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Speed of autumn migration of birds ringed in Finland

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Data on the speed of migration are most easily obtained from birds ringed and recovered on passage. Other methods, e.g. comparison of arrival dates of migrants or records of migration waves passing different localities along the main flyway, give only approximate and thus less reliable information.

In Finland, on average 200 000 birds are ringed annually. Of these, more than half are captured as adults, mainly at bird observatories in the outer archipelago during migration. Some of them are recovered shortly afterwards, when probably still on passage, and their average speed can be calculated from the time interval and distance covered. This report summarizes the data on the speed of autumn migration obtained for birds ringed in Finland up to August 1982. Smaller sets of data have been reported earlier by Linkola (1958) and Hildén (1974, 1978).

To exclude atypical or unreliable data, the following criteria were used:

(1) The bird should be ringed and recovered within the migratory season of the species in question. For this purpose, time limits were determined for each species, based on the present knowledge of the onset and termination of autumn migration. In spite of this, a few birds ringed outside the bird observatories may not yet have started their departure at the time of ringing, and others may have been some days in their winter quarters before being recovered.

(2) The time elapsed from ringing to recovery should not exceed 50 days. This criterion, together with the previous one, is assumed to exclude most birds that have remained stationary for prolonged periods between ringing and recovery. One recovery was accepted in spite of this rule: a Willow Warbler *Phylloscopus trochilus* found in the Congo 56 days after ringing, at a distance of nearly 8 000 km, the only bird in this material recorded south of the equator.

(3) The distance between ringing and recovery should be at least 50 km.

(4) The date and place of recovery should be accurately reported. This does not, however, completely rule out the possibility of a fault, caused by, for instance, the "month

error" in the date of finding (cf. v. Haartman 1969, p. 11) or a mistake in reading the ring number. Therefore we have discarded the following four, otherwise acceptable recoveries, because the exceptional speed of the bird gives reason to suspect an error:

Actitis hypoleucos	1402 km in 1 day
Erithacus rubecula	3076 km in 7 days
Sylvia atricapilla	3080 km in 3 days
Anthus trivialis	1826 km in 4 days

Some of these recoveries may, of course, be correct, and conversely errors may exist in some that were accepted.

(5) The average speed should exceed 10 km/d (for irruptive species 5 km/d). The few individuals that had moved at lower speeds were considered to represent stationary or roving birds rather than true migrants.

(6) The bird should not be in a state of decay when found.

(7) The bird should be found south of the W—E axis of the place of ringing. This was intended to exclude individuals that had performed reverse movements or been roving without any constant direction. This criterion was not, however, applied to the irruptive species which commonly travel in a northward direction.

Table 1 presents the data on those species for which at least five recoveries fulfil the above criteria. The average speed for each species was worked out in two different ways. In method A it was calculated from the mean daily speeds of all the individuals. With this method, equal weight is given to all the recoveries, irrespective of the time interval between ringing and recovery. Most of the maximum speeds were recorded for birds recovered shortly after ringing, often after only one or two days, these being birds that had travelled long distances under favourable weather conditions or when crossing areas without suitable resting places. These recoveries represent maximum performances rather than the average speed for the whole migratory journey, which generally includes even long stops for resting and renewing the fat deposits. Hence, this method gives too high average speed of migration for most species.

In method B, both the distances covered and the time intervals between ringing and recovery were summed, and the former sum was divided by the latter. In this method, the recoveries after a long time interval affect the result much more than those made after a short interval, for which reason the value obtained should be closer to the real average speed for the whole migratory journey. On the other hand, the values will be too low if criteria (1) and (2) have failed to exclude all the birds that had not yet started their migration when ringed or had been in their winter quarters for some days before they were found.

The two methods may give substantially deviating results, if the data include a large proportion of birds that have covered long distances within a few days. To give a simplified example, let us assume that we have recoveries of only two birds, one that had covered 1 000 km in 2 days, and another that had taken 20 days to cover the same distance. Method A gives an average speed of 275, method B 91 km/d! A difference of almost this order of magnitude is revealed by the Curlew Sandpiper *Calidris ferruginea,* 209 as against 108 km/d. For this species, four of the nine recoveries concern birds that had travelled 662 to 1035 km within two or three days. On the whole, waders show the greatest difference between the two values for migratory speed. This may be explained by their special mode of migration: suitable resting areas with extensive mud flats are relatively scarce, and the birds may cross the intervening areas in long non-stop flights and then rest for several days. For the passerines, however, the two methods give largely similar results. This shows that passerine birds migrate at a more even speed, without longer stops to "refuel".

