

## ON THE NORMAL FLIGHT SPEEDS OF BIRDS.

BY

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DURING 1927, 1928 and 1929, while motoring in various parts of England and Wales, I have collected data on flight speeds of birds. Though my observations are obviously very incomplete, yet they will serve to show that much remains to be done on this important subject, the study of which is open to many ornithologists. This cannot claim to be anything more than a mere contribution and I hope to summarize all the available data in a subsequent article; here, I am primarily concerned with the speed of daily movements.

It is perhaps justifiable to claim a considerable degree of accuracy for these figures, as the methods described below do not allow of a large margin of error, and on many occasions one observation has been checked by another. The great majority of the records refer to birds in *normal daily flight*, concerning which there is even less information than on migratory flight; all are, of course, ground speeds.

## METHODS.

The procedure, in taking each speed, was simple yet reasonably accurate. All were taken either from (i) a motor car or (ii) a motor cycle.

- (i) In the case of those speeds taken from a car, it proved necessary to have an assistant. I (as driver) concentrated on keeping level with the flying bird, and when I had been going level and parallel—and at uniform speed—for a considerable distance (*at least* 50 yards, unless otherwise stated, and usually over 200 yards) my passenger—usually my brother—would read the speedometer, when the needle was quite steady. With a similar method Wetmore (1) obtained a number of records in California. As Ticehurst (2) points out, it is extremely difficult for one person alone to obtain accurate data from a moving car, though Jones (3) and White (4) have done useful work with only one observer.
- (ii) Roughly, a third of these records were obtained from a high powered motor-cycle capable of 75 miles an hour. On this machine was fitted a special type of speedometer, on a long upright arm from the centre of the handlebars. This brought the instrument to within twelve inches of my eyes and directly in front of them. Thus the difficulties of watching bird and speedometer together were minimized.

With both vehicles the speedometers were tested every week or so by means of a stop watch over a known distance, and also against each other. In no case was any error found. Practice and experience were valuable factors in obtaining the records, and progress at first was very slow.

#### CONDITIONS.

In no case was any record accepted where there was a possibility of doubt—either in identification or in accurately obtaining the speed. Every case in which the wind was more than a very slight breeze has been rejected, and the breeze has been mentioned whenever present. Brief remarks have been made in each case to indicate roughly the nature of flight. These remarks are open to criticism, as it is often impossible to indicate—in a few words—the exact nature of flight in each record<sup>(1)</sup>. I merely give them for what they are worth and as I took them down on the spot.

In every case the bird was apparently subject to no abnormal stimuli, though in four cases<sup>(2)</sup> the bird was chased or flying directly in front of the vehicle. Only seven of the records are for birds on migration, the remainder being for ordinary normal daily flight. In all cases the bird flew directly parallel with or over the road, and never more than 50 feet up. Except where otherwise mentioned the record refers to a single bird flying alone. No bird flying normally showed any appreciable change in speed during the time it was under observation, apart from two birds somersaulting and three others twisting in flight.<sup>(3)</sup>

#### LOCALITIES.

All these records were obtained in England and Wales, mostly on flat or rolling open country with more or less straight roads—Salisbury Plain, the north coast of Norfolk, the Romney Marsh and Anglesey. It is difficult to obtain speeds in wooded or very hilly country.

#### RESULTS.

The result of three years' observations from motor vehicles is the following list of 103 records for thirty-six species. Many other records were obtained which did not fulfil the conditions outlined above, and were therefore rejected.

(1) The word "pressing" has been used to indicate birds apparently hurrying or flying fast for the species.

(2) House-Sparrow 33 m.p.h., Sand-Martin 31 m.p.h., Partridge 41 m.p.h., Willow-Warbler 27 m.p.h.

(3) Lapwing 40 m.p.h., and 30 m.p.h.; Willow-Warbler 27 m.p.h., Kestrel 38 m.p.h., Yellow Bunting 26 m.p.h.

TABLE I.

