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L. Parmenter and C. N. Colyer who identified the flies, and supplied the quotations from Séguy and Bouché.

## The Mammals and Birds of Highams Park.

By D. G. TUCKER.

### 1. Introduction.

This report describes very briefly some intensive observational work on the mammals and birds of Highams Park, Epping Forest, carried out by the author from December 1945 to August 1946. The object of the work was twofold:—(a) To obtain some consistent scientific data with which to test and establish the theoretical analytical work on population statistics described in the author's paper published on pp. 42-55 above, and (b) to record, for the Epping Forest Survey, particulars of a part of the Forest about which little appears to have been published previously, and which was, during the period stated, very accessible to the author.

In all, about 50 visits were made to the Park. These were well distributed throughout the period. On 28 visits a systematic count of the birds observed was taken. These counts are in every way consistent, being of constant duration (45 minutes  $\pm$  5 mins.) and always on the same route. The time of day, weather, number of human visitors in the Park, etc., were, of course, not constant, but were noted in the hope of obtaining some correlation between these factors and the bird numbers. The observations on the mammals were not planned in this way, but the numbers concerned were in any case too small for such a procedure to have any value.

In this report only the simplest possible analysis of the results is given in order that it should remain readable and intelligible to the general naturalist. But the full results are available for inspection on request.

### 2. Description of the Park.

Highams Park is an integral part of Epping Forest, but is not quite natural in its physical features and its vegetation; until 1891 it was a private park, and the lake in it was dug as a fish-pond. The vegetation includes some exotic species and others which cannot be considered normal Epping Forest species. But in spite of this, it is an important link in the somewhat irregular sequence of woods and open spaces which comprise the southern part of Epping Forest. It joins the dense oak-woods near the Woodford-Walthamstow urban boundary to the open heathy grassland of the Woodford Golf Links, which in turn leads into the extensive woodlands of the central part of the Forest.

The area considered in this report is shown on the accompanying map, and comprises the narrow strip, about 200 yards wide, running between The Charter Road and Chingford Lane, a length of about 1000 yards; about 30 acres is thus included. The lake covers roughly 6 acres, there is about 6 acres of open grassland, and the remaining 18 acres are





Park and on domesticated mammals are also appended to the Table for completeness. These latter cover 28 special visits for bird counts, corresponding to about 20 hours observation over a wide variety of time, climatic and seasonal conditions; the average numbers per hour therefore form a fairly reliable index of the population throughout the year, with probably a bias in favour of the week-end figures. These averages work out to be about 150 human beings and 13 dogs per hour.

TABLE 1. MAMMALS.

Species.	No. of Records.		
	Winter.	Spring.	Total.
Water Vole ( <i>Arvicola a. amphibius</i> (L.))	40	3	43
Grey Squirrel ( <i>Sciurus carolinensis</i> Gm.)	10	6	16
Brown Rat ( <i>Rattus norvegicus</i> Erxleben)	2	2	4
Red Squirrel ( <i>Sciurus vulgaris</i> L. ? subsp.)	1	1	2
Long-tailed Field-Mouse ( <i>Apodemus s. sylvaticus</i> L.)	0	2	2
Bat (unidentified species)	2	0	2
Also (recorded on bird counts only):			
Human Beings	916	2155	3071
Dogs	179	86	265
Horses	0	12	12
Cats	0	3	3

Cattle also stray into the Park from time to time.

#### 4. The Birds.

As stated in the introduction, the object of the observation of the bird population was partly to establish certain theoretical work on the logarithmic series and index of diversity. In the present report, this aspect of the work is ignored.

Apart from casual observation, the system adopted was to walk through the Park from south to north, in the woodland area and, in parts, alongside the lake, and to return along the eastern side, which is predominantly open grassland. The walks had a duration of about 45 minutes, and all birds observed were recorded, as individuals and species. During the winter period, when there was no foliage, only visual observation was employed, but during the spring an attempt was made to compensate for the reduced visual conspicuousness due to the foliage by including auditory observation as well. It is, of course, quite impossible at present to make any real allowance for variable conspicuousness, but this is an aspect of quantitative work which has been frequently emphasized and on which much work is urgently required.

