ORNIS FENNICA

XXXV, N:o 1

1958

SUOMEN LINTUTIETEELLISEN YHDISTYKSEN JULKAISEMA
UTGIVEN AV ORNITOLOGISKA FÖRENINGEN I FINLAND

Toimitus
Redaktion O. Kalela, G. Nordström

Seasonal, geographical and yearly trends in the weight of capercaillie *(Tetrao urogallus)* and blackgame *(Lyrurus tetrix)* in Finland.

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The weight records of birds have a dual biological interest, depending on whether the static or the dynamic aspects of weights are emphasized. First, the body weights of birds are taxonomic characters like any other measurements. It is a common opinion, however, that weights within a species vary too much to be of great value in taxonomy. There certainly is more interindividual variation in weights than in most linear measurements, which means that small and non-homogeneous samples cannot be relied upon in taxonomic work. On the other hand, large series of weights should yield just as valuable taxonomic information as any other morphological characters. MILLER (1941) has shown that the variation in weight of the breeding male Oregon juncos, *Junco oreganus,* over a six-week period, does not exceed the variation generally expected in zoological samples (coefficient of variation 5.2). Similarly, GRIMM (1954) found in a large material of house sparrows, *Passer domesticus,* from Germany, distinct population differences in weight and a significant correlation between weight and wing length. BÄHRMAN (1950) established subspecific variation in weight in the goshawk, *Accipiter gentilis,* in Europe. MOREAU (1944) noted that some species are apparently heavier at higher altitudes. NELSON & MARTIN (1953) established a progressive increase in the weight of the bobwhite quail, *Colinus virginianus,* from south to north in North America. Both these findings conform to Bergmann's Rule. v. ZEDLITZ (1924) on the other hand, has indicated the presence of a trend of decreasing weight towards the north in the capercaillie, *Tetrao urogallus,* in Europe, but in this case, other factors than mere latitude are obvi-

ously involved (cf. p. 9 of the present study). Although in some cases at least body weight and linear measurements are but poorly correlated (MILLER 1941), there is fair support for AMADON'S (1943) suggestion that weight is a good index of general body size and that weights can be used successfully in taxonomic work.

The second biological aspect of bird weights is connected with their variation other than geographical. There are wide variations in weight correlated with individual, sex, age, season, year, time of day, nutritional condition etc. These variations have aroused much interest, and many important biological correlations have been established.

v. ZEDLITZ (1926), BALDWIN & KENDEIGH (1938), NICE (1938) and HAGEN (1942) have pointed out the general biological significance of the variations in bird weights. BALDWIN & KENDEIGH (op. c.) and HAGEN (op. c.), in particular, have made basic, comprehensive surveys of a great number of weight data on various bird species. Seasonal weight variations in migratory species have been studied by these and numerous other authors, including HEINROTH (1922), WOLFSON (1945), RICHDALE (1947) and ODUM (1949). LINSDALE & SUMNER (1934), BALDWIN & KENDEIGH (op. c.), HAGEN (op. c.), LEOPOLD & al. (1943), HAFTORN (1951), OWEN (1954) and many others have investigated the weights of various permanent residents.

The general conclusion from these studies seems to be that the weight of permanent residents reaches its maximum at about midwinter or a little earlier. The fat accumulated in early winter is assumed to be a protective adaptation against low temperatures although its value as an energy reserve during the late winter may be important also. It seems, however, that too broad generalizations are not warranted on the basis of the few representative studies made on a small number of species. There are numerous factors affecting weight-environment relations in different areas and in different types of food biology.

This paper is an analytical summary of the variations in autumn and winter weights of capercaillie, *Tetrao urogallus,* and blackgame, *Lyrurus tetrix,* based on over eight thousand weight records collected in Finland over a period of five years (1952—1956). The »dynamic» aspect of weight studies is represented by an analysis of seasonal and yearly weight variations. The »static» weights will be utilized in a discussion of subspecific and latitudinal differences.

A preliminary discussion of the seasonal trends in the weight of capercaillie and blackgame, based on the material of 1952 (total 1070 weights), has been published earlier (KOSKIMIES 1954).

Material.

The weight records of 3659 capercaillie and 4498 blackgame were collected by the cooperators of the Game Research Institute in the autumns and early winters of 1952—1956. The birds were weighed to an accuracy of 0.1 or 0.05 kg. not more than a few hours after having been shot. The wing of each bird, supplied with a record of the date and locality of collection, weight etc. was sent to the Game Research Insitute for aging. The aging was performed by the conventional outer primary method (cf. KOSKIMIES 1953, 1956) further developed and refined by HELMINEN (1954). Species and sex can be readily told from the general appearance of the wings.

