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DISTRIBUTION AND FOOD OF THE DANISH ROOKS

BY

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INTRODUCTION

The rook (Corvus frugilegus) breeds in most of Europe. It is distributed from southern Norway and central Sweden in the north to central France, northern Italy, the northern Balkan Peninsula and southern Russia in the south. The western limit of its distribution runs along the Atlantic coast of Ireland, while towards the east it breeds in most of the temperate regions of Asia.

In great parts of Denmark it is a common breeder. It arrives at the breeding gounds as early as February. It is a pronounced colony breeder, and the same rookeries are used year after year.

According to "Nordens Fugle i Farver II" (1959) the rook lays 3–5 eggs at the end of March or in the beginning of April. The incubation period lasts a little less than three weeks, and in the latter half of May the young are fully fledged.

In the course of the summer the birds leave the rookeries. It looks as if most of the breeding rooks in Denmark migrate towards the southwest in October-November, and that the rest spend the winter in Denmark.

Only few recoveries of rooks ringed in Denmark have been received. According to Salomonsen (1953), a single rook was shot in January in Denmark. One was recovered from Holland in December, and one was killed in England in October. A few Swedish rooks have been killed in Denmark, which indicates that Scandinavian birds may winter here.

The present paper gives, in the first place, a survey of the distribution of the rooks in Denmark 1960–63. The data collected are compared with the official Danish National bag record on the distribution of the killed rooks on counties in the shooting season 1957–58.

Secondly, stomach analyses of 760 rooks, collected in the years 1942–60, are discussed. These rooks were mainly shot in the months March to June. Finally, several foreign papers are mentioned as well as an older Danish paper dealing with the food of the rooks.