In addition to the number of individual birds and the number of species observed, a record was made of other factors, such as weather, time of day, number of human visitors and dogs, etc. An attempt was made to cover as wide and complete a range of conditions as possible, and that this was effected is evident from the tables which follow.

Lists of the bird species recorded, arranged in order of frequency of observation, are presented in Tables 2 and 3, covering winter (December to March) and spring (April to June) respectively. A summary of the 28 counts, on a basis of number of birds and number of species, is given in Table 4, where particulars of the other (environmental) factors are also entered. It must be emphasized that house-sparrows are excluded

TABLE 2. BIRDS IN ORDER OF FREQUENCY (WINTER).

TABLE 3. BIRDS IN ORDER OF FREQUENCY (SPRING).

Species.	Average No. per Count.	Species.	Average No. per Count.
Wood-Pigeon (380)	17.3	Starling (14)	9.8
Chaffinch (40-41)	13.2	†Chaffinch (40-41)	9.6
Great Tit (97-98)	11.3	†Greenfinch (19)	8.3
Greenfinch (19)	10.2	Great Tit (98)	5.8
Blackbird (184)	6.7	Blue Tit (100)	5.7
Blue Tit (99-100)	5.9	Blackbird (184)	5.4
[Gulls (478, 481-486) flying over	5.3]	Robin (208)	3.3
Fieldfare (173)	4.2	Wood-Pigeon (380)	3.0
Mistle-Thrush (174)		*Chaffinch (40-41)	3.0
Song-Thrush (175, 177)	(together)	*Greenfinch (19)	3.0
Redwing (178, 179)	3.4	Mallard (317)	1.7
Starling (14)		Song-Thrush (175)	1.6
Mallard (317)	3.2	Willow-Warbler (132)	1.3
Robin (207, 208)	2.6	Wren (213)	0.8
Rook (4)	1.6	Mistle-Thrush (174)	0.5
Carrion-Crow (3)	(together)	Jackdaw (5)	0.4
Moorhen (570)	1.2	House-Martin (222)	0.3
Tufted Duck (330)	0.94	Tree-Creeper (93)	0.2
Coal-Tit (102)	0.83	Carrion-Crow (3)	0.2
Jay (10-11)	0.67	Swift (225)	0.2
Hawfinch (18)	0.67	Marsh-Tit (107)	0.2
Long-tailed Tit (111)	0.67	Jay (11)	0.1
Brambling (42)	0.55	Bullfinch (33)	0.1
Jackdaw (5)	0.42	Long-tailed Tit (111)	0.1
Marsh-Tit (107)	0.33	Chiffchaff (129)	0.1
Wren (213)	0.26	Hedge-Sparrow (211)	0.1
Tree-Creeper (93)	0.17	Lesser Spotted Woodpecker (238)	0.1
Great Spotted Woodpecker (236, 237)	0.17	Kestrel (263)	0.1
Hedge-Sparrow (210, 211)	0.05	Moorhen (510)	0.1
Green Woodpecker (235)	0.05	Also recorded, but not on counts:—	
Kestrel (263)	0.05	Coal-Tit (102).	
Also recorded, but not on counts:—		Great Spotted Woodpecker (237).	
Goldfinch (20).		Cuckoo (240).	
Tawny Owl (253).		Mute Swan (302).	

N.B.—Numbers in brackets following each species refer to Witherby's 'Check-List of British Birds' (1941), where scientific names will be found. House-Sparrows (61) omitted from all counts.

† including April. \* excluding April.

from all these results; they are very numerous in Highams Park, especially in winter, and were so often too numerous to count (upwards of 100) that there was no alternative to their exclusion. Whether or not they represent an important ecological factor is difficult to say; they do not nest in the Park, but in the built-up parts adjacent to it; they feed in the Park, but as it is unlikely that food is a limiting factor in the bird population, this may not have much influence on the rest of the bird species.

