LIMOSA
JAARGANG 23, 1950, No. 3—4
Verschenen SEPTEMBER 1950
ORGAAN DER CLUB
VAN NEDERLANDSCHE VOGELKUNDIGEN
VOORTZETTING VAN JAARBERICHT 1 — 17, 1911 — 1928

The post-glacial distribution of *Corvus monedula* in Europe

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(with one text-figure).

1. The problem.

Previous work on the distributional history of forest birds (*Dendrocopos, Pyrrhula*: VOOUS, 1947 and 1949) has yielded the following details of the post-glacial dispersal of these birds in Europe.

1. Iberian populations of *Dendrocopos major* (and *minor*: VON JORDANS, 1938) proved to be distinct from Italian ones. Their isolation was thought to have started during the last Glacial Period; the Iberian races being consequently older than the S. W. European ones. Further investigations have to bring to light whether the Pyrenees actually represented a barrier to birds inhabiting forests and park lands not only during, but also after the last Glaciation. The taxonomy and distribution of North African populations indicated that these are probably still older than Iberian ones.
2. The whole of Central Europe and the British Isles have been peopled by populations from a southwestern and southern forest refuge. This refuge was thought to be situated in S. France and N. Italy. However, the evidence of the existence of continuous glacial forests in S. W. France and Italy and the consequent racial correspondence of present Italian and French races of birds inhabiting forests and park lands has still to be proved in many more cases than are known at present.
3. S. E. European populations of *Dendrocopos major* and *D. minor* were probably very incompletely separated from southern and southwestern ones, but this does not therefore imply that this is a rule in birds of the deciduous forest. The S. France and Italian race (*albipectus*) of *Garrulus glandarius* is said to inhabit also Yugoslavia (KLEINER, 1938), but a distinct race (*graecus*) lives in Bulgaria and Greece. Isolated populations of *Pyrrhula pyrrhula* must have inhabited S. E. European glacial conifer forest refuges, which were probably separated from a deciduous forest region in Italy and S. France.

4. The present distribution of S. E. European races indicates the influence of the Carpathian Mountains and Transsylvanian Alps, as also of the Hungarian plains, as important barriers, which must have prevented the postglacial dispersal of forest birds to central Europe. However, the apparent post-glacial extension of *Dendrocopos medius* (and other birds, e.g. *Lanius minor*) from a southeastern refuge arises the question of the general validity of these barriers to birds of forests and park lands.
5. Present Russian and Fennoscandinavian populations proved to represent post-glacial immigrants from an Asiatic refuge. However the exact situation of Asiatic glacial refuges of birds inhabiting forests and park lands is still uncertain.
6. The regions of a post-pleistocene dispersal-contact between Asiatic and S. W. European populations (Poland, the Danish Isles and the Jutland Peninsula) proved to be hybridization zones with a very large amount of individual variability. The question arises whether the presence of hybridization zones in corresponding areas is a common feature of the distribution pattern of birds of the European forests and park lands.
7. In the Carpathian Mountains and Bohemia hybridization occurs between the eastern, southeastern and southwestern refuge populations of *Dendrocopos major, D. minor* and *P. pyrrhula*. Future work will have to investigate the question whether the occurrence of hybrid populations of forest birds in these regions must be regarded a rule or an exception.

2. Introduction.

It is the aim of the present work to study the above discussed points of general zoogeographical interest in the light of the distribution and taxonomy of the Jackdaw (*Corvus monedula* L.). This species forms a mono-typic taxonomic unity ("genus" *Coloeus*) without close relatives. Hence the distributional history of this species can be treated as a whole. *C. monedula* has the advantage that it does not cross the limits of the palaearctic region and that it is not confined to a forest biotope, as are *Dendrocopos* and *Pyrrhula*, previously studied by me in a similar way. It shows a marked preference for park lands and cultivated regions and is, together with *Pyrrhocorax*, the only member of the crow tribe that breeds in holes, both in trees and in rocks, in forests as well as in steppes.

