*Carex otrubae,* and *C. hirta* both frequent, and *C. acutiformis* occasional).

Some common wildflowers have taken root on slag-heaps, Coltsfoot *Tussilago farfara,* Creeping buttercup *Ranunculus repens,* and Dandelion *Taraxacum officinale* agg. being widespread. Intermittently there are clusters of the following:—

Chamaenerion angustifolium Rosebay
Cirsium arvense Creeping thistle
Crataegus monogyna Hawthorn
Hieracium species Hawkweed
Rubus species Bramble
Sambucus nigra Elderberry
Sarothamnus scoparius Broom
Senecio squalidus Oxford ragwort
Ulex europaea Gorse

Now and again these are locally abundant, and a combination of them growing in some areas has resulted in the formation of dense scrubland. The list of species is sure to lengthen as time goes on, and all these have arisen by natural process—none having been deliberately planted by man.

LESS WIDESPREAD PLANTS.

3.) Plainly a number of plants try to maintain themselves on the slag-heaps but do not succeed for long, and a stable community is in the process of being evolved. Herbage at the base of most slag-heaps is now quite luxuriant and it is difficult to know where the soil proper lies and the slag begins. When first the slag was dumped upon fertile earth the spoil-heaps had an adverse effect on the immediate surrounding vegetation, probably due to acid content. Now vegetation at the base of mounds is much the same as along waysides and verges. Other species actually thriving, though only in isolated patches, on slag-heaps and not previously mentioned include:—

Agropyron repens Couch grass
Alopecurus pratensis Meadow foxtail
Anthoxanthum odoratum Sweet vernal grass
Anthriscus sylvestris Cow parsley
Lamium album White dead nettle
Lotus corniculatus Birdsfoot trefoil

Phleum pratense Timothy grass
Plantago lanceolata Narrow leaved plantain
P. major Broad leaved plantain
Polygonum avicular agg. Knotweed
P. persicaria Persicary
Rosa canina agg. Dog rose
Rumex acetosa Sorrel
R. acetosella Sheeps sorrel
R. crispus Curled dock
R. obtusifolius Broad leaved dock

On the dry summit of a slag-heap in the Valley at Whateley, near Wilnecote there is an abundance of Wavy hair grass *Deschampsia flexuosa,* and nearby at Stoneware is a clump of Crown vetch *Coronilla varia.* Dyers rocket *Reseda luteola* grows in one spot at Alvecote, and there in both dry and wet situations is a fair amount of Hair moss *Polytrichum commune.* Thorn Apple *Datura stramonium* has been found on the slag-heap at Kingsbury.

PLANTING SLAG-HEAPS.

4.) Over the years, extremely little or no attempt has been made to remove unsightly slag-heaps, or to reclaim them by converting them to some useful purpose. Planted trees are known in only one locality around Tamworth. These were planted about 1935 when several kinds were introduced to hide a two acre slag-heap eyesore at the side of Blue Brick Hill, Watling Street, Wilnecote. Since then, the trees have flourished, after a slow start, and are practically up to normal growth compared with those in ordinary soil conditions. It is surprising other slag-heaps in the district have not been utilised for timber production. In 1959, these trees on the two acre 15 feet high slag-heap at Wilnecote are in good condition and reach 25-30 feet. These consist of a mixture of deciduous species: —

Aesculus hippocastanum Horse chestnut
Betula pubescens Birch
B. verrucosa Birch
Fagus sylvatica Beech
Populus species including *P. x candensis* Black Poplar sp.

Only the Black Poplars have met a setback. In recent years they have apparently suffered a disease, being bare of leaves on many upper branches though the crowns keep shooting. Sapling *Betula, Aesculus,* and *Populus* have sprung up in the last few years under their parent trees. This planted slag-heap is really a thicket, as the trees have never been thinned out. No evergreens were set. It is likely Pines would be amongst the most productive species, as in other counties when planted on slag-heaps, and where air-pollution is not great. In the last year or two on this small slag-heap, Holly *Ilex aquifolium* and Cherry laurel *Prunus laurocerasus* have sprung up thinly, self-sown; also a little stunted Willow *Salix sp.* As yet, no Ivy *Hedera helix*

has arrived. Practically all the natural dense scrub (*Crataegus, Rubus, Sambucus, Sarothamnus, and Ulex*) was cleared for the first time in the 1957-58 winter. Where the scrub was profuse much Bracken *Pteridium aquilinum* shot through though it was totally absent before; builder's rubble had been dumped hereabouts and may have been a factor in its appearance. Gramineae and various other annual perennial plants are now quite thick on these planted slopes. One species particularly worth mentioning is Primrose *Primula vulgaris*, two very small patches on a bank with a southerly aspect. These did not flower in the first year, 1958, but spread to a few clusters in 1959.

The National Coal Board now have the intention of planting some slag-heaps in the Nuneaton district.

THANKS.

5.) Our thanks are extended to several local amateur naturalists, notably Messrs. D. E. Jebbett, and H. Lapworth, B.Pharm., Ph.C., interested in the wildlife of Opencast Coal Mining Sites and Colliery Slag-Heaps. Also to the Nature Conservancy, particularly Miss J. M. Laptain, B.Sc., and her successor as Midland Regional Officer, T. Pritchard, B.Sc., Ph.D.; to the Regional Opencast Executive at Tettenhall, near Wolverhampton, for their attention upon the concern of naturalists; and to J. G. Hawkes, M.A., Ph.D., D.Sc.; and especially to Mr. R. C. Readett for suggestions and advice in preparing this paper.

REFERENCES.