The total data of weights has been examined for variations in both species caused by sex, age, season, locality and year. For regional treatment of the data, the country was divided into three zones: South, Central and North Finland (Fig. 1). The same zones were used

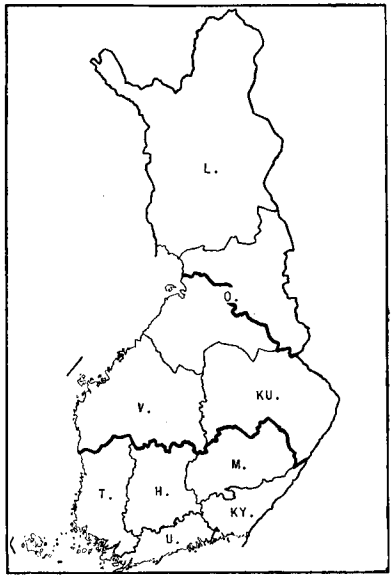

Fig. 1. The administrative provinces of Finland (T = Turku and Pori, U = Uusimaa, H = Häme, Ky = Kymi, M = Mikkeli, V =Vaasa, Ku = Kuopio, O = Oulu, L = Lapland) and the zones of South, Central and North Finland.

in a previous study on the flocking behaviour of capercaillie and blackgame (KOSKIMIES 1957), and the basis of this zonation was described there. Suffice it to mention here that the boundary between the zones of Central and North Finland coincides roughly with the general ecological and biogeographical boundary (the Maanselkä watershed) which forms the limit of distribution of many plant and animal species and ecopopulations (cf. e.g. KUJALA 1936, KALELA 1944, SEISKARI & KOSKIMIES 1955, VOIPIO 1956). The central and southern zones are separated by purely administrative boundaries.

Owing to regional and yearly differences in the hunting seasons, not all parts of the country nor all periods, are equally represented in the data collected. The shooting of capercaillie and blackgame was allowed in the following periods between 1. IX and 31. XII.

1952. Provinces of Oulu and Lappland (cf. Fig. 1): 2. IX — 31. XII; other areas: 1. IX — 30. XI.
1953. 1. IX — 11. X and 1 — 31. XII.
1954. 1. IX — 31. XII. Females protected in the province of Uusimaa in September.
1955. Province of Uusimaa: 11. IX — 31. X; Lapland 11. IX — 31. XII; other areas: 11. IX — 30. XI.
1956. Province of Uusimaa: 1. IX — 31. X; Turku and Pori, Kuopio, Oulu: 1. IX — 30. XI; Häme, Kymi, Mikkeli, Vaasa: 10. IX — 31. X; Lapland 1. IX — 31. X; Lapland 1. IX — 31. XIII.

The heterogeneity of the yearly sampling period may affect the year-to-year comparisons. Other overall averages are not distorted to any significant extent.

A material of more than eight thousand weight records may seem ample to illustrate the weight characteristics of two bird species. However, as the data are split not only between two species, but also between two sexes, two age groups, three zones, four months and five years, all requiring separate treatment, deficiencies in the data tend to appear. The method applied in collecting the data involves another disadvantage. Due to lack of adequate weighing equipment available to some of the sources, the accuracy of the weighing could not be maintained at as high a level as desirable.

However, for birds with an average weight of 1 to 4 kg., a weighing accuracy of 0.1 to 0.05 kg. gives a maximum error of only 1 to 10 % in the individual measurements. This is no greater than the inevitable chance variability in *true* weights caused by differing amounts of food in the crop; the full crop of a male capercaillie averages 150—200 g., of blackgame 50—100 g. (P. S e i s k a r i, person-

al communication based on material of the Game Research Institute). Also, the normal daily variation of an individual's weight has been found to range between 5 and 10 % of the average body weight (e.g. STEWART 1937, BALDWIN & KENDEIGH 1938). In a large material of data such random variations should not affect the validity of conservative conclusions.

It thus seems that the general trends and gross averages essential to the points of this paper are sufficiently substantiated. Exceptional extremes, which generally have little biological significance, ranges of variability and local records remain outside the scope of this study.

The seasonal trends.

Our data extend from the beginning of September to the turn of the year. Within this period of four months considerable changes of weight occur in the two species studied. As these changes are different in principle in all the different age and sex groups, they will be dealt with separately.

Adult males. The adult males of both capercaillie and blackgame maintain a roughly constant body weight throughout the autumn season (Table 1). However, in both species there is an increase of

Table 1. Seasonal trends in the weight of adult male capercaillie and blackgame (weighted means of 1952—1956; all zones).

	IX	X	XI	XII
Capercaillie				
Number	369	245	149	94
Absolute weight (kg.)	3.96	3.99	4.00	3.99
Relative weight (%)	99.0	99.8	100.0	99.8
Blackgame				
Number	441	354	177	93
Absolute weight (kg.)	1.22	1.27	1.32	1.27
Relative weight (%)	92.4	96.2	100.0	96.2

weight up to November, after which comes a slight decline. Proportionately, the change in weight in the course of the autumn is greater in blackgame than in capercaillie, the percentage increases from September to November being 8.2 and 1.0 %, respectively (Table 5, p. 8). The more labile body weight of the blackgame is also obvious from the relative weights given in Table 1. These are expressed as percentages of the maximum (November) monthly mean weight.