Speed (Miles per hour.)	Remarks.	Speed (Miles per hour.)	Remarks.
<b>ROOK (<i>Corvus frugilegus</i>.)</b>			
35	Deliberate, at dusk.	29	Foraging from rookery.
35	Easy.	28	" " "
32	Fair (against very slight breeze).	27	" " "
32	Easy.	24	Very easy indeed. "
<b>JACKDAW (<i>Colæus monedula</i>.)</b>			
36½	Quite easy.	32	Flock of fifteen; normal.
35½	Pressing.	31	Fairly easy.
35	Ordinary pace.	31	Easy.
35	Fairly easy.	30	Very easy, against slight breeze.
33	Effortless.		
<b>MAGPIE (<i>Pica pica</i>.)</b>			
19	Flying from one tree to next (40 yards).		
(1)(2) <b>STARLING (<i>Sturnus vulgaris</i>.)</b>			
30½	Two flocks together.	27	Very easy.
30	Pressing.	26	(No remarks.)
29	Easy.	25	Preparatory to landing.
29	Searching for spot to alight on.		
<b>GREENFINCH (<i>Chloris chloris</i>.)</b>			
36	Short flight (45 yards).	35	Quite easy (up and down).
<b>GOLDFINCH (<i>Carduelis carduelis</i>.)</b>			
26	Apparently usual speed.		
<b>LINNET (<i>Carduelis cannabina</i>.)</b>			
36	Very deliberate — slight favourable breeze.	31	Pressing slightly.
		30	" " "
33	Very deliberate.	27	Short flight (40 yards).
32	Apparently ordinary pace.	26	" " "
(2) <b>CHAFFINCH (<i>Fringilla cælebs</i>.)</b>			
29	Quite easy—slight favourable breeze.	27½	Against slight breeze.
		25	Very deliberate.
(1) <b>HOUSE-SPARROW (<i>Passer domesticus</i>.)</b>			
33	Alarmed, and chased by car.	32	Slight favourable breeze.
<b>CORN-BUNTING (<i>Emberiza calandra</i>.)</b>			
34	Pressing.		
<b>YELLOW BUNTING (<i>Emberiza citrinella</i>.)</b>			
35	Alarmed.	27	Very easy, against slight breeze.
35	Deliberate, against slight breeze.	26	Two chasing each other, and fighting in flight.
32	Deliberate.		

(1) I have seen *Starlings* and *House-Sparrows* flying level for 300 yards (and see Ticehurst (2)).

(2) I have seen a *Chaffinch* outfly a *Starling* against a strong wind.

Speed (Miles per hour.)	Remarks.	Speed (Miles per hour).	Remarks.
	(1) YELLOW WAGTAIL ( <i>Motacilla flava</i> ).		
30	Fairly rapid.	22½	Pair together.
	PIED WAGTAIL ( <i>Motacilla alba</i> ).		
25	Very easy.		
	BLUE TIT ( <i>Parus cæruleus</i> ).		
21	Flying from tree to tree (40 yards).		
	WILLOW-WARBLER ( <i>Phylloscopus trochilus</i> ).		
27	Chased by car and twisting in flight.		
	FIELDFARE ( <i>Turdus pilaris</i> ).		
31½	Slightly alarmed.	31	Disturbed—a flock.
	MISTLE-THRUSH ( <i>Turdus viscivorus</i> ).		
35	Pressing slightly.		
	SONG-THRUSH ( <i>Turdus philomelus</i> ).		
30½	Alarmed.		
	BLACKBIRD ( <i>Turdus merula</i> ).		
30	Rapid.	29	Alarmed by car ( <i>not</i> chased).
30	Very deliberate.		
	WHEATEAR ( <i>Enanthe ænanthe</i> ).		
38	For 50 yards—fitting flight.	35	Rapid flitting (100 yards).
	SWALLOW ( <i>Hirundo rustica</i> ).		
32	Normal (not on migration).	26	In front of car.
30½	Slightly alarmed.	25	Easy, probably on migra- tion, against breeze.
30	Easy, probably on migration, with slight favourable breeze.	23½	Easy, probably on migration, against slight breeze.
30	Probably on migration; many together.	23	Hawking for flies.
29	Ordinary pace ( <i>not</i> migration).	23	Deliberate, against slight breeze.
28	Deliberate, probably on migration.		
	HOUSE-MARTIN ( <i>Chelidon urbica</i> ).		
27	Fairly deliberate, on migra- tion.	24	Cruising low over meadow.
27	Fairly deliberate, on migra- tion.		
	SAND-MARTIN ( <i>Riparia riparia</i> ).		
31	Chased by car.		

(1) The 30 m.p.h. record for *Yellow Wagtail* may be slightly inaccurate.