C. monedula differs from the other members of the Corvidae by having a rather short bill and a glossy crown which contrasts sharply with the grey head and generally lighter grey hind neck. Its taxonomy has been satisfactorily studied by KLEINER (1942). Consequently I have followed in the present paper most of his conclusions. In addition I have studied more than 200 specimens mostly from northern and eastern European countries on which I had to build up my own conclusions. Fortunately I found these to be quite in accordance with KLEINER's. The examinations were made in the Zoological Museum at Amsterdam, the British Museum of Natural History at London, the Zoological Museum at Copenhagen, the Natural History Museum at Malmö, the Royal Museum of Natural History at Stockholm. During these studies I received most kind facilities from the museum officials, as also important help from my wife, to all of which I wish to express my sincerest thanks. Thanks are also due to the "Organisatie voor Zuiver Wetenschappelijk Onderzoek" (The Hague) which supplied me a grant for the study at the above named foreign museums.

The character geography of *C. monedula* includes the following characteristics: (1) general size, (2) intensity of grey coloration of under parts, (3) intensity of grey coloration of upper parts, (4) development of grey neck band, (5) presence and development of white patches to the sides of the neck (below ear-coverts). In eastern Asia a black-and-white form (*dauuricus*) occurs, having a white breast and neck band. Except for this conspicuous race, which was for long regarded as a distinct species, all Jackdaws resemble each other closely.

Attention has to be drawn to the fact that examination of specimens should be exclusively done with birds of (1) comparable age and of (2) comparable date of collecting. In the first winter plumage (characterized by brownish and strongly abraded primaries and tail quills) the under parts are darker, the hind neck is darker grey, and — in races with a white ear-patch — the ear-patch is much less developed than in the final adult plumage. Throughout the winter season the under side in adult birds becomes slightly darker and the grey neck much lighter than in the freshly-moulted autumn plumage, through the abrasion of soft grey feather edges. In spring the upper parts can get a more or less scaly appearance, caused by wear of the light grey edges of the dark mantle feathers: in the partly abraded edges but very few rami have remained which in favourable lights give a silvery structure effect.

In the following chapter I have tried to draw a rough sketch of the post-glacial distributional history of *C. monedula* based upon the evidences of modern distribution and character-geography (fig. 1). The results should be compared with the conclusions arrived at previous examinations and summarized in chapter 1. The importance of such a comparison increases through the fact that *C. monedula* has slightly different ecological claims than the Pied Woodpeckers and the Bullfinches on which chapter 1 is based.

3. Distributional History of *Corvus monedula*.

1. The Jackdaws of the Iberian Peninsula (*ibericus* (KLEINER)) agree with W. European and Italian birds in having a rather dark uniform upper side and by lacking a white side-patch below the ear-coverts. They differ slightly from these birds by having a lighter grey hind neck and lighter grey under parts. They are

somewhat intermediate between the birds from W. Europe and N. Africa. Besides, KLEINER's measurements prove Iberian Jackdaws to be slightly smaller than W. European ones. The taxonomic differentiation of birds from the Iberian Peninsula includes the possibility of their separation from France and Italy dating back to the last Glaciation and confirms the zoogeographical conclusions mentioned in the first paragraph (sub 1). No specimens from the Pyrenees could be examined so that nothing can be contributed to the knowledge of the supposed importance of this dispersal barrier in post-glacial times.

N. African Jackdaws are different from Iberian ones. They are among the darkest of the known races of this species and have an only faintly pronounced hind neck. The Moroccan form (*nigerrimus* (KLEINER)) seems to be an exclusive mountain breeder and is strikingly large (rule of BERGMANN). These birds live in rather few and isolated rookeries in the Atlas Mountains and were often found associated with Alpine Choughs (*Pyrrhocorax*). Conspicuously smaller and still darker birds (*cirtensis* (ROTHSCHILD & HARTERT)) live in N. Algeria (near Constantine). They seem to be rather scarce and their populations must be well isolated from the Moroccan ones. The fact that two different populations of this species live in N. Africa, which, moreover, are strikingly distinct from the S. European ones, indicates that they must have become isolated before the present Iberian ones and apparently long before the last Glaciation.