1. BAGNALL, J. E. (1891)
'The Flora of Warwickshire'.
2. CADBURY, MISS D. A., HAWKES, J. G., READETT, R. C. (1957)
'Flora of Warwickshire: Species Distribution Maps and Habitat Analyses', *Proc. Birm. Nat. Hist. and Phil. Soc., Vol.* XVIII, *Part* VI *pp.* 135-145.
3. CHRISTIAN, GARTH (1958)
'A Place for Animals' (*Lutterworth Press*).
4. CLAPHAM, A. R., TUTIN, T. G. and WARBURG, E. F. (1952)
'Flora of the British Isles' (*Cambridge*).
5. HAWKES, J. G. and READETT, R. C. (1952-3)
'The Warwickshire County Flora Revision: A New Method of Recording'. *Proc. Birm. Nat. Hist. and Phil. Soc., Vol.* XVIII, *Part* IV., *pp.* 61-74.
6. HAWKES, J. G., READETT, R. C. and SKELDING, A. D. (1955)
'The Warwickshire County Flora Revision Mapping Distribution' *Proc. Birm. Nat. Hist. and Phil. Soc., Vol.* XVIII, *Part* V., *pp.* 109-112.
7. Nature Conservancy Annual Report (1958), *p.* 83.
8. REES, W. J. (1955)
'Some Preliminary Observations on the Flora of Derelict Land', *Proc. Birm. Nat Hist. and Phil. Soc., Vol.* XVIII, *Part* V, *pp.* 119-129.
9. Royal Society for the Protection of Birds (1950)
'Bird Protection', Annual Report, *p.* 7.
10. Royal Society for the Protection of Birds (1950-51)
'Bird Notes', *Vol.* XXIV, *No.* 5, *p.* 178.
11. West Midland Bird Club Annual Report (1950) *p.* 4.

APPENDIX I.

FLORA OF BENTLEY PARK WOOD

Near Atherstone, Warwickshire.

Abstracted from 'Flora of Warwickshire' (1891) by J. E. BAGNALL.

It is possible that the flora had altered between Bagnall's time and the coming of opencast mining around 1945. However, the following list gives a good idea what was there. Much of this Oak woodland (*Quercus robur*) has undergone opencast mining resulting in many of the following plants being removed. Some of the northern part, Monk's Park Wood, is now devoted to Conifers.

Nomenclature is as in the Bagnall work, with present names where different. The frequency of the plants was not given: —

Cardamine amara Bitter cress
Brassica rapa Turnip
Lepidium smithii Smiths Cress
Viola reichenbachiana Violet
Lepigonum rubrum = *Spergularia rubra* Sand spurrey
Hypericum dubium St. John's Wort
Oxalis acetosella Wood sorrel
Rubus species Bramble
Peplis portula Water purslane
Circaea lutetiana Enchanters nightshade
Cornus sanguinea Dogwood
Viburnum opulus Guelder rose
Galium saxatile = *G. hercynicum* Heath bedstraw
Asperula oderata Woodruff
Valeriana officinalis Valerian
Arctium minus Burdock
Serratula tinctoria Saw wort
Hieracium species Hawkweed
Vaccinium myrtillus Bilberry
Calluna erica = *C. vulgaris* Ling
Lysimachia nummularia Creeping jenny
L. nemorum Yellow pimpernel
Erythraea centaurium = *Centaurium minus* Centaury
Veronica officinalis Speedwell
Melampyrum pratense Cow wheat
Mentha sativa = *M. xverticillata* Mint
M. arvensis Corn mint
Lamium galeobdolon = *Galeobdolon luteum* Yellow archangel
Teucrium scorodonia Wood sage
Rumex sanguineus Dock
Euphorbia amygdaloides Wood spurge
Salix aurita Sallow
Populus alba Poplar
Neottia nidus-avis Birds nest
Listera ovata Tway blade
Epipactis latifolia = *E. helleborine* (*L*) Crantz. Helleborine

Convallaria majalis Lily of the Valley
Allium ursinum Ramsons
Scilla nutans = *Endymion nonscriptus* Bluebell
Luzula pilosa Hairy woodrush
L. sylvatica Greater woodrush
Carex pendula Pendulous sedge
C. sylvatica Wood sedge
C. pseudo-cyperus Cyperus sedge
Milium effusum Wood millett
Agrostis canina Brown bent grass
A. gigantea Common bent grass
Deschampsia flexuosa Wavy hair grass
Molinia caerulea Moor grass
Melica uniflora Wood melick
Bromus giganteus = *Festuca gigantea* (L) Vill. Tall Brome
Athyrium filix-foemina Lady fern
Lastraea Filix-mas = *Dryopteris filix-mas* (L) *Schott* Male fern
Lastraea spinulosa = *Dryopteris spinulosa* (Müll) *Watt* Narrow buckler
L. dilitata = *Dryopteris austriaca* (Jacq,) *Woynar* Broad buckler
Equisetum maximum = *E. telmateia Ehrh.* Great horsetail
E. sylvaticum wood horsetail
E. limosum = *E. fluviatile L* Water horsetail

Bagnall also listed a number of Mosses, Liverworts, and Fungi as occurring at Bentley Park Wood.

Dr. V. M. Conway, senior botanist of the Nature Conservancy, in June, 1952, found at Bentley Park, *Frangula alnus*, also *Carex pendula* still surviving at a pond—location 42/287 953.

FLORA OF MEREVALE PARK

Near Atherstone

Bagnall specifically recorded the following amongst the Oak-wood flora of Merevale Park: —

Nymphaea alba Water lily
Lepidium smithii Smiths cress
Dipsacus pilosus Small teasel
Arctium intermedium =
A. vulgare (Hill) A. H. Evans. Burdock
Cnicus pratensis =
Cirsium dissectum (L) Hill. Meadow thistle
Lactuca muralis =
Mycelis muralis (L) Rchb. Wall Lettuce
Typha angustifolia Lesser reedmace
Scirpus sylvaticus Wood club rush
Scolopendrium vulgare =
Phyllitis scolopendrium (L) Newm. Harts tongue
Chara vulgaris

APPENDIX II

PLANTS FOUND ON TOPSOIL DUMP OF OPENCAST COAL MINING SITE AT HILL FARM, SHUTTINGTON, 1956-59.

The habitat included a ditch and shallow pond.