Some general conclusions can be drawn from the results. The average speed of migration is much lower than the maximum speed during short periods. This is due to the necessary resting intervals and the often indirect migratory routes, caused by changeable weather conditions and the use of leading lines. All the highest speeds were recorded for waders, which may fly up to 400—1000 km a day. Among passerines, the longest day's journey is only 200—300 km, and such speeds occur only rarely (except on flights over extensive stretches of sea or desert). The maximum speeds for some species not included in Table 1 are given below:

Anas platyrhynchos	123	km/d	(8)
Pernis apivorus	255	"	(6)
Calidris temminckii	194	"	(9)
Larus fuscus	102	"	(7)
Asio flammeus	83	"	(26)
Luscinia svecica	97	"	(14)
Sylvia communis	153	"	(4)
Lanius excubitor	97	"	(8)
Emberiza hortulana	122	"	(21)

Another general conclusion is that among passerines night migrants travel faster than day migrants. The average speed of 17 typical night migrants included in Table 1 is 72 km/d,

TABLE 1. Speed of autumn migration (km/d) of birds ringed in Finland. The criteria used in selecting the material are explained in the text. Figures in parentheses after records of maximum speed give the time interval (in days) between ringing and recovery. D = day migrant, N = night migrant, I = irruptive or partial migrant.

Species	No. of recoveries	Average speed A	Average speed B	Three records of highest speed		
Anas crecca	12	62	52	120 (7)	119 (6)	108 (10)
Accipiter nisus	50	46	37	224 (6)	160 (15)	120 (4)
Charadrius hiaticula	56	102	82	459 (5)	258 (10)	241 (8)
Numenius arquata	10	46	38	119 (7)	73 (16)	43 (45)
Tringa erythropus	6	122	86	263 (9)	155 (2)	114 (21)
T. totanus	31	94	70	362 (5)	292 (6)	215 (4)
T. glareola	50	100	79	625 (2)	287 (8)	175 (10)
Actitis hypoleucos	15	90	76	220 (6)	138 (12)	123 (6)
Arenaria interpres	11	103	109	182 (36)	147 (45)	137 (14)
Capella gallinago	16	54	45	177 (11)	125 (6)	86 (28)
Calidris canutus	6	123	83	177 (11)	168 (4)	166 (4)
C. minuta	46	137	112	400 (3)	322 (2)	283 (8)
C. alpina	119	115	74	1023 (1)	543 (2)	482 (2)
C. ferruginea	9	209	108	518 (2)	402 (2)	272 (3)
Philomachus pugnax	117	71	59	757 (2)	295 (2)	160 (8)
Aegolius funereus (I)	22	31	19	199 (1)	105 (1)	51 (8)
Dendrocopus major (I)	13	25	21	53 (2)	35 (29)	32 (21)
Nucifraga caryocatactes (I)	12	43	45	121 (23)	66 (17)	55 (42)
Parus major (I)	55	15	11	45 (11)	43 (2)	37 (6)
P. caeruleus (I)	10	12	8	32 (6)	21 (10)	12 (18)
P. ater (I)	12	33	30	67 (3)	62 (28)	53 (1)
P. montanus (I)	13	10	10	24 (24)	22 (26)	20 (20)
Aegithalos caudatus (I)	28	40	35	72 (1)	71 (10)	71 (10)
Certhia familiaris (I)	15	32	23	100 (2)	78 (2)	36 (18)
Erithacus rubecula (N)	100	60	59	146 (17)	113 (20)	107 (14)
Phoenicurus phoenicurus (N)	35	74	71	134 (12)	102 (17)	102 (26)
Saxicola rubetra (N)	6	81	88	94 (20)	86 (39)	84 (22)
Oenanthe oenanthe (N)	7	110	109	263 (13)	111 (17)	101 (27)
Turdus merula (N)	5	36	35	53 (29)	38 (40)	37 (39)
T. iliacus (N)	41	65	59	213 (10)	121 (17)	111 (21)
T. philomelos (N)	56	67	62	212 (11)	130 (22)	108 (32)
Acrocephalus scirpaceus (N)	10	56	54	86 (29)	84 (12)	75 (28)
A. schoenobaenus (N)	8	89	77	149 (10)	127 (12)	88 (3)
Sylvia atricapilla (N)	6	75	72	91 (25)	85 (8)	81 (20)
S. borin (N)	19	102	94	202 (9)	143 (12)	140 (12)
Phylloscopus trochilus (N)	13	84	84	141 (56)	119 (8)	99 (20)
Regulus regulus (I)	61	53	46	159 (5)	152 (9)	118 (6)
Muscicapa striata (N)	20	65	65	120 (14)	111 (25)	95 (23)
Ficedula hypoleuca (N)	12	93	94	141 (14)	115 (25)	115 (13)
Prunella modularis (N, D)	11	52	53	72 (30)	62 (31)	61 (29)
Anthus pratensis (D)	8	71	64	177 (21)	68 (28)	61 (35)
A. trivialis (N)	11	79	73	124 (16)	103 (18)	103 (20)
Motacilla flava (D)	11	71	69	100 (27)	89 (25)	88 (20)
Bombycilla garrulus (I)	62	53	44	244 (2)	161 (3)	128 (8)
Lanius collurio (N)	6	96	75	303 (7)	97 (25)	96 (18)
Carduelis spinus (D)	35	59	54	105 (5)	90 (19)	87 (6)
C. flammea (D)	27	40	37	180 (1)	87 (7)	85 (23)
Pyrrhula pyrrhula (I)	12	22	23	53 (1)	30 (20)	25 (17)
Fringilla coelebs (D)	13	63	49	200 (7)	108 (5)	76 (18)
F. montifringilla (D)	9	41	42	77 (38)	52 (44)	49 (47)
Emberiza schoeniclus (N)	45	59	51	277 (7)	182 (4)	87 (26)