2. Italy, France, the British Isles and the whole of Central Europe are inhabited by one race (*spermologus* VIEILLOT) which is only slightly lighter above than *ibericus*, but darker on the under parts. From south to north these populations gradually get lighter general upper parts as well as a lighter grey hind neck. This process proceeds to such a degree that the extreme types of individual variability from the outermost populations of this cline (Italy and the southern half of France against E. Germany, W. Poland, Austria, Bohemia, part of Hungarian plains) are separated by KLEINER and a few other authors under the names *spermologus* and *turrium* (BREHM). To my mind the British Museum series of random specimens from France, the Netherlands, Saxony, and Hungary were almost alike. Hence it remains questionable whether the terminal populations of this slightly pronounced cline deserve a special name. The distributional pattern, however, is strictly comparable with the clinal variation found in *Dendrocopos major*, *D. minor* and *Garrulus glandarius* discussed in other occasions. In all these cases the terminal populations can be rather easily distinguished, but individual specimens from the remaining populations can hardly be classified. Corresponding with the gradual change in plumage characteristics KLEINER's measurements indicate a slight clinal diminution in average size. As a conclusion a post-glacial distributional dispersal from N. Italy and S. France north

to the British Isles, turning northwards along the Alps in eastern direction appears logically to suppose.

3. S. E. Europe, south of the Hungarian plains and the Transsylvanian Alps, is inhabited by a very distinct race (*collaris* (DRUMMOND)). Its racial characteristics are: rather small size, a conspicuous white patch on the sides of the neck, light grey neck, and relatively light grey under parts. The last named character distinguishes this race easily from the N. E. European race *soemmeringi*! All specimens from Servia, Macedonia, Albania and Bulgaria examined by me were constant in their plumage characteristics. Jackdaws seem to have a rather local distribution in N. Yugoslavia, Dalmatia, and Greece, but they are recorded as abundant in Albania and Bulgaria. Still the present distribution of races indicates a separation between S. W. European (Italian) and S. E. European populations. It has to be examined, however, if the S. E. race *collaris* forms a direct continuation of the populations inhabiting Asia Minor, Syria and Mesopotamia (*pontocaspicus* (KLEINER)). According to KLEINER's investigations a clinal variation of Jackdaws appears to exist in all these regions, so that it is very difficult to separate *collaris* and *pontocaspicus*. The latter race — from which I did not examine specimens — is said to be intermediate between *collaris* and *soemmeringi* in having the upper and under parts and the grey hind neck slightly darker than in *collaris*, but lighter than in *soemmeringi*. It cannot be excluded that *collaris* and *pontocaspicus* have represented continuous populations for a considerable period of time. Hence it must remain unproved that the S. E. European Jackdaws have survived there during the Glacial; they might be post-glacial immigrants in Europe from Asia Minor as well, although this is not likely.

4. At present the race *collaris* hardly crosses the mountain chains formed by the Balcans and Transsylvanian Alps and breeds only in the southern parts of the Hungarian plains, where it is replaced in the north by the central European form (KLEINER). KLEINER refers all his Transsylvanian birds from April to July to „*turrium*", but specimens from Transsylvania examined by me in the British Museum did not seem to be distinct from those from Servia and other S. E. European countries and are therefore referable to *collaris*. Only in the Dobrudsha *collaris* occurs north of the mountains, but here it apparently hybridizes with Russian *soemmeringi* (KLEINER). Hence the S. E. European mountains can be said to have acted indeed as a post-glacial dispersal barrier.

5. The whole of Russia and western and central Siberia is inhabited by the race *soemmeringi* FISCHER. It possesses the white patch on the sides of the neck also found in *collaris* but differs from this race by conspicuously darker under parts and slightly darker upper parts and by at the average larger size. The Scandinavian Jackdaws (*monedula* L.) can be regarded to be the westernmost representatives of these populations, since the white patch to the

sides of the neck — which is only an eastern characteristic — is found in many Swedish breeding birds. Among 68 birds from Sweden and the islands of Zealand and Bornholm (Denmark) I found 16 (23 %) which had a distinct white neck patch. Finland series were not available to me (the only one examined had a white patch), but 4 from 6 Baltic specimens had also white neck patches. A series of 11 West Siberian birds in the collection JOHANSEN (Copenhagen Museum) had white neck patches in 100 % of the specimens.

Apart from the white neck patches 6 birds from Esthonia and Lithauen could be hardly distinguished by me from Swedish ones. The same must be said from an adult Russian bird in the Stockholm Museum (Charkov, Dec. 22), which I found to be identical with Swedish birds, also lacking the white neck patch ! However, this bird can be a migrant. Among other authors JOHANSEN (1944) emphasizes the fact that the races *soemmeringi* and *monedula* merge gradually into each other, so that some authors cannot distinguish between them (o.a. STEGMANN). They apparently show a clinal diminution from east to west in the development of the white neck patch and in the same direction the under parts become slightly lighter and less pure grey, Scandinavian birds being tinged with a hue of sandy brown. According to KLEINER's measurements the average size decreases in the same direction. Hence it is certain that Fennoscandinavia has been post-glacially peopled by eastern immigrants from a *soemmeringi* stem.