Speed (Miles per hour.)	Remarks.	Speed (Miles per hour.)	Remarks.
<i>CUCKOO (Cuculus canorus).</i>			
27	Pressing slightly.		
<i>TAWNY OWL (Strix aluco).</i>			
45	Pressing—at dusk.	21	(Family?) party of five near
40	Very deliberate—at dusk.		together at dusk.
<i>KESTREL (Falco tinnunculus).</i>			
38	In front of car, twisting and turning.	36	Quite easy, across a considerable breeze.
		35	Planing, at slight angle.
(1) <i>HERON (Ardea cinerea).</i>			
24-25	Going rather slow, looking for place to alight.		
<i>RING-DOVE (Columba palumbus).</i>			
51	Pressing hard.	30	Easy.
50	Pressing hard.	27	Very leisurely indeed, with irregular beats.
43	Apparently ordinary speed.	27	Against breeze.
41	" "		
33½	Quite easy.		
(1) <i>STOCK-DOVE (Columba oenas).</i>			
59	Pressing very hard.	40	Preparatory to alight, and against slight breeze.
<i>TURTLE-DOVE (Streptopelia turtur).</i>			
51	Rapid, with slight favourable breeze.	42	Very deliberate.
(2) <i>LAPWING (Vanellus vanellus).</i>			
40	Fairly easy, and somersaulting.	30	Easy and somersaulting.
35	Quite effortless.	24	Planing down, before landing (50 yards).
34	Easy.		
<i>COMMON TERN (Sterna hirundo).</i>			
27	Easy.	25	Quite effortless.
(3) <i>BLACK-HEADED GULL (Larus ridibundus).</i>			
21½	Very deliberate—at dusk; going to roost.	20	Rather leisurely (inland).
<i>COMMON GULL (Larus canus).</i>			
23	Leisurely, but fairly deliberate against breeze.		

(1) I have a note of *seven Herons* together, keeping level with a *Stock-Dove*, against a considerable wind.

(2) See *Harrisson (5)* for details.

(3) See *Lack and Harrisson (6)* for remarks on relative speeds of *Black-headed Gull* and *Golden Plover*.

Speed (Miles per hour.)	Remarks.	Speed (Miles per hour.)	Remarks.
HERRING-GULL ( <i>Larus argentatus</i> ).			
20	Very easy indeed.	17	Very easy and effortless.
18	Very deliberate, breeze.	12	Planing parallel to ground (50 yards).
PARTRIDGE ( <i>Perdix perdix</i> ).			
41	Chased by car.		

DISCUSSION.

The above figures are, of course, too few in number to allow of any certain generalizations. Almost all speeds are less than those obtained by Meinertzhagen (7), whose paper is perhaps the main contribution to this subject. Meinertzhagen states that his "observations tend to show that migratory flight differs very little in its velocity from the flight of daily movement, and I see no reason why it should or how it can be so", and later "migratory flight differs in no way from every-day movement, except that it is steadier and possibly a trifle slower".

He takes the Rook as his example to illustrate this hypothesis, though all his records for this species are for birds on migration, and he has no "every-day movement" data on which to base such a statement. In order to provide a comparison, I tabulate below my five fastest Rook speeds, none of which refer to migratory birds, beside those of Colonel Meinertzhagen.

ROOK (*Corvus frugilegus*).

Meinertzhagen (all migrating).	Harrison (none migrating).
45	35
40	35
39½ (head wind of 12 m.p.h.)	32
39	32
38	29

Meinertzhagen's figures give an average of 40.25, my own (eight observations in all) give 30.25. Thienemann (8) attributes, on an average of four observations, a migratory speed of 32.37 to this species; Lucanus (14) finds 32 the average migration rate; Portal (15) notes a *maximum* speed of 48; Sabine (10) mentions 30 for daily movements; Walker (16) timed 24 and Cayley (20) calculated 24 for normal daily flight, while Artindale (21) puts it as low as 20.

A comparison between the records for the Swallow gives a result similar to that for the Rook :—

SWALLOW (*Hirundo rustica*).

Meinertzhagen (all migrating).	Harrison (not migrating).
[106] (quoted)	32
37 $\frac{3}{4}$	30 $\frac{1}{2}$
34	29

Professor C. J. Patten, with whom I have discussed this point, tells me that in his opinion Swallows on migration at sea travel at over 40, and H. P. O. Cleave confirms this.

Lynes (22) estimates the Swallow's migration speed as 25; Wallis (9) notes 25 for daily flight; Sabine (10) mentions 25-29 for birds feeding; Walker (16) timed birds in normal flight, and never found one going at over 25.

Or again the

LAPWING (*Vanellus vanellus*).

Meinertzhagen (apparently all migrating).	Harrison (none migrating).
50 (Portal quoted)	40
40-45	35
42	34
37 (head wind of 12)	30

F. Portal (15) gives 48 as the Lapwing's maximum.

This evidence seems to point to a conclusion diametrically opposed to that arrived at by Colonel Meinertzhagen, and to indicate a difference, in some species at least, between normal (i.e. daily) and migratory flight speeds.