In neither of these species should the male be physically stressed in late summer, whence it seems probable that the weight increase in autumn is the final stage of the period of rehabilitation after the spring minimum (cf. SIIVONEN 1957). The slight decline after the November maximum is probably the first sign of the effects of the critical winter season.

Adult females. The annual weight cycle of adult tetraonid females differs in principle from that of the adult males. As recently emphasized by SIIVONEN (1957), there are two weight maxima in adult female tetraonids: one in autumn (November, according to our data) and another in early spring, immediately preceding laying; males show a single weight maximum only in autumn (November).

Correspondingly, there are two periods of weight decline in the females against only one in the males: one, common to all sex and age groups of tetraonids, in late winter, and another in summer during laying, incubation and rearing of broods. Egg-laying is a process involving considerable physical effort for the breeding female. This period is followed by almost a month's incubation, during which the female has little opportunity for feeding. The brood period, finally, involves intensive rearing activity, although this season (late June to July) probably introduces the period of rehabilitation (SIIVONEN, op.c.). Bearing this in mind, the nutritional condition of the breeding tetraonid female in early autumn can well be expected to be inferior to that of the male, which has enjoyed a longer »free» summer season.

Tables 2 and 5 indicate that adult females have not yet re-established their normal winter weight by September. In both species the relative weight in September is clearly lower than that of

Table 2. Seasonal trends in the weight of adult female capercaillie and blackgame (weighted means of 1952—1956; all zones).

	IX	X	XI	XII
Capercaillie				
Number	456	216	36	21
Absolute weight (kg.)	1.83	1.88	1.92	1.99
Relative weight (%)	95.3	97.9	100.0	103.6
Blackgame				
Number	275	253	150	96
Absolute weight (kg.)	0.90	0.97	0.99	0.98
Relative weight (%)	90.9	98.0	100.0	99.0

the adult male: 95.3 against 99.0 % in capercaillie and 90.9 against 92.4 % in blackgame. This also implies that adult females put on weight at a considerably more rapid relative rate during the remaining two months than the males, to reach their 100 per cent November weight (Table 5).

The data for capercaillie in December are insufficient and the suggested increase of weight may not be real.

There is unusally great sex dimorphism in body size in both capercaillie and blackgame. The maximal (November) weight of the adult female capercaillie is only 48.0 % of the maximal male weight (Tables 1 and 2). In blackgame the corresponding proportion is 75.0 %. These figures agree with those given by HAGEN (1942) on the basis of Norwegian records: 46.9 and 74.5 %.

Juvenile males. At the beginning of September the young are about 2 to 2 1/2 months old. Table 3 shows the average weight of juvenile males in the following 4 months.

Table 3. Seasonal trends in the weight of young male capercaillie and blackgame (weighted means of 1952—1956; all zones). For calculation of the relative weight the November weight of the *adult male* (4.00 kg. for capercaillie, 1.32 kg. for blackgame) is taken as 100.

	IX	X	XI	XII
Capercaillie				
Number	676	289	122	10
Absolute weight (kg.)	2.76	3.15	3.38	3.29
Relative weight (%)	69.0	78.8	84.5	82.3
Blackgame				
Number	762	422	240	146
Absolute weight (kg.)	1.10	1.19	1.25	1.25
Relative weight (%)	83.3	90.2	94.7	94.7

Juvenile males remain considerably lighter in their first winter than the adults (Tables 1 and 3). Young capercaillie in September are only 69.0 % of the maximum adult weight and 69.8 % of the adult weight of the same period. The juveniles gain weight much faster (22.5 % increase from September to November in capercaillie, 13.6 % in blackgame) than adults (1.0 and 8.2 % respectively) during the same period (Table 5). The relative weight increase in young male capercaillie is thus particularly great. Nevertheless, in November still, when the adults reach their maximum weight, the juveniles are only about 85 % (capercaillie) and 95 % (blackgame)

of the corresponding adult weight. This confirms DAHL'S (1922) suggestion that young male capercaillie do not attain adult weight in their first winter. v. ZEDLITZ (1926) and LÖNNBERG (1932) put forward a similar view concerning blackgame.

The linear measurements (wing length) of the first winter birds of both species also remain clearly below those of the adults (HELMINEN 1954).

As the weight of juvenile males in November before the critical winter season starts is under that of the adults, it seems probable that also during the display season in early spring juvenile males are smaller and lighter than adults.

Table 4. Seasonal trends in the weight of young female capercaillie and blackgame (weighted means of 1952—1956; all zones). For calculation of the relative weight the November weight of the *adult* female (1.92 kg. for capercaillie, 0.99 kg. for blackgame) is taken as 100.

	IX	X	XI	XII
Capercaillie				
Number	664	202	32	71
Absolute weight (kg.)	1.67	1.75	1.86	1.76
Relative weight (%)	87.0	91.1	96.9	91.7
Blackgame				
Number	548	256	144	90
Absolute weight (kg.)	0.86	0.93	0.99	0.97
Relative weight (%)	86.9	93.9	100.0	98.0

Juvenile females. Juvenile females start the autumn season at a higher weight level, in relative terms, than juvenile males. In capercaillie, in particular, the difference is considerable (87.0 % in females against 69.0 % in males in September). The relative September weight is equal in both species. By November blackgame have reached a weight equal to the maximal adult weight, whereas capercaillie dot not quite reach this level in the first winter averages.