During the last Glacial Period *soemmeringi* must have survived somewhere in western Asia, but the present distribution and taxonomy do not give an exclusive key as to the exact localisation of the refuge. As a breeding bird in Sweden the species does not cross at present the 64° northern latitude, though it has been observed as far north as northern Lapland (Förteckning over Sveriges Fåglar, 1949). In Norway it does not breed north of the Trondhjem District (about 64° north), but stragglers are recorded north to 69° 30′ north (SCHAANNING, 1920). In Finland KALELA (1938) lists it as a typical "southern" species, only occurring in the southern parts of the land, mainly in regions of human cultivation. Hence it seems improbable that the species has survived very close to the pleistocene land-ice, which at least in Europa was moreover surrounded by barren peri-glacial zones with a tundra or steppe type of vegetation. Although the species lives at present in western Siberia in the taiga formation, breeding in tree-holes and even in open nests like those of other crows (!) (JOHANSEN, 1944), yet it seems mostly confined to the southern taiga. The postulation of a glacial refuge of this species in south central Siberia seems therefore not acceptable, but it may have survived in the park lands which still at present form the transitional zone of vegetation between the taiga and the steppe. It is possible — but not more than that — that glacial populations have lived somewhere in a southern Ural refuge. Since at present the Jackdaws in western Siberia also breed in steppe regions, in holes and crevices of steep river banks and low mountains it is possible that the west Asiatic glacial refuge was rather large. The close similarity of Jackdaws at present inhabiting western Siberia and Russia (*soemmeringi*), Turkestan (*ultracollaris* KLEINSCHMIDT) and the Ponto-Caspian region (*pontocaspicus*) may have found its explanation in this way.

In central Siberia *soemmeringi* extends its range eastwards to Lake Baical, where it meets the race *dauuricus* PALLAS. The latter birds are strikingly distinct by being bi-coloured, having the breast and hind neck pure white, sharply contrasting with the almost black coloration of the rest of the plumage. *Dauuricus* must have survived the last Glaciation in Manchuria and China and has now extended westwards to Baicalia. Between the River Yenisei and Irkutsk Jackdaws are said to be rather rare birds, but it is in this region that the very distinct races *dauuricus* and *soemmeringi* meet. JOHANSEN (1944) records the first unmistakable hybrid from Irkutsk (April 22, 1930); it has the upper parts as in *soemmeringi*, but the under parts are sooty grey, irregularly mixed with greyish white feathers. *Soemmeringi* does not seem to cross the River Ui near Irkutsk, but odd specimens of *dauuricus* have been collected as far westwards as Tomsk (JOHANSEN, 1944).

6. The distributional limits of *soemmeringi* and *turrium* are found in E. Poland. Roughly speaking the boundary is formed by a zone situated between the rivers Bug and Njemen. After the personal examination of 7 specimens from Slonim, E. Poland, and 2 from Wolhynia in the Zedlitz Collection (Stockholm Museum) I agree with KLEINER that these populations are characterized by extremely wide individual variation, which includes both the pure *soemmeringi*- and *spermologus*-types, as also many intermediate forms. Most of the birds examined by me (78 %) had white neck patches. This type of variation must be the result of the contact between distinct populations showing random hybridization. Not less than three systematic names have been adjusted to these mixed populations :

tischleri KLEINSCHMIDT : East Prussia.
schlüteri KLEINSCHMIDT : regions around Grodno and Wilna.
sophiae DUNAJEWSKI : Wolhynia.

Thus, not only the eastern origin of *soemmeringi* and the western origin of *spermologus* has been proved, but also the fact that hybridization occurs in the zone of contact of these populations. However, gene flow from east to west must have advanced at least as far westward as Kielce, S. W. Poland, since in one of two breeding females from this locality in the ZEDLITZ Collection (Stockholm Museum) I found a small white neck patch ; the birds being otherwise undistinguishable from German ones.