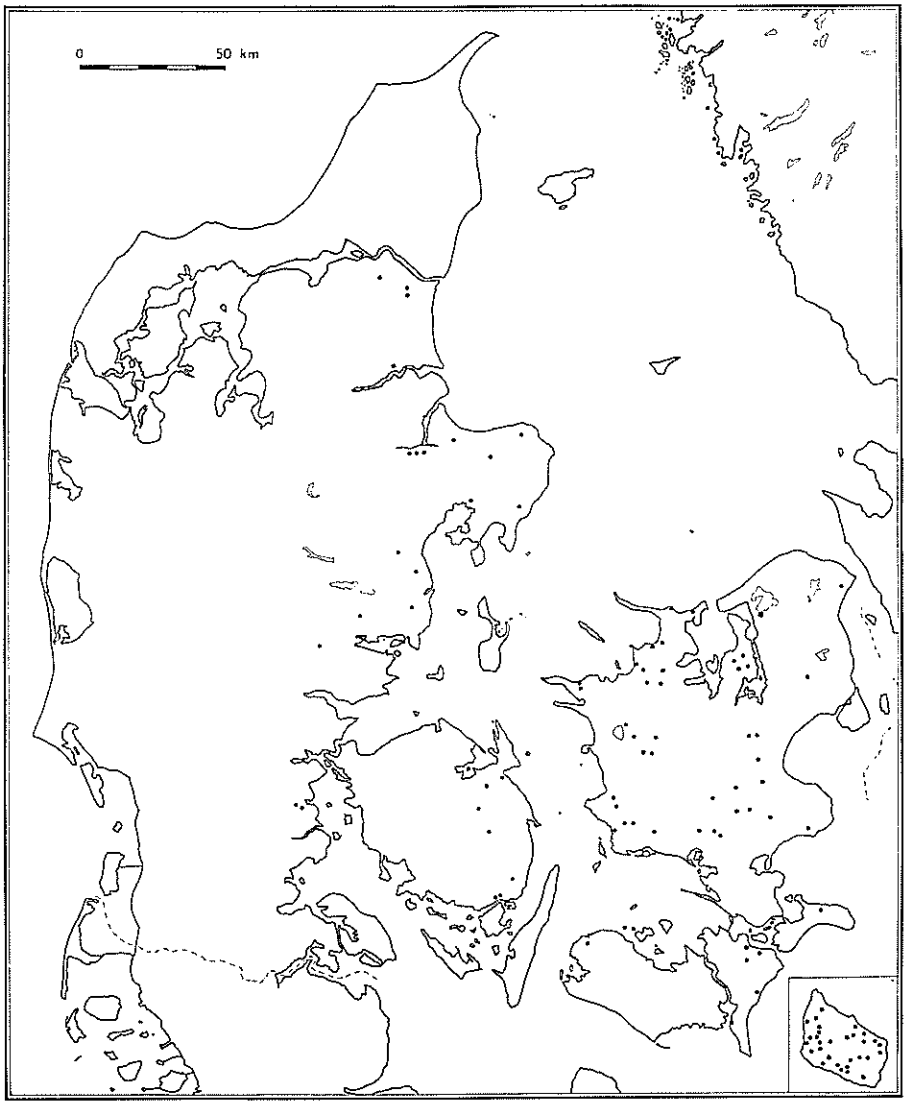

Fig. 1. Râgernes yngleudbredelse i Danmark 1909. Kortet omtegnet efter BOAS 1911.
Fig. 1. Breeding distribution of the rooks in Denmark 1909. Map redrawn according to Boas 1911.
1 spot = 1 rookery

DISTRIBUTION OF BREEDING ROOKS IN DENMARK 1960–63

In 1909 J. E. V. Boas made a census of Danish rookeries (Boas 1911). The data received originate from a number of people to whom inquiry forms were sent, and the replies to these form the basis of the map fig. 1.

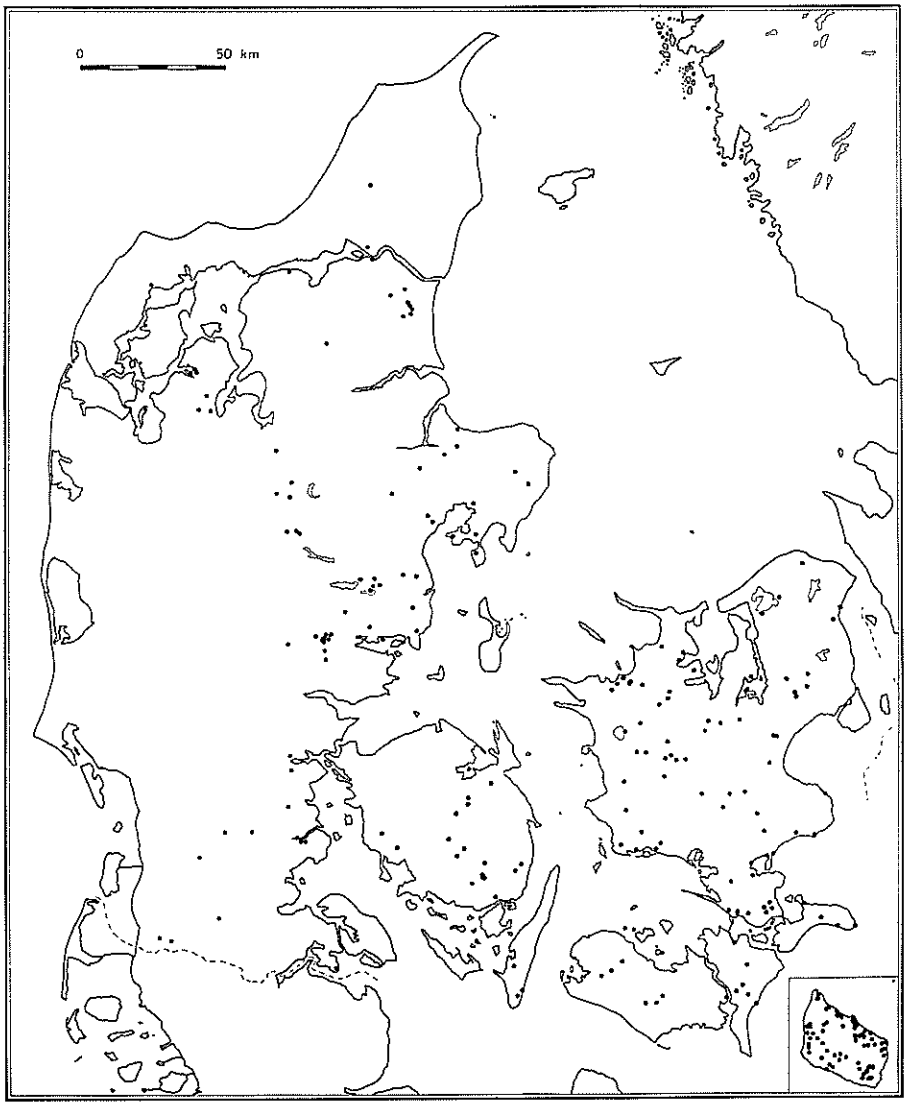

Fig. 2. Rågernes yngleudbredelse i Danmark 1960–63.
Fig. 2. Breeding distribution of the rooks in Denmark 1960–63.
1 spot = 1 rookery