Ranunculus acris freq., Buttercup
R. sceleratus occ., Celery leaved buttercup
R. aquatilis ssp peltatus rare, Water buttercup
Sinapis arvensis freq., Wild Mustard
Capsella bursa-pastoris loc. abund., Shepherds purse
Cardamine hirsuta occ., Hairy bittercress
Barbarea vulgaris freq., Winter cress
Nasturtium officinale occ., Water cress
Rorippa amphibia freq., Great yellow cress
Viola tricolor occ., Pansy
Stellaria media loc. abund., Chick weed
S. graminea occ., Stitchwort
Trifolium pratense loc. abund., Red clover
T. repens freq., White clover
T. dubium occ., Lesser yellow trefoil
Lotus corniculatus freq., Birdsfoot trefoil
Polygonum aviculare agg. occ., Knot grass
P. persicaria occ., Persicary
Anagallis arvensis occ., Scarlet pimpernel
Myosotis palustris occ., Water forget-me-not
Plantago lanceolata occ., Narlow leaved plantain
Galium palustre occ., Marsh bedstraw
Senecio vulgaris loc. abund., Groundsel
Tripleurospermum maritimum loc. abund.
Anthemis cotula rare. Stinking mayweed
Cirsium arvense freq., Creeping thistle
Alisma plantago-acquatica occ., Water plantain
Juncus bufonius occ., Toad rush
J. effusus occ. Rush
Glyceria plicata occ. Flote grass
Poa trivialis loc. abund.
Holcus lanatus loc. abund., Yorkshire fog
H. mollis freq., Creeping soft grass
Agrostis tenuis loc. abund., Bent grass
A. stolonifera freq., Fiorin
Alopecurus geniculatus occ., Marsh foxtail

APPENDIX III

NORTH WARWICKSHIRE COLLIERIES AND SLAG-HEAPS

A number of collieries in north Warwickshire have several mine-shafts and multiple slag-heaps. Some are known under alternative names. The collieries underlined are disused.

		6 figure reference	
1.	Amington Colliery	241 035	Now merged into
2.	Alvecote Colliery	247 044	one unit, North
3.	Pooley Hall Colliery	258 034	Warwickshire Colliery.
4.	Glascote Colliery	229 033	
5.	Belgrave Colliery	222 018	(Beauchamp's)
6.	Hockley Hall Colliery	221 005	(Tame Valley)
7.	Birchmore Colliery	250 018	
8.	Whateley Colliery	219 992	
9.	Wilnecote Colliery	228 016	
10.	Hall End Colliery	253 000	(Birch Coppice)
11.	Kingsbury Colliery	251 982	
12.	Dexter Colliery	231 982	
13.	Baddesley Colliery	278 987	
14.	Arley Colliery	286 899	
15.	Ansley Hall Colliery	306 937	
16.	Stockingford Colliery, Galey Common	314 917	
17.	Stockingford Colliery, Whittleford	332 919	
18.	Griff Colliery	348 890	
19.	Newdegate Colliery, Bedworth	335 870	
20.	Foleshill Colliery	375 825	
21.	Binley Colliery	382 771	
22.	Keresley Colliery	322 845	

PUFFIN ISLAND 1959

H. H. CARTER, V. C. SMITH, Department of Natural History,
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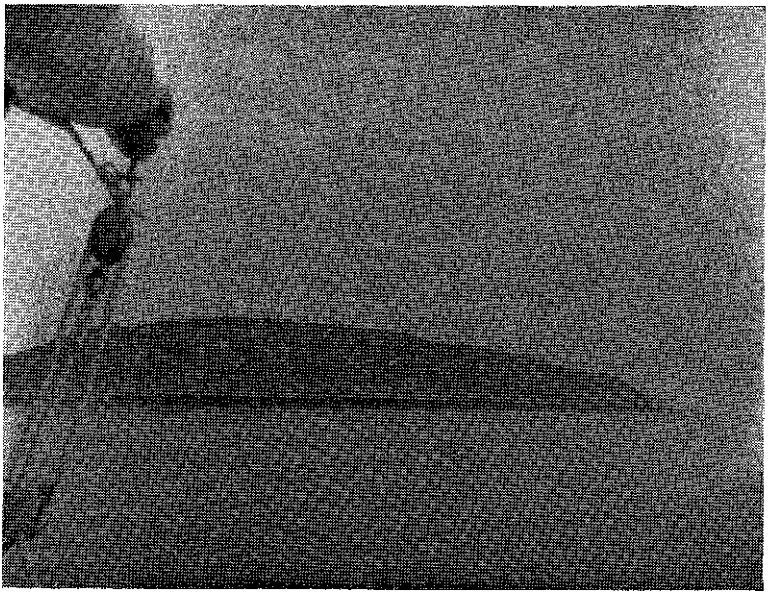
T. F. SPENCE, Birmingham University Medical School.

INTRODUCTORY

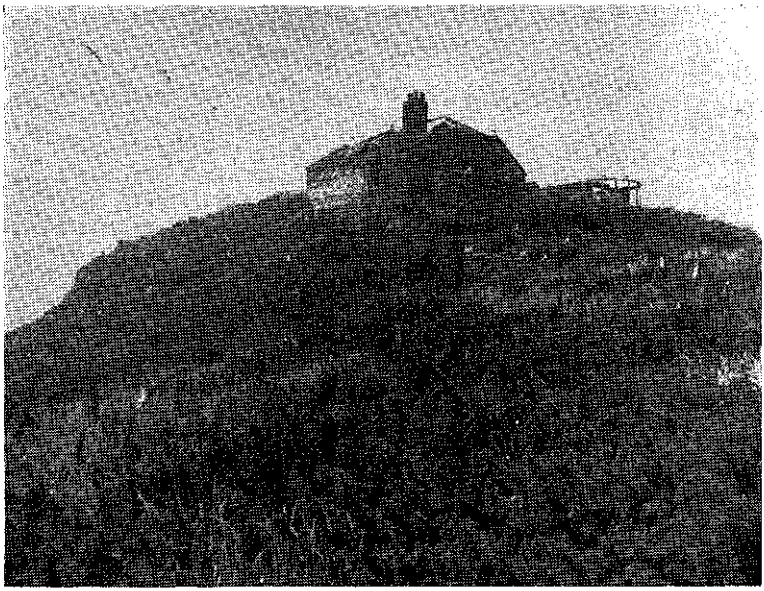
This year's expedition to Puffin Island was mounted jointly by the Birmingham University Medical School and the Natural History Department of the City Museum and Art Gallery. Its objects were twofold, firstly to survey the island's population and ecology, which have undergone several successive changes during the present century, and secondly to make a collection of photographs, recordings and other material to illustrate the contemporary state of affairs in the area.

We occupied the island from July 22 to July 27, 1959. In so brief a period it was of course impossible to obtain a comprehensive picture of the population, and we therefore concentrated our attention on the vertebrates to be found above the high tide mark.

We also found an abundant invertebrate fauna, much richer than we had anticipated, but only a small fraction of this could be secured for subsequent identification. Similarly, a representative but far from exhaustive flora was compiled.