In Denmark the situation is not quite clear. I found 14 breeding birds from the island of Zealand in the Copenhagen Museum to be identical with Swedish birds, but according to SALOMONSEN (1930) and LÖPPENTHIN (1946) the breeding populations from S. Jutland are strongly mixed with *spermologus*, if not pure *spermologus*. The boundary between *monedula* and *spermologus* is situated in the area between Esbjerg and Haderslev, where according to SALOMONSEN (in litt.) undoubtedly mixed populations are found. This situation represents a confirmation of the distributional history mentioned in the introductory paragraph (1) sub 6, stating that Denmark is post-glacially peopled by eastern populations from the north (*monedula*) and by southwestern populations from the south (*spermologus*).

Of 47 Swedish birds examined by me 3 adult birds in the Stockholm Museum were very conspicuous by being almost identical with W. European *spermologus*. They are (1) ♀ Dec. 17, 1927, Skabersjo, Scania, (2) ♀ Feb. 22, 1925, and (3) ♀ March 14, 1925, both from Pixbo near Göteborg. ZEDLITZ identified these birds on their labels very cautiously as *monedula* $\gtrless$ *spermologus*, but to my mind they could be matched with central and western European specimens. According to the new Handlist of Swedish birds (Förteckning over Sveriges Fåglar, 1949) the Jackdaw is partially a wintering species in Sweden and the above named specimens may therefore be considered as indigenous ones. It is possible that the three *spermologus*-like birds are the indication of a slight central European influence in originally eastern populations in South Sweden, a phenomenon which was also supposed in the case of *Dendrocopos major* and *Pyrrhula pyrrhula*. The present influence might then be the result of a former post-pleistocene extension of central European populations to Scandinavia at a time that S. Sweden was part of the Danish Peninsula, which lasted to the initial stage of the Ancylus Lake (about 6500 B. C.). An alternative explanation might be found in the fact that Jackdaws migrate in flocks and remain very social in their winter quarters. The possibility cannot be excluded that one or more indigenous Jackdaws from the S. W. European winter quarters may have associated a flock of migrants and may have followed their new companions on their way home to Scandinavia. A similar history must be assumed e.g. for an adult male of *Carduelis spinus*, marked as breeding bird on June 26th in the Giant Mountains, Czechoslovakia, (50° 38′ northern latitude) and recovered after two years on May 25th as a breeding bird in E. Finland (62° 35′ northern latitude) (KADLEC, 1939)!

7. According to KLEINER's data no intermediate populations between the races *soemmeringi*, *collaris* and *"turrium"* in Europe would exist, for the range of *collaris* was thought to extend not far enough north of the rivers Danube and Save. Most of the Hungarian plains, Carpathians and Transsylvanian Alps are according to KLEINER occupied by the central European race *"turrium"*. Hence only in the southern parts of the Hungarian plains the races

collaris and *"turrium"* contact each other and subsequently hybridize. However, the *collaris*-like specimens from Transsylvania which I could examine in the British Museum (see above) indicate that in this region contact between all three above mentioned races must have been realized. Contact between populations of *collaris* and *soemmeringi* has been described by KLEINER from the lowlands of eastern Rumania (Dobrudsha) and in northern Bulgaria and the coastal lowlands. Members of these populations, from which I did not examine specimens, are said to remind those intermediate ones from Poland known under the name *"sophiae"* ! Although the actual limitation of the ranges of *C. monedula* in S. E. Europe is different from the tentative ones described for *Dendrocopos major, D. minor,* and *P. pyrrhula,* yet the situation confirms that the S. E. European race (*collaris*) forms hybridization zones with both the eastern (*soemmeringi*) and the western (*"turrium"*) race. The western race of *C. monedula* occupies a larger area than the corresponding race of the other species examined, but we are still very far from knowing what has caused this wide extension of the range. At all events the populations of *"turrium"* must have come from W. Europa, since they form taxonomically the continuation of the central European birds and are distinct from the Italian ones from which they are also separated in N. W. Yugoslavia by the race *collaris.* Only through central and western Germany and France *"turrium"* gradually merges into the Italian populations.