In the course of the years 1960–63 a similar census was made, the results of which are seen in fig. 2. It would have been fortunate if all the date had referred to the same breeding season, but, unfortunately, such a census could not be carried through.

Collection of the material.

The data regarding the placing of the rookeries and their size were procured in different ways. In the first place an application was sent to the 11 game wardens in Denmark. Each of them was asked to give written information of the number of rookeries known to him within his district. Most of them were kind enough to answer the application.

Prof. R. Spärck thereupon, in "Meddelelser fra Dansk Ornithologisk Forening" 1962 no. 4, asked ornithologists to report what they knew about the placing and size of rookeries. Thus a number of new data was received.

Finally, in the spring of 1963, application by telephone was made to a number of people throughout the country which gave more data. These telephoned applications however strongly confirmed the data received earlier in other ways, and thus supported the belief that a very great percentage of the rookeries which had been inhabited in the years of census, are given in fig. 2.

In appendix *1* at the end of the paper a list of the geographical situation of the rookeries in the different counties is given. When known, the number of nests is indicated. It is further noted in which year the census of the particular rookery was made. If a rookery has been counted several years, the latest census and the latest statement of the number of nests are noted.

For several rookeries designations as "small", "fairly large" etc. have been given by the correspondents; they have not been included in the appendix, since they are expressions of a very subjective judgment.

Is the number of rooks today greater than fifty years ago?

Fig. 2 shows nearly one and a half times as many rookeries as fig. 1, namely 241 in fig. 2 and 106 in fig. 1. This might indicate that today the rooks are far more abundant than fifty years ago, but if we look at the size of the rookeries as shown in diagram 1 we see that the average number of nests per rookery was considerably greater in 1909 than it is today.

The figures in diagram 1 are not large, since neither Boas nor the present author state the size of the rookeries in all instances. In addition, the last census covers four seasons. As the size of a rookery may vary from one year to another, this may cause some uncertainty of the data stated, which however is partly counterbalanced by the fact that some rookeries are growing, while others decrease in number, so in broad features the number of breeding rooks within such a short period presumably does not vary very much.

The explanation of the decreasing size of the rookeries during the last fifty years might be found in the intensive control of rooks, so that by shooting and

Landsdele	Total number of rookeries Antal kolonier i alt 1909	Number of rookeries in which the total number of nests is known Antal kolonier, hvis samlede redeantal er kendt 1909	Total number of rookeries Antal kolonier i alt 1960-63	Number of rookeries in which the total number of nests is known Antal kolonier, hvis samlede redeantal er kendt 1960-63	Average number of nests per rookery 1909	Gennemsnitlige antal reder pr. koloni 1960-63
Bornholm	30	8 had 3750	61	32 had 1748	469	55
Sjælland (Zealand)	42	17 – 31220	74	44 – 5325	184	121
Lolland-Falster	7		13	7 – 1400		200
Fyn (Funen)	7	4 – 1350	19	12 – 1266	338	106
Jylland (Jutland)	20	3 – 2050	74	52 – 6743	683	130

Skema 1. I 1909 var der færre kolonier i Danmark end i dag, til gengæld var det gennemsnitlige redeantal pr. koloni betydelig større.

Diagram 1. In 1909 there were fewer rookeries in Denmark than today, but the average number of nests per rookery was considerably greater.

destruction of a rookery the result will in many cases only be a dispersal into smaller colonies.

It is well-known that the rooks are strongly pursued by man. In Denmark we have a law of 1953 ordering control of rooks if these do damage to the crops. It lies in the first place with the owner of a rookery to try to hold the rooks in check. If he does not succeed, his neighbours are entitled to lodge a complaint with the public authorities which will then intervene. This happens in many cases, for while the owner, as a rule, is pleased with his rooks, which are a popular shooting object, the presence of a rookery is often a source of irritation for the neighbours.