Puffin Island from Menai Straits



The old marine biological station

The birds and mammals, however, our main concern, were amply documented with some 150 photographs, plain and coloured, and a dozen spools of tape recordings.

THE AREA

Puffin Island (Grid Ref. 23/650820) lies half a mile off the coast of Anglesey, near the eastern end of the Menai Straits. The island consists of a tilted block of carboniferous limestone 1,000 yards long and 300 yards across at the widest part. The rock is deeply cracked and jointed, so that the precipitous sides of the block provide innumerable ledges and overhangs to shelter cliff-nesting birds and to daunt the climber. In places they have been undercut by wave action to a depth of several yards along a wide front. Elsewhere, huge masses of cliff have subsided into the sea, leaving small coves overlooking a foreshore piled with rectangular slabs and boulders. At the northern end we found two blow-holes each about three feet in diameter and continuing downwards to an unknown depth, perhaps to sea level, while at the opposite extremity there was plentiful evidence of recent falls of rock.

The upper surface of the island follows the dip of the beds, being inclined to the north-west at an angle of 10° so that hardly a square yard could be described as level. Both of the two deserted buildings were on artificially levelled sites.

Tape recording

The older of the two is a 13th century tower surrounded by the remains of an earlier monastic establishment, which remained in use at least until 1555. This is in the centre of the island. At the north-east end stand the ruins of a telegraph station set up in 1841. This became disused in 1863, but was occupied from 1887 to 1893 as a biological station. On the Ordnance Survey maps a well is shown nearby, but of this we found no trace remaining, and we depended entirely on what we brought with us for food, water and shelter. All stores had to be ferried ashore by rowing boat and carried up a cliff path and a steep grassy slope to our camp site. These considerations necessarily imposed a limit on the amount of scientific and technical equipment we could bring.

EQUIPMENT AND METHODS

The largest single item was an E.M.I. L.2b battery-operated tape recorder with its ancillary equipment. This included a microphone, 60 ft. of co-axial cable, stethoscope-type earphones and battery set. This was specially made for the occasion, as the U.2 cells which the L.2b recorder is designed to use have a very short working life of 45 mins. and replacements could not of course be obtained in the field. Instead we employed a set of 13 rechargeable NIFE 1.28v. zinc-iron cells arranged in series to supply, through appropriate resistances, 3v. to the valves and 12v. to the motor. These cells

were permanently connected up in a box screened with sheet aluminium to prevent interference, and fitted with a webbing sling for easy carriage. This gave a working life of twelve hours continuous running under test, and proved entirely satisfactory under field conditions. 3¼″ reels of tape were found to be the most convenient size for our purpose.

Some difficulty was experienced in obtaining satisfactory recordings of other species owing to the continuous background of noise from the very numerous Herring Gulls (*Larus argentatus, Pontop.*) It was found that by setting up the microphone within ten feet of the subject and reducing the gain setting on the recorder to four or below, good results could be achieved. Under these conditions we found that gulls more than 20 feet from the microphone were not recorded. The quieter species, however, and in particular the Puffins (*Fratercula arctica* L.) could only be received at very close ranges, not more than three or four feet. We found it possible, by a discreet approach, to get within such a distance of a Puffin while holding the microphone, and indeed the only Puffin sounds we were able to record were the growls of protest emitted when the interviewer came within arm's length.

With more nervous species this was out of the question, and the microphone had to be wrapped in a drab-coloured duster and left near a nest-site or other likely spot until the desired birds came close enough to be audible to the machine. While this was actually running, it was only necessary to observe the needle of the voltmeter, which was deflected into the operating range each time a sound was recorded. At other times we had to rely on our own hearing, or on visual observation of the bird's bill and throat. Shags (*Phalacrocorax aristotelis* L.) were particularly difficult subjects and refused to settle anywhere near the recorder operator. The closest distance to which they would approach considerably exceeded the length of the microphone cable and even when settled their utterances were few, short and largely unpredictable. A wholly disproportionate amount of time and tape was consumed in obtaining the few satisfactory recordings of these birds, which were made by "planting" the wrapped microphone close to an inaccessible group of nests halfway up an almost sheer cliff while the recorder was operated from a position at the foot of the cliff and out of sight. The birds could then be observed as they flew in off the sea and the recorder switched on as they were about to land. At such a moment they were more likely to utter one of their occasional croaks than at any other time.

Other bolder species, such as the Kittiwakes (*Rissa tridactyla* L.) could be provoked into more frequent utterance by hat-waving and similar menacing gestures which if applied to the Shags would have caused the precipitate departure of the whole colony in silent panic.

Some wholly inaccessible sites on overhanging faces could be reached by lowering from above. For this purpose the expedition's

Herring Gulls

climbing rope was used to reinforce the cable of the microphone, the accurate location of which was ensured by watching with binoculars from some point of vantage to seaward. The sudden appearance of a dangling object a few feet away seemed to cause the birds little concern, but unfortunately such sites were found to be very exposed to air currents, and wind noise spoiled many recordings.

The expedition carried two official cameras, a 35mm. Finetta, used mainly for colour photographs, and a Leica equipped with a 13.5cm. long-focus lens. This was found essential for the shyer subjects such as Shags, Cormorants (P. carbo L.) and Grey Seals (*Halichoerus grypus* F.) which would not tolerate a close approach. The relatively high shutter speeds obtainable with the Leica enabled us to photograph birds in flight, although the wing-tips of Puffins, Guillemots (*Uria aalge, Pontop.*) and Razorbills (*Alca torda* L.) were not entirely "frozen". Many photographs of these species were taken from positions on the cliff-edge near their nesting sites. The birds would fly into land, hesitate for a moment on seeing us, and swing out to sea again. They would then describe a wide semi-circle and return to repeat the performance with such exactitude that a camera could be trained in readiness to pick them up on their next circuit, while an observer with a field of vision unrestricted by a viewfinder gave warning of their approach and of the momentary loss of speed which gave the best chance of a photo-

graph. The main difficulty experienced was in connection with focusing, since ranges were so close that a difference of a few feet in the bird's path on successive circuits was critical.

Six Longworth traps for small mammals were set and baited with oatmeal, but nothing was taken, nor did we find any trace of land mammals other than rabbits.