The November weight is the highest in the juveniles of both species. This indicates that the critical winter period starts in general, for juveniles as for adults, by December.

Table 5. Percentage increase in weight from September to November of capercaillie and blackgame. Data from Tables 1—4.

	Adult male	Adult female	Juvenile male	Juvenile female
Capercaillie	1.0	4.9	22.5	11.4
Blackgame	8.2	10.0	13.6	15.1

Geographical and racial differences.

The area covered by the present study extends over 1000 km. in the north-south direction. It is thus conceivable that latitudinal and other geographical differences may be discernible in weights, as in clutch size and dynamics of population (e.g. SIIVONEN 1952, 1957), feeding and roosting behaviour (SEISKARI & KOSKIMIES 1955), flocking behaviour (KOSKIMIES 1957) and many other aspects of biology.

Table 6 illustrates the differences between the weight averages in the zones of South, Central and North Finland in the pooled data of all five years.

In blackgame there is a clear south-north trend of increasing weight. The high weights of the northernmost zone are particularly obvious. They exceed the corresponding weights of the southernmost zone by 10 (adult male), 13 (adult female), 10 (juvenile male) and 13 (juvenile female) per cent. The weights of the central zone, although keeping consistently between those of the southern and the northern zones, tend to remain closer to the former. This is probably in part due to the greater latitudinal distance of the »centre» of the central zone from the »centre» of the northern than of the southern zone. The two more southern zones may also be fairly homogeneous in their environmental conditions, the northern zone differing more (cf. VOIPIO 1956).

Table 6. The average weight of capercaillie and blackgame in the zones of South, Central and North Finland (weighted means of October 1—December 31, 1952—1956) and the variance ratio (F) values for testing the significance of the differences between the zone averages. The degrees of freedom for the mean squares involved: $n_1 = 2$; $n_2 = 8$. The 5, 1 and 0.1 per cent levels of significance are denoted with one, two, and three asterisks, respectively.

	South Finland	Central Finland	North Finland	F
Capercaillie				
Adult male	4.13	3.94	4.02	9.64**
Adult female	2.03	1.82	1.92	19.42***
Juvenile male	3.27	3.19	3.24	3.39
Juvenile female	1.82	1.75	1.76	0.16
Blackgame				
Adult male	1.25	1.27	1.37	7.01*
Adult female	0.93	0.96	1.05	6.58*
Juvenile male	1.16	1.19	1.28	8.16*
Juvenile female	0.89	0.94	0.01	5.91*

There is no parallel latitudinal trend in the weights of capercaillie. On the contrary, in this species the weights of the southernmost zone are *highest* and those of the central zone consistently lowest. The weights of the northern zone thus come between those of the central and southern zones.

The regular weight gain of blackgame seen on moving north conforms to Bergmann's Rule. A similar trend has been established for the bobwhite quail (NELSON & MARTIN 1953), the only game bird species on which these authors had sufficient material to study the geographical variation in weight.

The more irregular »cline» in the weight of capercaillie is probably connected with the racial conditions of this species. It is probable (e.g. LÖNNBERG 1924, VOIPIO 1951, JOHANSEN 1957; cf. also SEISKARI & KOSKIMIES 1955) that the capercaillie population of Finland is influenced by two or three different races. JOHANSEN (op.c.) suggests, that they are probably of geographically different origin and have invaded their present ranges in Finland from different directions, as many of the subspecies pairs (and groups) in the Fenno-scandian area have obviously done. Their characteristics, including weight, may have evolved independently. Differences in such characteristics may thus be explicable as evolutionary responses to differing environmental influences, perhaps primarily factors other than those dependent merely on latitude.

It is significant that the weight of capercaillie is consistently higher, not lower, in the southernmost zone than in the central one. The cline thus runs opposite to that in blackgame (and bobwhite quail) and to what might be expected according to Bergmann's Rule. This discrepancy (like the relation of the northernmost population to the central and southern ones) can hardly be explained otherwise than as resulting from different racial origins of the populations in question.

As there is a consistent trend of decreasing weight from the southern to the central zone, it seems that there is a zone of intergradation between a *large southern* and a *small eastern* form in South and Central Finland. The range of the eastern race should extend across Central Finland to form an apparently »central» race and be limited in north by a *medium-size northern* form.