In Tables 5, 6 and 7 an attempt is made to see what correlation exists among the various factors involved. Table 5 considers the effect of the human population in the Park. It was thought that when fewer than 20 people were seen in the course of a count, conditions could reasonably



TABLE 4. STATISTICAL SUMMARY OF BIRD COUNTS.

Date.	No. of Birds.	No. of Species.	No. of Humans.	No. of Dogs.	Temp.	Weather.			Time of day (G.M.T.).
						Sun.	Rain.	Wind.	
25.12.45	55	9	26	7	W	S	D	—	Noon.
26.12.45	74	11	96	12	W	S	D	—	Noon.
6. 1.46	39	10	130	24	W	O	D	—	Noon.
6. 1.46	49	10	81	17	W	O	D	—	3.30 p.m.
11. 1.46	69	15	1	1	W	D	W	W	Noon.
12. 1.46	41	9	47	12	W	S	—	S	3 p.m.
13. 1.46	96	11	130	24	C	S	—	S	1 p.m.
13. 1.46	77	12	65	11	F	S	—	—	3.30 p.m.
19. 1.46	130	11	55	16	F	S	F	—	3.30 p.m.
20. 1.46	112	11	6	4	F	Ice and Snow	—	—	9 a.m.
24. 1.46	105	13	9	5	C	—	D	—	8 a.m.
4. 2.46	108	13	3	0	W	D	D	W	1 p.m.
10. 3.46	77	12	39	7	C	S	—	—	11 a.m.
16. 3.46	79	10	17	8	F	D	F	S	Noon.
18. 3.46	120	14	11	3	W	D	D	—	11 a.m.
24. 3.46	123	11	132	13	W	D	F	—	Noon.
28. 3.46	161	13	8	7	H	S	F	B	9 a.m.
28. 3.46	112	11	60	8	H	S	F	B	3 p.m.
7. 4.46	87	12	341	14	H	S	F	—	11.30 a.m.
7. 4.46	56	13	585	19	H	S	F	B	3 p.m.
14. 4.46	56	12	382	23	H	S	F	S	11 a.m.
2. 5.46	45	14	7	4	C	D	—	—	7.30 a.m.
5. 5.46	73	12	152	4	C	O	D	W	Noon.
19. 5.46	40	13	8	2	W	D	W	—	11 a.m.
19. 5.46	60	14	78	7	W	S	—	—	3 p.m.
7. 6.46	85	17	14	3	H	S	F	S	9 a.m.
11. 6.46	35	10	258	4	W	S	F	B	3 p.m.
23. 6.46	50	10	330	6	H	S	F	S	11 a.m.

N.B.—Temperature:—H=hot, W=warm, C=cool, F=freezing, very cold.

Sun:—S=sunny, O=overcast, D=dull.

Rain:—F=fine, dry, D=damp, W=wet.

Wind:—W=windy, B=breezy, S=still.

*House-Sparrows excluded from all counts.*

be considered "quiet" and the distinction between quiet and busy was therefore set at 20 human beings per count. It will be observed that both the average number of birds and the average number of species per count is considerably lower for the busy series, but as there is a very large variation in numbers from one count to another in the same group, this difference in averages must be considered in relation to the variation among the individual counts. This is done by the statistical method described as a "test of significance" (see the author's paper on pp. 42-55 above for a description of this process), and the differences are declared "significant" if there is no more than a 5 per cent. chance that they are due merely to random causes, and "highly significant" if the chance is no more than 1 per cent. The difference in the average numbers of birds is accordingly found to be significant, while the difference in the average numbers of species is highly significant. This means that we can quite reliably conclude that the presence of a large number of human beings corresponds to a considerable reduction in the numbers of birds and species. We may not, of course, conclude that the presence of human

beings causes the reduction in numbers unless we can show that no other factors could cause it.

TABLE 5. EFFECT OF HUMAN POPULATION.