The equipment for the collection of invertebrates was intended primarily for spiders, and we did not expect to find a large population of winged insects on a small wind-swept island over-run with birds. We took with us only a sweep-net, collecting tubes and a bottle containing a modification of Oudeman's Solution, which was used to kill and preserve all specimens other than Lepidoptera. We had also for general use a number of plastic bags and a small quantity of formaldehyde 40%, but this we used only for jellyfish, diluting it with sea water.

Botanical material was pressed and dried in the usual way. Another item of scientific equipment was a prismatic compass which enabled us to plot with some accuracy the positions of our various finds.

ECOLOGY

The most fundamental influence affecting the whole of this rich and varied population is geological. The structure of the island has already been described, and is derived immediately from the nature of the rock composing it. Furthermore, this rather pure carboniferous limestone yields only a thin layer of light though fertile soil on weathering, so that after rainfall most of the surface water seeps rapidly away through the crevices of the limestone. These features, together with its small size, have rendered it unattractive to man and the other larger mammals, so that to outward appearance at least the birds are now the dominant animal form. However, we hope to show that this appearance, if not wholly deceptive, is only partially true.

Aspden drew attention to the profound effects of the presence or absence of certain mammals on the life of the island (Aspden, 1928). In 1816 or 1817 rats came ashore and greatly reduced the Puffins which later recovered. Prior to 1892 a herd of goats kept the coarser plants under control, and Alexanders (*Smyrnium olusatrum*) was confined to the south-west corner, where the remains of a walled patch of cultivation are still to be seen. In 1927 when Aspden visited the island this plant covered half the upper surface. In 1959 it occurs throughout the island and is especially dense along the northern coast. This area was formerly a grassy slope inhabited by Puffins, which Aspden saw killing Gull chicks which blundered into their burrows while making their way seaward from the Gull territories further inland.

"Alice"

It thus appears that the Puffins were well able to defend themselves against direct competition from Gulls, but the more insidious invasion of their breeding grounds by Alexanders has drastically reduced them. They are now dependent for their continued survival and for the possibility of future expansion on another mammal, the Rabbit (*Oryctolagus cuniculus*). Rabbits were present in 1890, and exploited commercially. There are now perhaps a dozen of these animals on the island. Five of these we were able to recognise as individuals by their markings or behaviour. These were an albino (named by us 'Alice,' but sex not determined), a liver-brown (Harvey), a black and white, a large wild-coloured rabbit with black markings about the muzzle, and a small shy wild-coloured one whose 'burrow' was a mere crevice between two limestone blocks, less than 3′ long, open above and at both ends, but screened by vegetation. These animals formed a small colony near our camp site, and another colony existed further along the north coast. In each case Alexanders are sparse and Puffins common near the burrow.

The other locality for Puffins is on the very limited area of the Chickweed slopes towards the north-east end.

Aspden also mentions the presence of a fox (*Vulpes vulpes*) on the island, which in the year it was there brought about a marked reduction in the numbers of Herring Gulls, which, however, soon

returned. The following is a table showing the status of birds mentioned by Aspden as compared with their status in 1959. Some of this information is derived from an unpublished communication from Dr. Hobbs who visited the island in June, 1959.

SPECIES	1927	1959
Phalacrocorax carbo	6 prs. at foot of W. cliff	Common along N. coast.
P. *aristotelis*	Scarce but regular	80—100
Haematopus ostralegus	6—8 prs.	4 prs.—1 bred
Tadorna tadorna	Variable, along cliff top	None seen
Larus marinus	Visitor (has nested twice)	13 prs.
L. *fuscus*	—	c,30 prs.
L. *argentatus*	Abundant, increasing	c.25,000 prs.
Rissa tridactyla	24 prs.	30 prs.
Alca torda	Common all round coast	c.650 N. coast, fewer on S.
Uria aalge	On west cliffs	Common on S. coast, 40 N.E. end, 18 S.E. Side
Fratercula arctica	Common, decreasing	240 N. side
Columba palumbus	—	2
C. *oenas*	2—3 prs.	None seen
Corvus monedula	Small colony S.E. corner	Flock of 20
C. *corax*	A few, resident	Not seen
Sturnus vulgaris	A few prs. in the ruins	Not seen, 180 roosting
Parus coeruleus	—	One at telegraph stn.
Troglodytes troglodytes	—	2 prs.
Turdus merula	1 nest	1 pr.
T. *ericetorum*	3 nests	1 pr.
Oenanthe oenanthe	Not numerous	Not seen
Prunella modularis	Not since 1910	2 prs.
Anthus spinoletta	Common	7 prs.
A. *pratensis*	Common, decreasing	None seen
Motacilla alba	—	One, casual

In general, the cliff nesting species have maintained or slightly improved their position. The two *Phalacrocoracidae* are a notable exception, and for this we are unable to offer any explanation. It may be that these very wary species have profited from the policy of the island's owner in treating it as a nature reserve, and restricting human interference to a minimum. Alternatively, some change in the unseen population of the surrounding seas may have benefited them, as they are underwater fishfeeders.

The ground-nesters of the top of the island show a different picture. Here there has been an overall loss of the birds of open spaces (e.g. *A. pratensis, O. oenanthe*) and shores (*T. tadorna, H. ostralegus*) in favour of species of dense cover and undergrowth

(*T. troglodytes, P. modularis*). *L. fuscus* not mentioned by Aspden, though not normally associated with these, was found nesting freely in the densest stands of Alexanders and may well have been encouraged by its spread. The Ravens (*C. corax*) have evidently been replaced as scavengers by *L. marinus*. We found numerous disembowelled carcases of Gull chicks but no evidence of predation on Puffins.

Indeed, the ground was littered with dead chicks of various ages, most of them uneaten. Unfortunately most of them were too far decomposed for a post-mortem to be practicable. However we witnessed many vicious attacks on wandering chicks by adults through whose territory they were passing, and we found many corpses and one still living chick which were swarming with blow-fly maggots. *Calliphora erythrocephala* and *Lucilia caesar* are both very abundant. It seems feasible that there is a mechanism controlling the maximum density of Gulls, thus: the greater the degree of overcrowding, the greater the probability of a chick receiving a crippling injury and succumbing to *L. marinus* or (more probably) to *myiasis*, and the lower the rate of successful reproduction. (For an alternative interpretation of this behaviour, see Fisher and Lockley, 1954).