This idea of the pattern of subspecific distribution of the capercaillie in Finland, based on an examination of weights, agrees com-

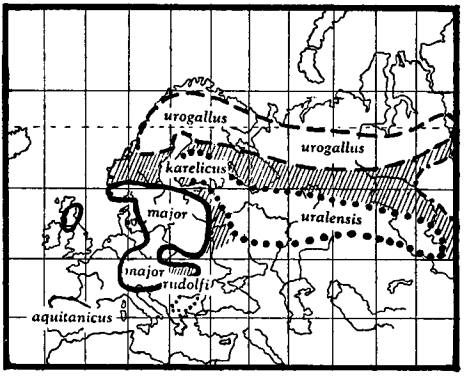

Fig. 2. The subspecific status of the capercaillie in Europe. From JOHANSEN (1957).

pletely with JOHANSEN's (1957) idea of the taxonomic status of this species in Fennoscandia (Fig. 2). The hypothetical large southern form whose influence is reflected by the »reverse» cline of weights in south and central Finland corresponds to the race *major* (or hybrids between *major* and *uralensis);* the lighter central (eastern) population would belong to *T. u. uralensis* (whose westernmost representatives have also been called *karelicus).* The northern population, again, with a cline of moderately increasing weight towards the north, corresponds to *T. u. urogallus,* separated from *uralensis* by the distinct zoogeographical barrier of the Maanselkä watershed (i. e. the boundary between the zones of Central and North Finland applied in the present study).

The body size ratios in the three populations, expressed in terms of wing length, parallel the weight ratios. In JOHANSEN's (op. c.) data the wing lengths of the males of the population with an assumed influence of *major* vary between 380 and 405 mm. The central *uralensis (= karelicus)* is smallest with wing measurements of 370—390 mm., whereas representatives of the race *urogallus* from northernmost Finland (i.e. farther north than is included in the averages of the northern zone of the present study) are roughly equal in size to the southern form (wing lengths 380—410 mm.).

The consistent latitudinal trend in the weight of blackgame agrees with the fact that no taxonomic differences warranting subspecific separation have been established in the Finnish populations of this species (VOIPIO 1951).

Although the blackgame of the northernmost zone are heavier than those of the more southern areas, the southern birds are at a

Table 7. The geographical differences in the September weights of capercaillie and blackgame expressed as percentages of the maximal (November) monthly mean weight of each group and zone.

	Adult male	Adult female	Juvenile male	Juvenile female
Capercaillie				
South Finland	95.7	96.1	87.7	97.7
Central Finland	99.2	89.1	81.5	94.2
North Finland	98.3	93.8	80.5	96.7
Blackgame				
South Finland	92.4	92.7	97.4	88.2
Central Finland	92.4	89.8	88.5	87.6
North Finland	95.7	87.3	87.8	85.7

more advanced stage of development in early autumn (Table 7). If the maximal monthly mean weight attained by each sex and age group during the winter is considered the »goal» of the yearly weight development, this goal is more nearly reached in September by the southern than by the northern birds. In blackgame this trend is apparent in juvenile birds of both sexes and in adult females, i. e. in all groups showing a greater weight increase in late summer and autumn.

This geographical difference in the stage of weight development is probably caused in part by the later breeding season of the northern areas, resulting in a less advanced stage of juvenile development (and adult female rehabilitation) in early autumn. However, the higher maximum weights in these areas may also tend to cause the early autumn weights there to appear proportionately lower than in the south.

The difference established also means at the same time that the northern birds increase in weight in autumn (in and after September) at a relatively faster rate (13.9 % increase from September to November in young male blackgame) than the southern ones (2.7 %). For juvenile females the corresponding rate of weight gain is 16.7 % in the northern zone, 13.4 % in the southern one.

Capercaillie shows indications of a similar trend (Table 7). In all groups except adult males the highest relative September weights are those of the southernmost zone. The trend is not consistent for the two northern zones, perhaps due to inadequate data.

The data of October 1 to December 31, broken down by years, has been examined for geographical differences by a two-way analysis

of variance of the yearly zone averages, taking into account the variations resulting from both geographical an yearly differences. The results are given in Table 6.

For blackgame the data are very consistent, and give a fair degree of significance for the zone differences illustrated by the averages in Table 6. The latitudinal trend between all three zones in consistent throughout. For capercaillie, again, the zone differences (of different pattern than in blackgame) are significantly consistent (and similar) in adult birds in the years studied; in the juveniles the zone differences are parallel to those in the adults, but not significant.

Yearly differences.

The year-to-year variations in the average weights are highly consistent in practically all sex and age groups of blackgame (Table 8). The weight has increased from 1953 to 1954 and from 1954 to 1955, but decreased from 1952 to 1953 and from 1955 to 1956. There is only one exception (juvenile female blackgame in 1954—1955) to this trend. In all groups of capercaillie the weight trend from 1952 to 1953 and from 1954 to 1955 is parallel to that in blackgame. In the other years the differences are insignificant.

Table 8. The average weight of capercaillie and blackgame in 1952—1956 (weighted means of October 1—December 31; all zones) and the maximal yearly variation in % of the November mean weight for all five years.

	1952	1953	1954	1955	1956	Maximal variation %
Capercaillie						
Adult male	4.04	3.97	3.95	4.09	4.09	3.5
Adult female	2.01	1.88	1.81	1.94	2.03	11.5
Juvenile male	3.28	3.12	3.27	3.29	3.07	6.5
Juvenile female	1.87	1.73	1.72	1.75	1.76	8.1
Blackgame						
Adult male	1.28	1.22	1.31	1.32	1.30	7.6
Adult female	0.98	0.95	1.00	1.01	0.93	8.1
Juvenile male	1.19	1.17	1.24	1.25	1.19	6.4
Juvenile female	0.94	0.88	1.00	0.96	0.91	12.1

The yearly variations in weight are very probably correlated with yearly differences in weather, notably temperature (Fig. 3).