4. Measurements.

Size variation in *C. monedula* is very large. Hence, dimensions can hardly be used in separating geographic races. It appears, however, that average values of wing length are rather constant and can be used as additional evidence of the supposed post-glacial way of dispersal. In figure 1 I have summarized the wing lengths of 275 adult breeding birds mentioned by KLEINER, including those specimens from southern populations that KLEINER regarded as indigenous ones. It would be wrong adding my own measurements to those of KLEINER's, since his method of measuring must have been different from mine; his figures being usually at least 5 mm smaller than those taken by me of wings pressed flat on the ruler. The figures given on the map are the mean values of the average wing length of males and females. In large European series the average wing length of females proved to be 96.6% of that of males. KLEINER's measurements of E. Asiatic *C. m. dauuricus* showed a figure of 96.1%, indicating that the sexual difference in dimensions is rather constant throughout the whole range. In those cases that KLEINER's tables mentioned breeding males only (W. France, Russia) I calculated the female average by taking 96.6% of the average of males. The following wing measurements (KLEINER) have been used in figure 1 :

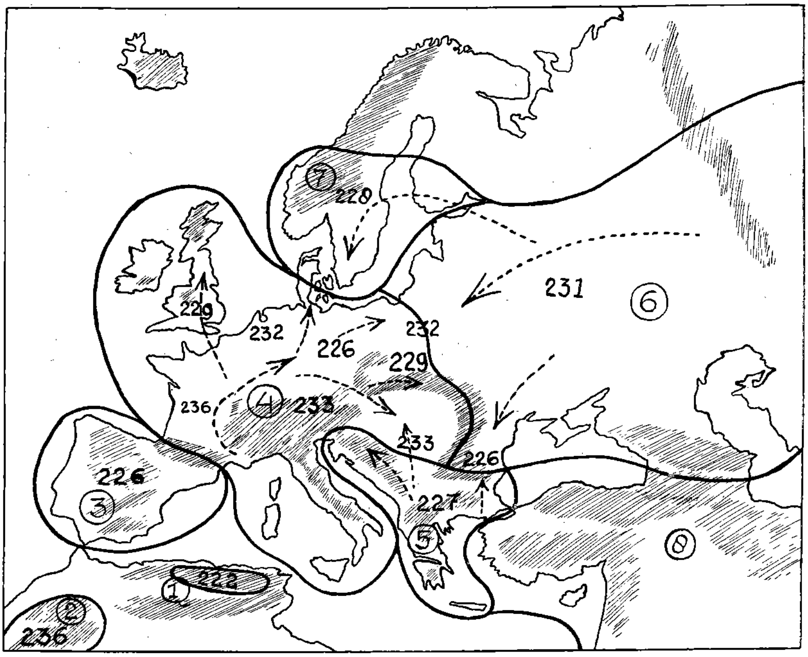

Figure 1. Distribution of *Corvus monedula* in Europe. The ranges of the races are indicated, as also the mean values of the average wing length of males and females, calculated from measurements given by KLEINER (1939—42). The supposed post-glacial dispersal is indicated by arrows. 1. *cirtensis*; 2. *nigerrimus*; 3. *ibericus*; 4. *spermologus* (incl. *"turrium"*); 5. *collaris*; 6. *soemmeringi*; 7. *monedula*; 8. *pontocaspicus*.

Algeria	—	2	♂♂	218—224,	average	221.0
	—	3	♀♀	220—228,	,,	223.2
Morocco	—	4	♂♂	238—255,	,,	243.2
	—	2	♀♀	227—231,	,,	229.0
Spain	—	2	♂♂	230—233,	,,	231.5
	—	3	♀♀	218—224,	,,	220.7
W. France[1]	—	4	♂♂	236—247,	,,	240.0
	—		♀	calculated as 232		
Belgium Netherlands Great Britain	—	6	♂♂	233—245,	average	238.2
	—	7	♀♀	220—231,	,,	225.0
	—	5	♂♂	221—240,	,,	233.2
	—	2	♀♀	221—227,	,,	224.0
Central Germany	—	13	♂♂	220—240,	,,	233.0
	—	15	♀♀	211—230,	,,	219.5
S. Germany Austria	—	17	♂♂	226—249,	,,	235.1
	—	6	♀♀	223—235,	,,	230.5

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[1] Probably exceptionally large males measured!