The geographical distribution of the rooks in Denmark.

The geographical distribution shown in the two maps clearly indicates that today the rooks have taken possession of new regions. They have spread to the northwest. In 1909 there were for instance no rooks north of the Limfjord, today there are rookeries in Brønderslev, Thisted, and Nørresundby. South Jutland was not included in Boas' census, as this region belonged to Germany in 1909.

West of the ice margin border from the last glaciation there are practically no rookeries, only in South Jutland a few are found. The reason why West

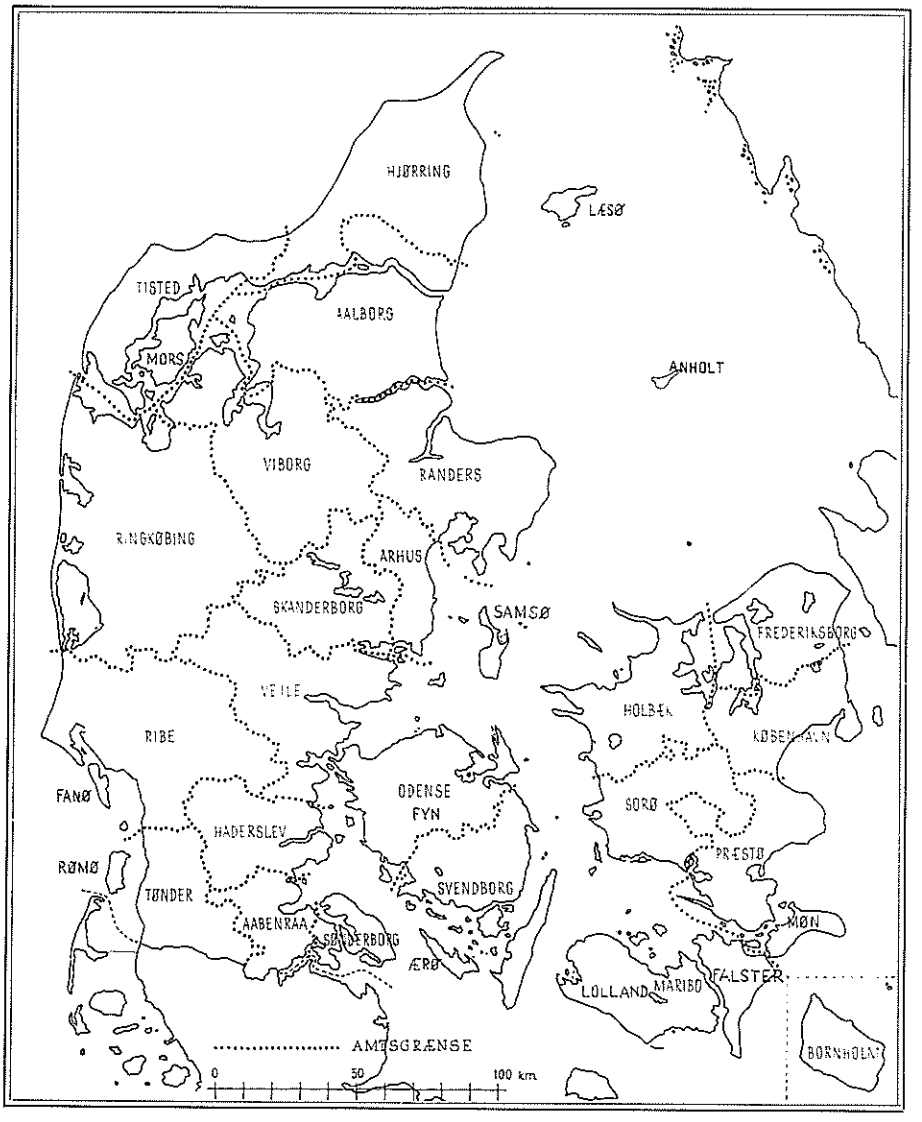

Fig. 3. Kort visende de danske amter.
Fig. 3. Map showing the counties of Denmark.

Jutland has no breeding rooks is not known, but presumably either the climate or the sandy areas in West Jutland do not appeal to them. It is hardly lack of breeding sites which limits the distribution of the rooks, since today there are tall trees throughout West Jutland.