For a quantitative comparison of these variables the following method was used: In each species, sex and age group (Table 8) any weight higher than th

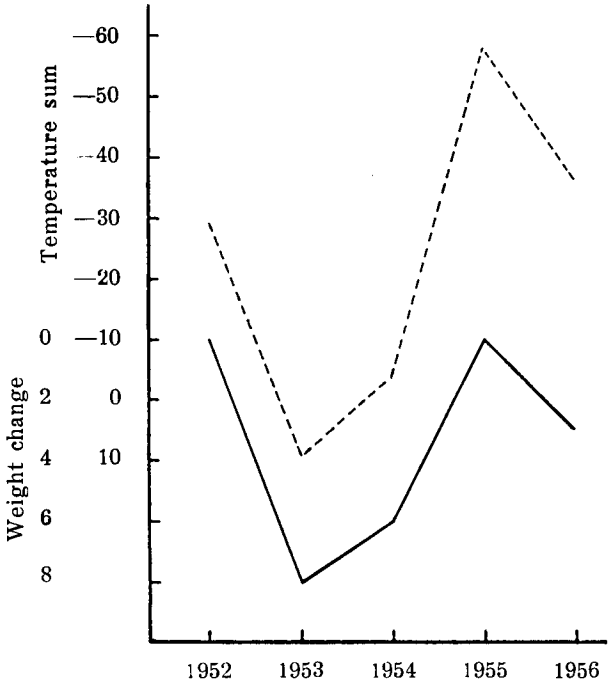

Fig. 3. Yearly variations in the weight of capercaillie and blackgame in Finland (solid line) and the corresponding mean temperature sums (broken line). Note the inverted scale of the temperature values. Further explanations in text.

corresponding weight of the previous year was given the numerical value of +1 and a weight lower than that of the previous year, the value —1. The arithmetic sum of all eight such group indices was used as a general index of the yearly weight status in relation to that of the previous year.

Year	Higher than in the previous year	Lower	Index
1953	0	8	—8
1954	5	3	2
1955	7	1	6
1956	2	5	—3

These indices were used to construct the curve in Fig. 3. The year 1952 was taken as 0 and the weight status of each year was plotted on the diagram in its correct relation to the previous year.

The indices of temperature used in Fig. 3 are the cumulative sums of October, November and December mean temperatures in Helsinki (South Finland), Kuopio

(Central Finland) and Sodankylä (North Finland) according to data of the Meteorological Central Institute.

The inverse relation of the temperatures and the weights is very obvious. In autumns with low temperatures the weights are high and vice versa. This result agrees with those of BALDWIN & KENDEIGH (1938), ODUM (1949), HAFTORN (1951), OWEN (1954) and others.

Obviously, in cold periods the birds eat more to sustain their energy balance and are consequently heavier, during the hours of daylight, at least. They probably also accumulate reserves of fat to be utilized in conditions of extreme cold and food deficiency.

During the period under review the maximal yearly variations have ranged from 3.5 (adult male capercaillie) to 12.1 (juvenile female blackgame) % of the November mean weight (Table 8). There is no clear difference in the relative degree of weight variation of capercaillie and blackgame, but the weights of the females seem to vary more than those of the males.

Summary.

The weights of 3659 capercaillie and 4498 blackgame, recorded in the autumns and early winters of 1952—1956, were analysed for variations caused by sex, age, season, locality and year.

In November the average weight of the adult female capercaillie is 48.0 % of the corresponding male weight; for blackgame the corresponding figure is 75.0 %.

In September the weight of the young capercaillie is only 69.8 (♂) and 91.3 (♀) % of the adult weight for the same period. For blackgame the corresponding percentages are 90.3 (♂) and 95.5 (♀). In November the juvenile weight is still only 84.5 (♂) and 96.9 (♀) % of the adult weight of capercaillie; with blackgame the proportions are higher, 94.7 (♂) and 100.0 (♀) %.

In all sex and age groups of both species there is a weight gain from September to November varying from 1.0 % in adult male capercaillie to 22.5 % in juvenile male capercaillie. Except in young males, the relative weight increase is greater in blackgame than in capercaillie.

The maximum weights are reached in November. By December the weights gradually start to decline.

Blackgame show a consistent trend of increasing weight from

south to north. However, all groups showing a greater weight increase in autumn (i.e. adult females and juveniles of both sexes) reach a more advanced stage of weight development by September in the south than in the north. This tendency is also present in capercaillie, but not as clearly expressed.

With capercaillie, the southernmost populations are heaviest and the central ones lightest on the average. It is probable that the former are influenced by a large southern race *(Tetrao urogallus major)* and the latter by a smaller eastern one *(T. u. uralensis)*. The northern populations are intermediate in weight, probably representing the nominate race *T.u. urogallus*.