The records of normal day flights obtained by Ticehurst (2), Clay, Wallis, Joy and Dooly (9), Sabine and Crawshaw (10), Truman (11), Donald (12) and others give comparatively low speeds. Wetmore (1) obtained 14 records for seven species of widely separated genera, yet the whole range of speed was only 22-28 m.p.h. (all the birds flying normally). Jones (3) obtained several records from a car, all 25-35 m.p.h., and the average below 30. Out of twenty-three records of normal flight taken by White (4) only two were over 30 m.p.h.

The data for migration, on the other hand, show a marked difference. Thus v. Lucanus (14) found that the average migration rate for seven species especially studied all come to between 30 and 46. Thienemann's average migration speeds for Corvidæ and Finches (8), based on a mass of

accurate material, range from 31-46. Brown (17) obtained data for a number of species (including Swift and Starling), all of which had *maximum* migration speeds of between 40 and 70. It is possibly significant that the slowest speed recorded by Meinertzhagen (7) is 20.25 for Red-throated Pipits in normal daily flight, while his migration figure for the same species is 26.5. Winkenwerder (13) made many observations with a telescope on migrating birds, and classified them under four headings according to speed: seventy-five birds travelling "very rapidly", twenty-two "moderate", twelve "slow", and two "very slow".

These figures further demonstrate that daily flight is on the whole unexpectedly slow in many species, whereas migratory flight is often comparatively rapid. Clearly a great deal remains to be done on this subject, but it is difficult to avoid at least the suspicion that speed on migration (with its apparently special stimulus) would in some, if not all, cases differ from normal flight. It seems possible that figures for *dusk* flights to roosts in certain species would more nearly approximate to those obtained for migration.

The fastest speed I have obtained is 59 m.p.h. for a Stock-Dove<sup>(1)</sup>, the slowest 17 m.p.h. for a Herring-Gull. It is worth noting that during the past six years I have never seen any bird pass a motor or fast train in which I have been travelling, either in Britain, France, Switzerland, Norway, Brazil, Argentina, or Uruguay. This suggests that very rapid flight at low levels during daylight is the exception, not the rule.

The records of Tawny Owl at 45 and 41 m.p.h. are surprising—though Portal (9) has recorded a Little Owl travelling at 40. The range of variation in my personal records for Ring-Dove (27-51 m.p.h.) is very striking, and indicates considerable individual variation. The discrepancies in the various records for Starling are even more marked, and a summary of these given below clearly illustrates the lack of complete information on flight speeds in general, despite the number of individual records:—

STARLING (*Sturnus vulgaris*).

43-49 (13 obs. <i>not</i> migrating)	Meinertzhagen (7)
49 (maximum)	Brown (17)

<sup>(1)</sup> No attempt has been made to deal with maximum or accelerated speeds, as this article is concerned with normal flight; such data will be dealt with in a subsequent article.



STARLING (*continued*).

45-48½ (22 obs., birds between 120 and 325 ft.)	Meinertzhagen (7)
46 (migration average)	Lucanus (14)
46 (2 obs. on migration)	Thienemann (8)
44 (maximum)	Portal (15)
35-40 (estimate for migration)	Eagle Clarke (19)
32 (not migrating)	Sabine (10)
31.4 (3 parties leaving roost, timed over 1 mile 700 yds.)	Wynne-Edwards (18)
28-30 (several obs. not migrating)	Crawshaw (10)
25-30½ (av. of 7 obs.=28 m.p.h., none migrating)	Harrisson
24 (not migrating)	Ticehurst (2)

Even allowing for inaccuracies and individual variations in speeds of different birds (a very uncertain factor at present) the above figures are puzzling, though apart from the first record they show a well-marked distinction between migratory and daily flight.

Below is a table summarizing results for species for which I have obtained three or more records; it is clearly not possible to give any real "average"; this figure is given for comparison and convenience. I must emphasize the fact that these "averages" are not based on migratory flight speeds.

TABLE II.

<i>Species.</i>	<i>Maximum.</i>	<i>Minimum.</i>	<i>Average.</i>	<i>Number of observations.</i>
Rook ... ..	35	24	30.2	8
Jackdaw ... ..	36½	30	33.3	9
Starling ... ..	30½	25	28.0	7
Linnet ... ..	36	26	30.7	7
Chaffinch ... ..	29	25	27.2	3
Yellow Bunting ... ..	35	26	31.0	5
Blackbird ... ..	30	29	29.7	3
Swallow ... ..	32	23	27.3	11
House-Martin ... ..	27	24	26.0	3
Tawny Owl <sup>(1)</sup> ... ..	45	21	35.3	3
Kestrel ... ..	38	35	36.3	3
Ring-Dove ... ..	51	27	41.6	8
Lapwing <sup>(2)</sup> ... ..	40	30	34.7	4
Herring-Gull <sup>(2)</sup> ... ..	20	17	18.3	3

(1) This average may be misleading, as one speed was under different circumstances to the other two.