The rook nests in deciduous as well as in coniferous trees. The nests are generally placed 15–20 m above the ground, however sometimes lower. The rookeries are often found in small private woods or in small groves; e.g. ash or alder groves are preferred habitats.

In larger woods the rookeries are almost always found near the edge.

Bornholm is the county (see map fig. 3 of the Danish counties p. 70), where the rookeries today, as well as fifty years ago, are most densely situated, then follow the counties on Zealand.

Every sportsman in Denmark is liable on his license to state what kind of game he shoots and how much, and the name of the county where he killed the game. All these data are sent to Vildtbiologisk Station on Kalø, where the figures are gradually worked up and published.

The latest worked up figures originate today from the hunting season 1957–58, i.e. they comprise the game killed from 1st April 1957 to 31st March 1958. In this season altogether 86.285 rooks were shot in Denmark.

Annually between 65.000 and 87.000 rooks are shot in this country. The fluctuations from one year to another are not great. By far the greater number of rooks are no doubt killed as nestlings, i.e. they are killed in the rookeries. It is a popular sport to shoot the almost fully-fledged young which before they leave the nest for good creep out on the nearest branches and stay there.

The national bag record indicates the total number of rooks shot in the different counties, and the number killed per 100 ha.

These data can be compared with the number of rookeries which according to the census 1960–63 were found in the said counties. This comparison must be valid, if—as said above—it is presumed that the Danish population of breeding rooks does not fluctuate in any noteworthy degree from one year to another.

Diagram 2 clearly shows that the counties which harbour many rookeries are also the counties where a great number of rooks are killed. The shooting figures further show that there are practically no rooks in West Jutland. The population on the islands appears to be greater and denser than in Jutland, and the densest population is found on Bornholm.

The rooks on the smaller Danish islands.

During the census 1960–63 an attempt was made to find out which of the smaller Danish islands harbour rooks.

Like the rest of West Jutland, the islands in the Wadden Sea have no population of rooks.

County Amt	Total yield Total udbytte $^{1}/_{4}$ 1957– $^{31}/_{3}$ 1958	Shot per Skudt pr. 100 ha	Number of rookeries Antal råge-kolonier 1960–63
Bornholm	6656	12,0	61
Holbæk	13055	7,7	20
Præstø	7784	4,8	24
Sorø	6829	4,8	15
København	5344	4,8	10
Århus	3654	4,7	6
Maribo	5544	3,2	13
Svendborg	4892	3,0	13
Randers	6735	2,8	11
Skanderborg	4099	2,5	16
Frederiksborg	3045	2,3	6
Odense	3852	2,2	6
Ålborg	4599	1,6	11
Viborg	3648	1,2	13
Haderslev	1222	0,9	7
Åbenrå-Sønderborg	1074	0,9	2
Vejle	1804	0,8	4
Tønder	807	0,6	2
Ringkøbing	941	0,2	0
Thisted	152	0,1	1
Ribe	85	–	0
Hjørring	75	–	1

Skema 2. Rækkefølgen af amterne er opstillet efter, hvor mange råger, der er skudt pr. 100 ha. Det er især i de østdanske amter, der nedlægges mange råger, langt de fleste rågekolonier findes også her.

Diagram 2. The counties are listed according to the number of rooks shot per 100 ha. It is especially in the eastern counties in Denmark that many rooks are shot, by far the greatest number of rookeries is also found here.

On the isle of Mors breeding rooks were to be found earlier, but these are said to have been exterminated during the general rook control.

Læsø, Anholt, and Samsø have no rookeries, but a medium-sized rookery is found in the protected isle of Vorsø situated in Horsens fjord. In 1961 150 nests were found there.

The island of Als has no breeding rooks.

There are three rookeries on Langeland situated in the southern half of the island. Otherwise, there are no breeding rooks on the islands south of Funen.

In 1961 Møn had four smaller rookeries with a total of 100 nests. There are

no information about the other islands round Zealand, however Saltholm must be said to be without any attraction at all to the rooks. Here no nests or foraging localities are found.

The size of the rookeries.

Diagram 3 gives a survey of the size of the rookeries in the different regions of Denmark.