There are year-to-year variations of about 5—10 % in the average weight of the period October—December. The yearly weight level is in inverse relation to the average temperature of the same period.

References: AMADON, D., 1943, Bird weights as an aid to taxonomy. Wilson Bull. 55: 164—177. — BALDWIN, S. P. & S. C. KENDEIGH, 1938, Variations in the weight of birds. Auk. 55: 416—467. — BÄHRMANN, U., 1950, Das Totalgewicht des Hühnerhabichts, Accipiter gentilis gallinarum (Br.), und seine Bedeutung als Hilfsmittel zur Unterscheidung der Habichtsrassen. Vogelwelt 71: 177—184. — DAHL, K., 1922, Ti aars iagttagelser over skogsfugl og ryper. Norsk Jaeger- og Fiskerforenings Tidskr. 6. — GRIMM, H., 1954, Biometrische Bemerkungen über mitteldeutsche und westdeutsche Sperlingspopulationen. Journ. Ornith. 95: 306—318. — HAFTORN, S., 1951, En undersøkelse over vektvariasjoner i vinterhalvåret hos kjøttmeis. Fauna (Oslo) 1951: 83—91. — HEINROTH, O., 1922, Die Beziehungen zwischen Vogelgewicht, Eigewicht, Gelegegewicht und Brutdauer. Journ. Ornith. 70: 175—185. — HAGEN, Y., 1942, Totalgewichts-Studien bei norwegischen Vogelarten. Arch. Naturgesch., N. F. 11: 1—173. — HELMINEN, M., 1944, Metson ja teeren iänmäärityksestä siiven rakenteen perusteella. Unpublished M.A. thesis, Univ. Helsinki. — JOHANSEN, H., 1957, Rassen und Populationen des Auerhuhns (Tetrao urogallus). Viltrevy 2 (in print). — KALELA, O., 1944, Suomen luonnonhistoriallisesta aluejaosta. Mem. Soc. F. Fl. Fenn. 19: 151—165. — KOSKIMIES, J., 1953, Kanalintujen iän määritys siipisulista. (Summary: The 1952 kill of capercaillie and blackgame in the light of wing samples.) Suomen Riista 8: 30—35. — 1954, Metson ja teeren paino. (Summary: The weight of capercaillie and blackgame.) Ibid. 9: 124—125. — 1956, Ålderbestämning av hönsfåglar med ledning av vingpennornas utseende. (Summary: Determining the age of gallinaceous birds by the outer primary method.) Viltrevy 1: 158—161. — 1957, Flocking behaviour in capercaillie, Tetrao urogallus L. and blackgame, Lyrurus tetrix (L.). Pap. Game Research 18: 1—32. — KUJALA, V., 1936, Kasvillisuus. In: Suomen maantieteen käsikirja. Helsinki. — LINSDALE, J. M. & E. L. SUMNER, 1934, Winter weights of golden-crowned and fox sparrows. Condor 36: 107—112. — LÖNNBERG, E., 1924, Något om tjäderraser. Fauna o. Flora 19: 66—74. — 1932, Till kännedomen av våra jaktbara fåglars vikt. Svenska Jägareförbundets Tidsskr. 70: 355—362. — MILLER,

A. H., 1941, Speciation in the avian genus Junco. Univ. Calif. Publ. Zool. 44: 173—434. — MOREAU, R. E., 1944, Some weights of African and of wintering Palearctic birds. Ibis 86: 16—30. — NELSON, A. L. & A. C. MARTIN, 1953, Gamebird weights. Journ. Wildl. Managem. 17: 36—42. — NICE, M. M., 1938, The biological significance of bird weights. Bird Banding 9: 1—11. — ODUM, EUGENE P., 1949, Weight variations in wintering white-throated sparrows in relation to temperature and migration. Wilson Bull. 61: 3-14. — OWEN, D. R., 1954, The winter weights of titmice. Ibis 96: 299—309. — RICHDALE, L. E., 1947, Seasonal fluctuations in weights of penguins and petrels. Wilson Bull. 59: 160—171. — SEISKARI, P. & J. KOSKIMIES, 1955, Ecological evidence of racial divergence in the capercaillie, Tetrao urogallus L. in Finland. Pap. Game Research 16: 1—11. — SIIVONEN, L., 1952, On the reflection of short-term fluctuations in numbers in the reproduction of tetraonids. Ibid. 9: 1—43. — 1957, The problem of the short-term fluctuation in numbers of tetraonids in Europe. Ibid. 19: 1—43. — STEWART, P. A., 1937, A preliminary list of bird weights. Auk 54: 324—332. — VOIPIO, P., 1951, Linnustomme alalajikysymyksen nykyinen vaihe. (Summary: Recent status of subspecific bird taxonomy in Finland.) Ornis Fenn. 28: 1—19. — 1956, The biological zonation of Finland as reflected in zootaxonomy. Ann. Zool. Soc. 'Vanamo' 18, 3: 1—36. — WOLFSON, A., 1945, The role of the pituitary, fat deposition, and body weight in bird migration. Condor 47: 9—127. — v. ZEDLITZ, O., 1924, Das Gewicht als Rassenmerkmal bei Tetrao urogallus. Journ. Ornith. 72: 244—252. — 1926, Vogelgewichte als Hilfsmittel für die biologische Forschung. Ibid. 74: 296—308.