S. W. Poland	— 11	♂♂	232—241,	average 235.8
	— 3	♀♀	216—226,	,, 221.3
S. E. and E. Poland	— 10	♂♂	222—240,	,, 233.9
	— 8	♀♀	226—237,	,, 230.1
W. Balkan Peninsula	— 13	♂♂	224—240,	,, 232.8
	— 5	♀♀	210—229,	,, 220.8
N. Bulgaria E. Rumania	— 12	♂♂	218—239,	,, 229.4
	— 11	♀♀	215—235,	,, 223.3
Russia	— 9	♂♂	228—240,	,, 235.1
	—	♀	calculated as 227	
Sweden Norway	— 11	♂♂	226—240,	average 232.6
	— 4	♀♀	220—230,	,, 223.3

Notwithstanding the fact that size-variation in *C. monedula* proved very large I thought it interesting to know the standard deviation of the variation of the wing length in those populations which were supposed to be hybrid ones.

a. Contact between *spermologus* and *soemmeringi.*

S. W. Poland	— *spermologus*:	average of 11	males	235.8 ± 2.3
S. E. and E. Poland	— intermediate:	,, 10	,,	233.9 ± 6.0
Russia	— *soemmeringi*:	,, 9	,,	235.1 ± 4.0

b. Contact between *spermologus* and *collaris.*

S. E. Germany, Austria	— *spermologus*:	average of 17	males	235.1 ± 5.4
Hungarian plains	— intermediate:	,, 34	,,	236.4 ± 7.4
W. Balkan, Peninsula	— *collaris* :	,, 13	,,	232.8 ± 4.8

c. Contact between *collaris* and *soemmeringi.*

W. Balkan, Peninsula	— *collaris* :	average of 13	males	232.8 ± 4.8
S. Bulgaria	— intermediate:	,, 7	,,	232.7 ± 6.3
N. Bulgaria, Rumania	— intermediate;	,, 12	,,	229.4 ± 7.2
Russia	— *soemmeringi*:	,, 9	,,	235.1 ± 4.0

It seems that in those regions which according to the preceding chapters can be regarded as zones of hybridization the standard deviation is larger than in the bordering regions. However, the conclusions can only be tentative, since the standard deviation in two apparently "pure" populations, of which KLEINER measured a suitable series, vary also considerably :

Sweden and Norway	— *monedula* :	average of 11	males	232.6 ± 3.9
Central Germany	— *spermologus*:	,, 23	,,	231.5 ± 6.6

5. Summary.

The post-gacial distribution of *Corvus monedula* based upon the taxonomy and the ranges of geographic races is shown in figure 1. It should be compared with the distributional history of *Dendrocopos major* and *P. pyrrhula* (VOOUS, 1947 and 1949). The present European populations appear to exist of Asiatic, S. E. European and S. W. European components, which were isolated from each other during the last Glacial Period. Additonal populations from the Iberian Peninsula and North Africa probably became isolated before the last Glaciation. Practically the whole of central Europe is occupied by populations which must have been derived from the S. W. European glacial refuge.

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Noordoostpolderbewoners, 8e bericht; broedseizoen 1949

door

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(Afdeling Onderzoek van de Directie van de Wieringermeer; Noordoostpolderwerken).

(met 2 tekstfiguren en 5 kaarten)

(Tevens 30ste Publicatie van de „Club van Zuiderzeewaarnemers")

(With an English Summary)

Inleiding.

Na het in 1941 droogvallen van de Noordoostpolder werd dadelijk begonnen met een onderzoek van de vogelbevolking van dit 4800 ha grote gebied. Tot 1947 werden jaarlijks de voorkomende broedvogels beschreven, terwijl tevens enige aandacht aan het probleem der vogelkolonisatie besteed werd (TEN KATE, 1941; J. MULLER, 1942, 1943, 1944; J. H. MULLER, 1945; VAN LEEUWEN, 1947). In de jaren 1947 en 1948 bestond niet de gelegenheid dit onderzoek voort te zetten. Door de medewerking van een aantal vogelkenners was het echter mogelijk om voor het jaar 1949 weer een overzicht van de in de Noordoostpolder voorkomende broedvogels te geven. De in de jaren 1947 en 1948 verzamelde gegevens zijn eveneens in dit overzicht verwerkt, zodat toch nog enigszins een aaneengesloten geheel met de vorige publicaties verkregen kon worden. Te meer is dit van betekenis, daar de laatste jaren de Noordoostpolder door de voortschrijdende ontginning, sterk van karakter veranderd is. Dit laatste heeft niet nagelaten grote invloed uit te oefenen op de samenstelling van de vogelbevolking.

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