Provinces Landsdele	Rookeries with number of nests stated Kolonier med angivet rede-antal	Number of rookeries with Antal kolonier med			
		nests 0-50 reder	nests 51-100 reder	nests 101-250 reder	nests over 250 reder
Bornholm	32	19	12	1	0
Sjælland (Zealand)	44	21	3	15	5
Lolland-Falster	7	0	2	4	1
Fyn (Funen)	12	6	3	1	2
Jylland (Jutland)	52	19	9	17	7

Skema 3. På Bornholm er kolonierne gennemgående små i forhold til resten af landet. Tallene fra Lolland-Falster er ikke store, men det ser dog ud til, at kolonierne her er temmelig store, mens der i de øvrige landsdele både er store og små kolonier.

Diagram 3. On Bornholm the rookeries are on the whole small compared with the rest of the country. The figures from Lolland-Falster are not great, but it still looks as if the rookeries are fairly large, while, in the other parts of the country both large and small rookeries are found.

It is to be regretted that it was only possible to obtain the number of nests for about half the rookeries stated, and even these data should be considered with some reservation, partly because the census was made during a period of four years within which time the number of nests may vary considerably, partly because it is impossible to state how many of the counted nests were inhabited in the year when the census was made. This last source of error is however counterbalanced by the fact that some nests may have been overlooked during the census. Finally, the figures stated are in many cases given with some reservation, e.g. "between 150 and 170 nests".

According to diagram 3, the rookeries on Bornholm appear to be mainly small, while the rest of the country has both small and large rookeries; it looks however as if the rookeries on Lolland-Falster are on the whole fairly large. The same appeared from the figures in diagram 1 which stated the average number of nests per rookery in the different regions of the country.

A further confirmation of the fact that the rookeries on Bornholm are smaller than in the rest of Denmark is given by the national bag record. It is possible to calculate the number of rooks shot per rookery. See diagram 4.

Provinces Landsdele	Number of rookeries Antal kolonier 1960–63	Shot Skudt 1957–58	Shot per rookery Skudt pr. koloni
Bornholm	61	6656	109
Sjælland (Zealand)	74	36057	487
Lolland-Falster	13	5544	427
Fyn (Funen)	19	8744	460
Jylland (Jutland)	74	28895	390

Skema 4. Antallet af skudte råger pr. koloni må afspejle koloniernes gennemsnitlige størrelse i de forskellige landsdele, idet man må formode, at samme procentdel af de forhåndenværende kolonier er blevet registreret i alle landsdele; ligesom det må anses for givet, at antallet af skudte råger er opgivet lige nøjagtigt i alle amter.

Diagram 4. The number of rooks shot per rookery must reflect the average size of the rookeries in the different provinces, since it must be presumed that the same percentage of the rookeries present has been registered in all the provinces; it must also be taken for granted that the number of rooks shot has been stated equally exactly in all counties.

In this diagram too the figures should be taken with some reservation, since the figures for the killed birds from the national bag record and the census of rookeries do not cover the same season.

It looks as if on Bornholm only one-fourth as many rooks per colony are shot as in the rest of the country. The calculated figures per rookery of birds shot are very great when compared with the small number of colonies from diagram 3 which contained more than 250 nests. It should however be noted that diagram 3 comprises only about half of all rookeries known. Further, it must be assumed that not all rookeries have been counted, and that the figures may also include a few adult birds.

Diagram 5 contains a calculation of the number of rooks shot per nest. For this calculation the figures from the national bag record have again been used as well as the data obtained during the census.

This diagram has, on the whole, only theoretical interest. It was made mainly to illustrate whether it is reasonable to regard all the previous calculations as probable, for—as said above—all the data used have not been quite safe. Diagram 5 however seems to show that this unsafety is not alarmingly great. The number of birds shot per nest seems to be rather high as far as Zealand and Funen are concerned.