S e l o s t u s : **Metson ja teeren painon vuodenaikaisesta, alueellisesta ja vuosien välisestä vaihtelusta.**

Tutkimus perustuu 3659 metson ja 4498 teeren painotietoa käsittävään aineistoon, joka on koottu Suomen eri osista syksyllä ja syystalvella vuosina 1952—1956. Käsittelyssä eritellään sukupuolten, ikäluokkien, vuodenaikojen, alueiden sekä vuosien väliset erot kummankin lajin keskimääräisissä painoissa.

Marraskuussa vanhan naarasmetson paino on 48.0 % koiraan painosta, vanhan naarasteeren vastaavsti 75.0 %.

Syyskuussa nuorten metsojen painot ovat vain 69.8 (♂) sekä 91.3 (♀) % vastaavista täysikasvuisten yksilöiden painoista. Teerellä suhdeluvut ovat 90.3 (♂) ja 95.5 (♀) %. Vielä marraskuussakin nuorten metsojen paino jää vain 81.5 (♂) ja 96.9 (♀) %:ksi vanhojen lintujen painosta. Teerellä suhdeluvut ovat jälleen korkeammat: 94.7 (♂) ja 100.0 (♀).

Kummankin lajin kaikissa ikä- ja sukupuoliryhmissä keskipaino kasvaa syyskuusta marraskuuhun. Pienin painonlisäys (1.0 %) on vanhoilla koirasmetsoilla ja suurin (22.5 %) nuorilla koirasmetsoilla. Nuoria koiraita lukuunottamatta suhteellinen painonlisäys on teerellä suurempi kuin metsolla.

Suurimmat keskipainot saavutetaan marraskuussa. Joulukuun aikana painot alkavat vähitellen laskea.

Teeren paino kasvaa säännöllisesti etelästä pohjoiseen. Kuitenkin kaikki ne ryhmät, joissa esiintyy voimakkaampaa painonlisäystä loppukesän aikana (vanhat naaraat ja kaikki nuoret) ovat syyskuussa Etelä-Suomessa (niiden talviseen

loppupainoon verrattuna) suhteellisesti painavampia kuin Pohjois-Suomessa. Metsolla sama suuntaus esiintyy vähemmän selvänä.

Eteläisimmän Suomen metsot ovat keskimäärin painavimpia ja Keski-Suomen metsot keveimpiä. On luultavaa, että edellisten korkea paino heijastaa kookkaan eteläisen rodun *T. u. major* vaikutusta, kun taas Keski-Suomen yksilöt kuuluvat pienikokoiseen itäiseen muotoon *T. u. uralensis (= karelicus)*. Pohjois-Suomen metsot edustavat keskisuurta tyyppiä ja kuulunevat nimirotuun *T. u. urogallus*.

Loka—joulukuun keskipainot vaihtelevat vuodesta toiseen n. 5—10 % verran. Po. painot eri vuosina ovat käänteisessä suhteessa saman kauden keskilämpötilan kanssa.

Havaintoja rytikerttusen *(Acrocephalus scirpaceus)* ja ruokokerttusen *(Acrocephalus schoenobaenus)* pesimisvaiheesta.

KALEVI RAITASUO

Viimeksi kuluneiden vuosikymmenien aikana maahamme levinneen eteläisen linnustoaineksen piirissä tuskin on toista lajia, joka olisi kyennyt yhtä nopeasti vakiintumaan ja yleistymään elintilansa pohjoisilla äärialueilla kuin rytikerttunen. Oltuaan vielä 30 vuotta sitten varsin harvalukuinen tulokas maamme lounaisrannikolla voittaa se runsaslukuisuudessa nykyisin jo — ainakin paikka paikoin — sukulaisensa ja kilpailijansa ruokokerttusen (FRITZÉN & TENOVUO 1954, RAITASUO 1954).

Taulukko 1. Tietoja ruoko- ja rytikerttusen lukumääräsuhteista vv. 1926—1956.

Havainnoitsija		Havaintoalue	Laskettu laulavia ♂♂ *A. schoen.*	*A. scirp.*	Suhde:
1926	P. PALMGREN	Hammarland	26	1	96:4 %
1932	P. PALMGREN	Lemland, Geta, Finström, Jomala	24	5	83:17 %
1937	O. LEIVO	Espoo, Laajalahti	n. 18	7	75:25 %
		H:ki, Lauttasaari	3	1	
		H:gin pitäjä, Saunalahti—Brakvik	15	4	
		Herttoniemensalmi	3	1	
1952	N. FRITZÉN	Ruissalo	26	36	42:58 %
1956	K. RAITASUO	H:ki, Lauttasaari	7	12	37:63 %