(2) The last figure in Table I. is excluded here, for the bird was planing.

**CONCLUSIONS.**

This article includes 103 original records of thirty-six species taken from motor vehicles, with standardized methods (as described).

When compared with other material these observations suggest a difference between the speeds of normal daily flight and migration in some (? many) species. The data at present available suggest that migratory flight often tends to be rather more rapid than daily flight, though no doubt after long journeys migrants travel at a comparatively slow rate.

A great deal remains to be done on every aspect of the subject before any really sound conclusions may be drawn, and in particular comparative records for daily and migratory flights are needed. The extent of acceleration and of individual variation are factors concerning which little is known, while the effects of alarm, of flocks flying together, and of roost flights, need careful investigation. Every observation on any species should be put on record, with full details; the value of noting all cases where one species is seen to outfly another must not be forgotten.

Very useful data may be obtained, especially on normal daily flight, from motor vehicles working in open country, with two careful and experienced observers. Intensive observations on common and comparatively "easy" species (such as Rook, Jackdaw, Starling, Swallow, Ring-Dove and Lapwing) would be of special value. It is important to exclude records taken in a wind unless the speed of the wind can be determined, and it is essential that when the bird is actually chased or disturbed this fact should be noted.

The possibilities of timing birds over measured distances, and of taking speeds from aeroplanes, have seldom been exploited, though the author is glad to be able to say that a number of civil and military airmen are now collecting such data in England. Loos (23) has described a method of obtaining speeds by ascertaining distances flown in short periods (e.g., one second), which seems worthy of careful consideration and trial.

The whole subject is of importance to aviators and physiologists as well as to ornithologists, and it is to be hoped that within the next few years many useful observations will be made in all countries. The author hopes shortly to review and summarize the published data.

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## REFERENCES.

1. WETMORE, A. *Condor*, XVIII., pp. 112-113.
2. TICEHURST, N. F. *British Birds*, XVI., p. 31.
3. JONES, L. *Wilson Bulletin*, XXXIX., pp. 8-10.
4. WHITE, F. B. *Auk*, XLIV., p. 266 and XLVI., p. 399.
5. HARRISSON, T. H. *Field*, 24.v.28, p. 879.
6. LACK, D. L., and HARRISSON, T. H. *Cambridge Bird Club Report*, 1930, p. 31.
7. MEINERTZHAGEN, R. *Ibis*, 1921, pp. 228-238.
8. THIENEMANN, J. *Journal für Ornithologie*, LVIII., pp. 644-672.
9. VARIOUS WRITERS *British Birds*, XVI.
10. SABINE, J. S., and CRAWSHAW, N. F. *in litt.*
11. TRUMAN, E. *Field*, 28.iii.03, p. 534.
12. DONALD, C. H. *Journal of Bombay Nat. Hist. Soc.*, XXXIII., pp. 204-205.
13. WINKENWERDER, H. A. *Bull. Winconsin Nat. Hist. Soc.*, II., pp. 97-107.
14. LUCANUS, F. VON.<sup>(1)</sup> *Die Rätsel des Vögelzuges*, Langensalza, 1922, pp. 172-190.
15. PORTAL, F. C. A. *Field*, 18.ii.22, pp. 233-234.
16. WALKER, A. *Field*, 11.iv.03, p. 607.
17. BROWN, A. S.<sup>(1)</sup> *The European Starling on his Westward Way*, by M. B. Bready, New York, 1929, pp. 137-138.
18. WYNNE-EDWARDS, V. C. *British Birds*, XXIV., p. 351.
19. EAGLE CLARKE, W. *Studies in Bird Migration*, London, 1912, Vol. II., p. 30.
20. CAYLEY, G. *Aerial Navigation* (cf. *Field*, 4.iv.03, p. 573).
21. ARTINDALE, R. H. *Field*, 4.iv.03, p. 573.
22. LYNES, H. *British Birds*, I., p. 285.
23. LOOS, K. *Ornithologische Monatsberichte*, XI., pp. 49-56.

<sup>(1)</sup> I have unfortunately had no opportunity of consulting this reference in the original, and have relied on H. S. Gladstone's summary (see Acknowledgments).