Provinces Landsdele	(1) Number of rookeries Antal kolonier 1960–63	(2) Number of rookeries with number of nests known Antal kolonier med kendt redeantal	(3) Number of nests per rookery Antal reder pr. koloni	(4) Total number of nests Reder i alt	(5) Number of rooks shot in 1957–58 Antal råger skudt i 1957–58	(6) Number of rooks shot per nest Skudt pr. rede
Bornholm.....	61	32	55	3355	6656	2,0
Sjælland (Zealand)	74	44	121	8954	36057	4,0
Lolland-Falster.....	13	7	200	2600	5544	2,1
Fyn (Funen).....	19	12	106	2014	8744	4,3
Jylland (Jutland)	74	52	130	9620	28895	3,0

Skema 5.
(1) Koloniernes fordeling på landsdelene.
(2) De kolonier, hvor redernes antal er kendt.
(3) Det gennemsnitlige redeantal i kolonierne fra rubrik (2).
(4) Antager man, at gennemsnitstallene i kolonne (3) er repræsentativt, viser kolonne (4) det samlede redeantal i hver landsdel (f. eks. Bornholm: $57 \times 56 = 3192$).
(5) Antal råger skudt i de forskellige landsdele (se skema 4).
(6) Antal unger skudt pr. rede.

Diagram 5.
(1) Distribution of the rookeries on the provinces.
(2) Rookeries, in which the number of nests is known.
(3) The average number of nests in the rookeries from column (2).
(4) If it is presumed that the average figures in column (3) is representative, column (4) shows the total number of nests in each province (e.g. Bornholm: $57 \times 56 = 3192$).
(5) Number of rooks shot in the different provinces (see diagram 4).
(6) Number of young shot per nest.

INVESTIGATION ON THE FOOD OF THE ROOKS

Collecting of the material.

In the years 1942–47 703 rooks were collected, among other things to analyse their gizzard contents.

The identification of the animal content was made by Dr. M. Hammer and cand. mag. B. Schiøtz-Christensen, while Dr. M. Køie identified the vegetable content.

All the data of the birds which were received in 1957–58 were entered on index cards. Each rook got its own card, and all information about it was collected and entered on this card.

In 1956 "Jagtfondens vildtbiologiske undersøgelser" received 20 rooks from Vorsø. The gizzards were taken out and preserved. In 1960 37 rooks more were collected on Vorsø. I have myself examined these 57 gizzards, and Dr. S. Gisle Larsson and cand. mag. B. Schiøtz-Christensen have assisted with the identification of the animal content, while Dr. M. Køie carried out certain botanical identifications.

During the years 1942–47, 1956 and 1960 altogether 760 rook gizzards have been collected.

Unfortunately, some of the notes have disappeared in the course of the years. In 13 cases the data on the animal content have been lost, in 45 cases the botanical data are missing.

32 gizzards were completely empty, and in most of the calculations these have been disregarded.

In 37 stomachs there were exclusively vegetable food items, while 18 contained only animal food.

Distribution of the collected rooks on the provinces.

Diagram 6 shows the distribution of the collected rooks on the different provinces. By far the greater part originates from Bornholm and Zealand,

Provinces Landsdele	Number of rooks Antal råger	% of 760 rooks % af 760 råger
Bornholm	76	10,0
Sjælland (Zealand)	462	60,8
Lolland-Falster	48	6,3
Fyn (Funen)	45	5,9
Jylland (Jutland)	129	17,0

Skema 6. Fordeling på landsdelene af de råger, der i 1942–60 blev indsamlet til maveanalyse. Ca. 71% af de tilsammen 760 råger kom fra Bornholm og Sjælland.

Diagram 6. Distribution on the provinces of the rooks which in 1942–60 were collected for stomach analyses. About 71% of the totally 760 rooks came from Bornholm and Zealand.

which—as mentioned in the last chapter—are the regions which harbour the majority of rooks. The dots on the map fig. 4 show the localities where the rooks were killed.