as compared with 53 km/d for the six day migrants (method B). This difference was to be expected, as the day migrants have to use part of the daylight hours for feeding and are more inclined to follow the topographical leading lines than are the night migrants. The irruptive species, and irregular and partial migrants travel particularly slowly. The average speed of the 12 species included in the table is only 26 km/d, and maximum speeds exceeding 100 km/d are recorded for only *Bombycilla garrulus, Regulus regulus, Aegolius funereus* and *Nucifraga caryocatactes*. The low speed of migration results from several features typical of the behaviour of these birds: (1) they keep strictly to topographical leading lines and prefer to make long detours rather than to cross extensive open areas; (2) they frequently reverse their direction under the influence of the wind conditions; (3) they pause or deviate from the direction of migration to exploit good food supplies found en route.

Considerable differences in the speed of migration may exist between adult and juvenile birds. In waders, for instance, adults migrate much faster than juveniles, as shown for the Dunlin *Calidris alpina* by Saurola (1980); of the birds ringed in Pori on the Finnish west coast and checked at Ottenby in Sweden, the adults had covered this distance of 660 km in 3—6 days, on average 4.5 ($N = 6$), and the juveniles in 4—25 days, on average 13 ($N = 19$). In the present report, however, age and sex differences in migratory speed have not been analysed.

Selostus: **Suomessa rengastettujen lintujen syysmuuttonopeudesta**

Tiedonantoon on koottu suomalaisista rengaslinnuista elokuuhun 1982 mennessä kertyneet syysmuuton nopeutta valaisevat löydöt. Epätyypillisten ja epäluotettavien tietojen karsimiseksi aineistoon hyväksyttiin vain tietyt ehdot täyttävät löydöt. Tärkeimmät ehdot olivat: lintu rengastettu ja löydetty alle 50 vrk:n ja kullekin lajille määritetyn syysmuuttokauden kuluessa; rengastus- ja löytöpaikkojen etäisyys vähintään 50 km; löytötiedot täsmällisesti ilmoitetut; lintu löydettäessä ei mätä.

Taulukossa on esitetty keski- ja huippunopeudet (km/vrk) kaikista niistä lajeista, joista em. ehdot täyttäviä löytöjä on vähintään viisi. Keskinopeus on laskettu kahdella tavalla: A = kaikkien yksilöiden keskinopeuksien keskiarvo, B = kaikkien yksilöiden muuttomatkojen summa jaettuna kestoaikojen summalla. Menetelmän B katsotaan vastaavan paremmin lintujen keskinopeutta koko muuttomatkalla, siihen kuuluvine lepotaukoineen. Menetelmien antama ero on suuri monilla kahlaajilla, jotka taittavat pitkiä taipaleita pysähtymättä, ja pieni tasaisemmin matkaavilla varpuslinnuilla.

Keskinopeudet ovat yleensä huippunopeuksia paljon alhaisempia, mihin lepotaukojen lisäksi vaikuttavat sääolojen mukaan vaihtelevat lentosuunnat ja laajatkin kiertomatkat. Kahlaajat ovat nopeimpia muuttajia, varpuslinnuista yömuuttajat matkaavat nopeammin kuin päivämuuttajat, ja erityisen hitaita ovat vaelluslinnut ja osittaismuuttajat.

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Changes in the roosting habits of a pheasant *Phasianus colchius* population in winter

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The Itä-Pakila allotments in Helsinki, where I have systematically studied Pheasants since 1970, are the winter quarters of the local population; the neighbourhood broods and other individuals gather there in October-November. The population is highest at the beginning of winter (Table 1), but by spring only 50—80 % remain due to fatalities. The