Side by side with the effect of the vegetation on the birds, there has probably been a reciprocal effect, but this cannot be established because of the lack of earlier records of the flora. At present, however, the plants seem to fall into five categories:—

Indigenous	e.g. Grasses, Sedum
Wind-borne seeds	„ Compositae, Epilobium
Cultivated escapes	„ Smyrnium, Iris
Ruderals	„ Urtica, Arctium, Plantago
Bird-eaten seeds	„ Sambucus, Fragaria, Cereals

Of these, the third and fourth groups owe their presence to a mammal (Man) and the fifth to the bird population. But a more important effect has been the encouragement of the rank nitrogen-loving escapes and ruderals and the discouragement of the more delicate plants by the heavy-footed Gulls. Alexanders, the most successful plant on the island, is a biennial with a stout woody tap-root, able to accumulate reserves after the breeding season is over and shoot up rapidly in early spring before the Gulls return.

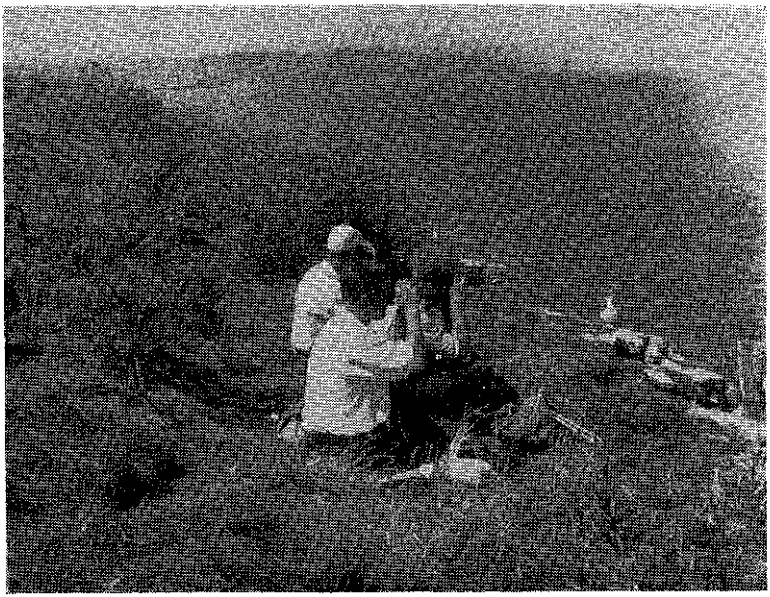
BEHAVIOUR

The behaviour of the birds on the island is centred on the possession of territory. From visual observation it appeared that Gull territories were on the average about ten yards square, and the incidence of attacks from territory owners, who could often be recognised by species or individual behaviour, confirmed this estimate. The density was fairly uniform all over the top and slopes, and was used to calculate the figure suggested for breeding pairs of Herring Gulls. The adult birds, at any rate by the end of the season, seem

to recognise and respect one another's territory—not so the younger birds, who wandered, usually downhill and consequently seaward, into adjacent territories, provoking the attacks mentioned above. It was the youngsters, too, who occasionally showed aggressiveness towards smaller birds of other species (e.g. Guillemots).

The adult birds invariably attacked the wanderers on foot and not from the air. By contrast, gulls on the ground retreated from intruding humans, and attacked us from the air if at all. The three *Larus spp.* were about equally aggressive, and any specific differences were well inside the range of individual variation within species. Methods of attack varied considerably. Most birds would swoop down from a height of some 20 feet to close their target to within three or four feet, at the same time uttering a distinctive scream. Some individuals habitually supplemented this with a stream of excrement, and a few bolder spirits would swoop by within inches of our heads. On several occasions we were struck with force enough to raise a lump on our scalps, by each of the three *Larus spp.* Attacks from behind alternated with those from in front as the bird oscillated overhead, but we were seldom assailed in flank. It was the attacks from behind which raised the lumps; birds approaching us face to face never came so close. Threatening gestures on our part, or the throwing of small objects, would avert actual contact but attacks would continue to be made. We found two procedures which would put a stop to the offensive. One was to stand still, or better still to sit or lie down. The other was to erect a stalk of Alexanders above the level of one's head. The rabbits too had evolved their own counter-measures. We only once saw them put into effect, for they were able to wander at will through the gull territories unmolested for the most part. On the one occasion when a gull did venture to attack, the rabbit stopped and lashed out skyward with its hind legs. The attack was not repeated. Before the end of our stay, the birds were already adapting themselves to our presence. The camp site was quickly recognised as our territory, and the gulls which occupied it before our arrival were dispossessed. Little notice was taken of our presence or activities within the camp area. By the end of our stay, the path leading up from the landing place was also conceded to us, and a particularly aggressive Herring Gull which commanded one stretch of it allowed us to pass unmolested. For the first four days of our stay this bird never failed to put in three successive attacks on anybody passing through, by the end of which they would have crossed his boundaries. The Kittiwakes, despite their reputation, never molested us although we passed close to their nesting sites when young were present.

The rabbits were much more amicable, and in consideration of a suitable gift of food would allow us to handle them freely. By the time we left, they would come loping towards us as we went past the burrows, expecting to be fed from our dwindling supplies.



Observation Post

ACKNOWLEDGMENTS

Our acknowledgments and thanks are due in the first place to Dr. J. T. Hobbs of the Dept. of Anatomy at Birmingham University. His extensive knowledge of the island, acquired on numerous visits over a long period of years, was of the greatest value to us, and only an unfortunate accident prevented him from leading the expedition on this occasion. We hope that in the near future he will publish a full account of its natural history, which he is uniquely qualified to write, beside which this paper will take its place simply as an interim report.

We also wish to express our obligation to Sir Richard Williams-Bulkeley, the owner of Puffin Island, and his agent for their kind permission to occupy it and to collect some of the fauna and flora; to Mr. J. D. Macdonald and Mr. Izzard of the British Museum (Natural History), (Bird skull and Hemiptera), Mr. Cartwright Timms (Diptera), Mr. Osbourn of the Hope Dept. of Entomology, Oxford University Museum (Coleoptera) and Dr. J. D. Hawkes of the Dept. of Botany, Birmingham University (Plants) for their assistance with the identification of specimens; and to the University and City Museum authorities who provided funds and equipment, and without whose encouragement the expedition could not have been undertaken.