No. of Human Beings in Park.	No. of Occasions.	Average No. of Birds.	Average No. of Species.
Less than 20 ("quiet")	10	92	13.3
More than 20 ("busy")	18	65	11.1
Whether significant difference.		SIGNIFICANT.	HIGHLY SIGNIFICANT.

The effect of weather is considered in Table 6; the distinction between fine and poor weather was set quite arbitrarily by the author's own judgment. It is clear from the results that the weather appears to have no correlation at all with the bird numbers, and cannot therefore be considered a factor affecting the numbers.

TABLE 6. EFFECT OF WEATHER.

Weather.	No. of Occasions.	Average No. of Birds.	Average No. of Species.
Fine	15	78	11.7
Poor	13	80	12.1
Whether significant difference.		NOT SIGNIFICANT.	NOT SIGNIFICANT.

Time of day is often said to influence bird numbers. Table 7 investigates this relationship. The day was divided into three approximately equal periods for this purpose, covering the hours of daylight only, of course. It will be seen that the only correlation possible is between "early" and the rest of the day, and on this basis the difference in the average numbers of birds is not significant (the chance of this being merely random is more than 1 in 20) although the difference in the numbers of species is significant. We can conclude from this that the bird numbers do tend to be larger in the early part of the day. But this is when there are fewest people about! So which is the real cause of the greater bird numbers, the early hour or the absence of people? This is an example of how careful we must be in assigning causes. However, as the correlation with the human population is much more significant, we may tentatively conclude that the presence or absence of human beings is the major factor affecting the bird numbers in Highams Park.

TABLE 7. EFFECT OF TIME OF DAY.

Time.	No. of Occasions.	Average No. of Birds.	Average No. of Species.
Early	6	98	13.3
Middle	15	74	11.5
Late	7	75	11.4
Whether significant differences.		NOT SIGNIFICANT.	SIGNIFICANT only on comparing Early with Middle + Late.

## APPENDIX.

**Other Species of Birds Recorded in Highams Park.**

The following is a list of species recorded in Highams Park in recent years which have not been noticed in the course of the work discussed in this paper. It can reasonably be assumed that they are all more or less rare. Many of them occur more frequently, or are even resident, in the country to the north of the Park, shown as "open grassland with hawthorns, etc.," on the map. It is perhaps surprising that they are rarely seen in the Park—this is particularly true of the Skylark, which is quite frequent within 200 yards of the north end, but has only once been seen in the Park. Most of the records available are from Mr W. A. Wright, but Messrs S. Austin, C. S. Bayes and J. Ross have also contributed some:

Magpie (7).*	Kingfisher (234) (once not uncommonly recorded, but has been absent for many years).
Siskin (21).	
Lesser Redpoll (25).	
Skylark (70).	Little Owl (249).
Meadow-Pipit (76).	Sparrow-Hawk (277).
Grey Wagtail (89).	Pochard (328).
Pied Wagtail (90).	Little Grebe (375).
Nuthatch (96).	Black-headed Gull (478) (frequently flying over).
Garden-Warbler (161).	
Blackcap (162).	Common Gull (481).

The probable total number of species recorded in recent years is 58.

\*For the significance of these figures, see note to Tables 2 and 3.

**The Climate, 1946.**

By H. HAWKINS.

(Observed at 119 Beresford Road, Chingford, Essex.)

**General Remarks.**

The Spring of 1946 gave promise of a good summer, which was not fulfilled. From May onwards cool, dull, and wet weather predominated, giving this country the worst harvest for many years, and holiday-makers cause for loud grumbings. Truly it can be said that the climate of this country is unpredictable.

Briefly, it was the wettest year in Chingford since 1939, with rainfall 5 inches above the average, the summer and autumn the worst for many years, and it was the sixth successive year with sunshine deficiency.

A summary of the statistics for the year is given in the Table. For explanatory notes on the instruments used, and for definitions of terms, the report for 1944 (*Lond. Nat.*, No. 24, p. 36, 1945) should be referred to.