BIBLIOGRAPHY

LMBA Annual reports of the Liverpool Marine Biological Association, 1888-1891.

PIBS Biennial reports of the Puffin Islands Biological Station, 1892-1897.

Aspden, 1928, in British Birds, Vol. XXII.

Fisher & Lockley, Seabirds (New Naturalist 1954) No. 28. pp. 239-250.

SUMMARY

The objects of the expedition to record and photograph the vertebrates of Puffin Island and note any changes in the population are outlined. The position and salient features of the island are described. An account of the methods and equipment employed is given. The animals and plants encountered are listed. The ecology of the island is briefly discussed with reference to earlier work. Some observations on behaviour are recorded.

SPECIES LIST

The following is a list of the animals and plants **taken** or **seen.**

KEY

N Not recorded 1888—1892
P Photographed 1959
R Recorded on tape 1959
S Sight record 1959
T Taken in 1959

COELENTERATA			
Scyphozoa	*Cyanea capillata*	Common all round the shore	S
	Chrysaora hyoscella	Abundant	T
Anthozoa	*Actinia equina*	One in rock pool	S
ANNELIDA			
Oligochaeta	*sp. indet.*	One under stone	S
MOLLUSCA			
Gastropoda	*Helix aspersa*	Very abundant on top of island	S
	Littorina littorea	Abundant among seaweed	S
	Patella vulgata	Common	S
ARTHROPODA			
Arachnida	*Araneus diadematus*	Common	T
	A. cornutus	Abundant	T
	A. adiantus	One	T
	Misumena vatia	Locally common	T
	Phalangium opilio	Abundant	T
	Mite, sp. indet	Parasitic on Calocoris (Hemiptera)	T

Crustacea	*Carcinus maenas*	Among seaweed	S
	Balanus balanoides	Very abundant on rocks	S
	Ligia oceanica	Abundant at high water mark	T
	Oniscus asellus	Abundant. One with young in pouch	T
	Armadillidium vulgare	One	T
Chilopoda	*sp. indet*	One	S
INSECTA			
Collembola	*app. indet*	Abundant	S
Dermaptera	*Forficula auricularia*	Abundant	T
		Not uncommon	T
Hemiptera	*Calocoris norvegicus*	Abundant in Smyrnium and Urtica	T
	Lygus pratensis		
	Liocoris tripustulatus	Abundant in northern half	T
	Plagiognathus arbustorum	One	T
	Philaenus leucophthalmus	Common	T
	Aphrodes bicinctus	Abundant	T
	Euscelis lineolata	One	T
	Cicadella aurata	Three	T
Lepidoptera	*Xylophasia monoglypha*	One	T
	Euxoa cursoria	Two larvae	T
	small Noctuids (?*sp.*)	Common at south-west end	S
	Plusia gamma	Common	T
	various Micro-leps	Common in long grass at north end	S
	Vanessa atalanta	Common	T
	Aglais urticae	Three	T
	Pieris brassicae	Common	T
	P. rapae	Several wasted specimens flew in on 25th July	T
Coleoptera	*Notiophilus biguttatus*	One	T
	Feromia madida	Three	T
	Tachyporus hypnorum	One	T
	Tachinus rufipes	One	T
	Rhagonycha fulva	One	T
	Brachypterus glaber	Abundant on flowers of Compositae	T
	Rhyzobius litura	Several	T

Hymenoptera	*Myrmica ruginodis*	Abundant	T
	Lasius alienus	Common	T
	Vespula sylvestris	One male	T
	Bombus lucorum	Common at south-west end	T
	Ichneumonoidea (?*sp.*)	Several	S
Diptera	*Tipula sp.*	Two	S
	Haematopota pluvialis	Two	T
	Lathyrophthalmus aeneus	Common at south-west end	T
	Syrphellus venustus	Several	T
	Madiza glabra	One	T
	Exorista erucarum	One	T
	Calliphora erythrocephala	Very abundant	T
	Lucilia caesar	Very abundant	T
	Cordyluridae (?*sp.*)	A few	S
	Hippoboscidae (?*sp.*)	One	S

CHORDATA

Pisces—none taken by us, but boats off shore were taking Mackerel (*Scomber scombrus*)

	Muraena anguilla	Dead—? brought ashore by birds	
Aves	*Phalacrocorax carbo*	Not uncommon	S.P.
	P. aristotelis	30—40	S.R.P.
	Haematopus ostralegus	Two pairs	S.R.P.
	Calidris or Tringa sp.	One	S
	Larus marinus	13 pairs	S.R.P.
	L. argentatus	c.3,000 breeding pairs	S.R.P.
	L. fuscus	c.30 breeding pairs	S.P.
	Rissa tridactyla	c.20 breeding pairs	S.R.P.
	Sterna hirundo	Two—not breeding on island	S
	Alca torda	Common all round coast	S.R.P.
	Uria aalge	Locally common	S.R.P.
	Fratercula arctica	30-40, mainly N.W. coast	S.R.P.
	Columba palumbus	Twice seen	S
	Carrier pigeon	Two, one ringed	S
	Corvus monedula	c.20	S
	Parus coeruleus	One	S
	Troglodytes troglodytes	One (? Two) prs.	S.R.
	Turdus merula	One pr.	S
	Prunella modularis	Two prs., one nestling	S

	Anthus spinoletta	c.7 prs.	S.R.
	Motacilla alba	One	?
	Sturnus vulgaris	c.180 roosting in Elders	S
Mammalia	*Oryctolagus cuniculus*	5 recognisable, probably more	S.P.
	Halichoerus grypus	12	S.R.P.
FLORA			
Ranunculaceae	*Ranunculus repens*	Fairly common	T
Cruciferae	*Capsella bursa-pastoris*	Fairly common	TN
	Sisymbrium officinale	A few	TN
Caryophyllaceae	*Stellaria media*	Locally common, N. slopes	TN
	Spergularia rupicola	Common on cliff-tops and sides	TN
Chenopodiaceae	*Chenopodium album agg.*	At foot of cliffs	T
	Beta maritima	Not common	T
Papilionaceae	*Trifolium repens*	Not common	T
Rosaceae	*Fragaria vesca*	3-4 scattered nr. camp site	TN
Onagraceae	*Epilobium hirsutum*	V. local nr. tower	TN
Araliaceae	*Hedera helix*	Local, on old garden wall	T
Umbelliferae	*Smyrnium olusatrum*	Dominant on top of island	T
	Conium maculatum (?)	Rare, stunted	T
Polygonaceae	*Polygonum persicaria*	Common	TN
	Rumex crispus	Common	T
Urticaceae	*Parietaria diffusa*	Common in N.E. half	T
	Urtica dioica	Abundant	T
Plumbaginaceae	*Armeria maritima*	Fairly common	T
Labiatae	*Echium vulgare*	A few nr. Telegraph Station	TN
	Glechoma hederacea (?)	Not common, S.W. end (No fl.)	T
	Teucrium scorodonium	Fairly common	T
Plantaginaceae	*Plantago lanceolata*	Fairly common	T
Caprifoliaceae	*Sambucus niger*	Abundant on crest of island	T
Dipsacaceae	*Dipsacus fullonum*	Abundant on S.W. slope	T
Compositae	*Senecio jacobaea*	Common and widespread	T
	S. vulgaris	Not common	TN
	Bellis perennis	Not common	T
	Matricaria maritima	Common	TN
	M. Matricarioides	Common	TN

	Arctium minus	Abundant on S.W. slope	TN
	Artemisia vulgaris	A few	TN
	Cirsium vulgare	Common	T
	Centaurea nigra	Not common	TN
	Sonchus asper	Fairly common	TN
	Taraxacum officinalis agg.	Common	T
	Crepis capillaris	Fairly common	TN
Iridaceae	*Iris foetidissima*	Locally common	TN
Araceae	*Arum maculatum*	Common	
Gramineae	*Lolium perenne*	Abundant	TN
	Dactylis glomerata	Abundant	TN
	Hordeum murinum	Abundant	TN
	H. sativum	A few	TN
	Avena sativa	A few	TN
	Holcus lanatus	Abundant	T
	Agrostis stolonifera	Abundant	TN

The greatest discrimination was exercised in collecting in order to minimise any disturbance of the ecology. In no case were more than four specimens taken of any species, and not more than one of any species considered to be less than "common." In no case were any of the less common plants uprooted, care being taken to remove only sufficient material for identification.

Objects found at gulls' nests and feeding places, at least 50 ft. above high water mark.

Claws and carapaces of crabs	Common
Shells of Mollusca:—*Helix aspersa*	Abundant
Cepaea sp.	Abundant
Buccinum	Common
Patella	Common
Ensis	A few
Mytilus	Abundant
Cardium	Common
Ostraea	Common
Donax	Common
Tellina	Abundant
Fish vertebrae and other bones	Common
Heads and feet of poultry	A few
Skulls of domestic fowl	Common
Rabbits scapulae and other bones	Common

Various mammalian bone fragments, some large (perhaps disinterred from graveyard on island)	Common
Bottle tops	Common
Teats from babies' bottles	A few
Waxed paper	Common
Regurgitated textiles	One
Expedition's documents (mangled but legible)	One
Plastic doll's shoe	One

RICHARD CHARLES L'ESTRANGE BURGES

1900—1959

The untimely closing of Dr. Burges' life leaves a very big gap in the affairs of our Society for we lose a warm-hearted friend, a thoughtful councillor and a good administrator. In deploring our own loss we must remember first our sympathy for his wife and son for whom the end came with such unhappy suddenness.

It is as a botanist that we specially think of him, but his reputation as a leading personality in other spheres is known to many of us. In his profession his skill was recognised both in his general medical practice and in the various official appointments which he held. As Chairman of the Birmingham Division of the British Medical Association, he gave it invaluable service during a very difficult period. In the field of sport too he attained unusual distinction. He played Rugby Football for his school, then for Caius College, Cambridge, and for the Old Edwardians and the North Midlands, and he played tennis for the Edgbaston Lawn Tennis Club, of which he was Chairman from 1950—1955, and for the County, for several years.

Interested in plants since his schooldays at King Edwards' New Street, where he and I were friendly rivals for the annual "Collection of Plants" Prize, Dick Burges rose to become one of the outstanding field botanists of the day. In 1931 he joined the Botanical Society of the British Isles and in 1939 he was elected to the Fellowship of the Linnean Society of London. It was in the former society that his chief public work for Botany was done. He contributed to its Reports, served on its council and Committees and was this year elected a Vice-President.

His ability as a field-botanist was based on those faculties of close observation and keen perception, which served him well in his profession, coupled with a remarkably good memory. These attributes enabled him, without hesitation, to compare species from one locality with those from any other he had visited; to recall the characters and autecology of any plant under discussion, or to advise the less experienced just where or what to seek. His knowledge of Midland Botany was encyclopaedic. He had paid visits, often many, to all the important botanical localities in Great Britain, Ireland and the Channel Isles, and latterley had made expeditions to the Alps, Southern France and the Pyrenees.

There were very few native plants in Britain which he had not seen *in situ*, but to this general knowledge he added an enthusiasm for alien species (B.E.C. Report 1943 "The adventive flora of Burton-on Trent") and he had a keen appreciation for the smaller characteristics which separate the critical species of various genera. (Euphrasia, Hieracium and Potamogeton to name but three of his special interests).

His insistence of the finer points of difference resulted in the recognition of *Alisma gramineum* from Westwood Park, Nr. Droitwich, as a distinct British species, and his field-work in various parts of the British Isles assisted in the clearing up of other problems.

Dick Burges had belonged to our Society for 25 years, more than half of which as a Council Member and was President during the years 1955 and 1956. The Botanical Section particularly owes him a very great deal. He was its Chairman during the formative years following seperation from the old Biological Section in 1946, and from the outset gave a lead in the survey of the Bombed-site Plants in Birmingham (B.N.H. & P.S. Proceedings 1947). His memory and our perpetual gratefulness to him will be preserved for future generations by the bequest to us of his Herbarium and Library.

Botanists and others—young and old—have always been accustomed to turn to him for the advice and help he so readily and generously gave. A measure of our present loss is the frequency with which we have said at our meetings "There's Dr. Burges, let's ask him" or "If Dr. Burges were here, he would know". Alas, it can only be the latter thought which must henceforth be in our minds.

CLAUDE E. A. ANDREWS.