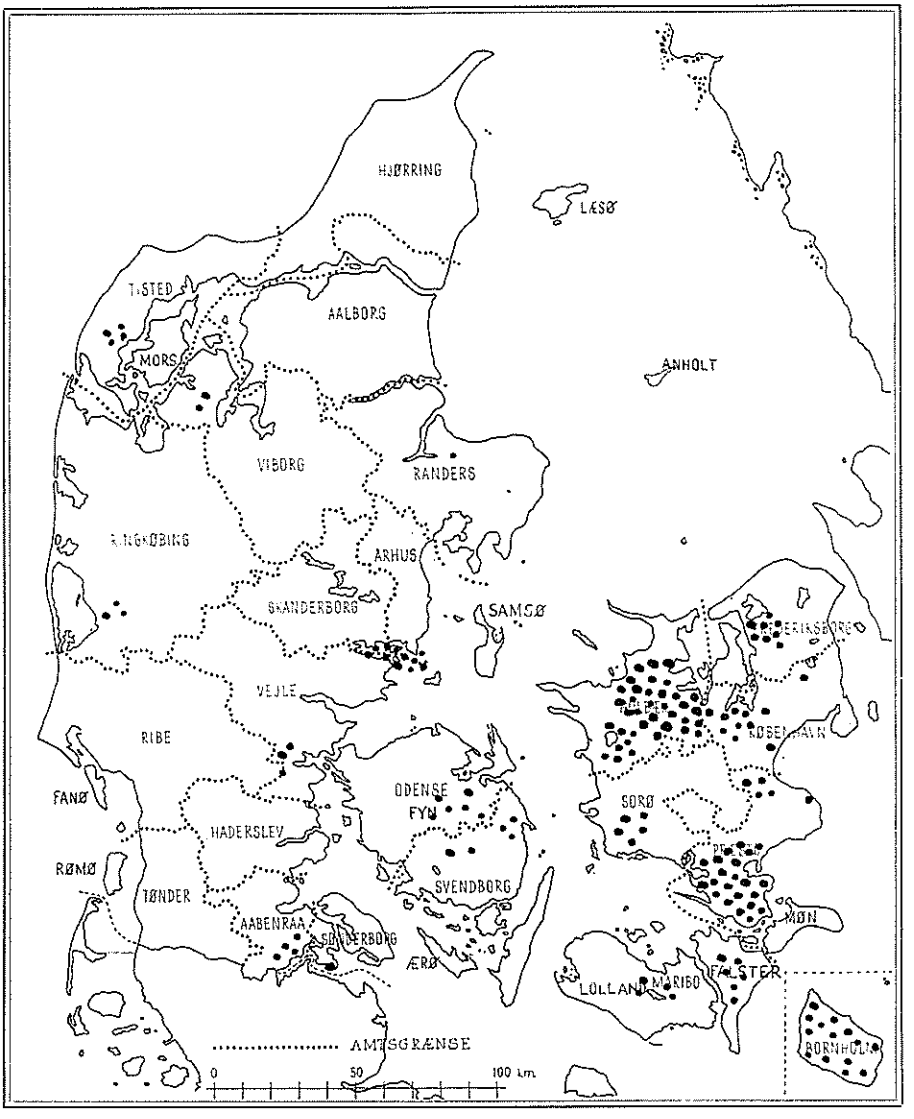

Fig. 4. Lokaliteterne, hvor de råger, der er blevet brugt til maveanalysen, stammer fra.
Fig. 4. The localities at which the rooks used for the stomach analyses were shot.
1 spot = 5 rooks

In which months were rooks collected?

The distribution of the rooks on the months of the year appears from diagram 7. The majority of the birds were killed in spring and early summer, viz. in

	Number of rooks Antal råger	% of 760 rooks % af 760 råger
January	2	0,3
February	3	0,4
March	100	13,2
April	151	19,9
May	340	44,7
June	150	19,7
July	0	0
August	1	0,1
September	4	0,5
October	9	1,2
November	0	0
December	0	0

Skema 7. Fordeling af 760 råger på årets måneder. 97,5% er nedlagt i månederne marts-juni.
Diagram 7. Distribution of 760 rooks on the months of the year. 97,5% were shot in the months March-June.

March, April, May, and June. It is very regrettable that there are only few rooks from the rest of the year, but—on the other hand—the rooks are said to do the greatest damage in spring. It is therefore important to have material just from that season. Besides, it would be extremely difficult to procure birds from the winter term, partly because they are difficult to shoot at that time, partly because they are few in number.

Distribution on age groups.

In most of the calculations on the diet of the rooks 728 birds were used, whose gizzards had some content. Of these birds 166 were nestlings and 347 adults. The adults are partly rooks whose age in the notes are designated as adult, partly all birds shot after July the 1st, as it must be assumed that after that time the young live on the same diet as the adult birds. The remaining 215 are birds which were killed in May or June, but whose age is not stated. They are probably mainly nestlings, but as there are no evidence of this, they are treated, as far as the age is concerned, in a separate group.

The rooks eat both animal and vegetable food.

An analysis of the stomach content from 670 rooks—on which all notes are available—showed that they lived partly on a vegetable, partly on an animal diet.

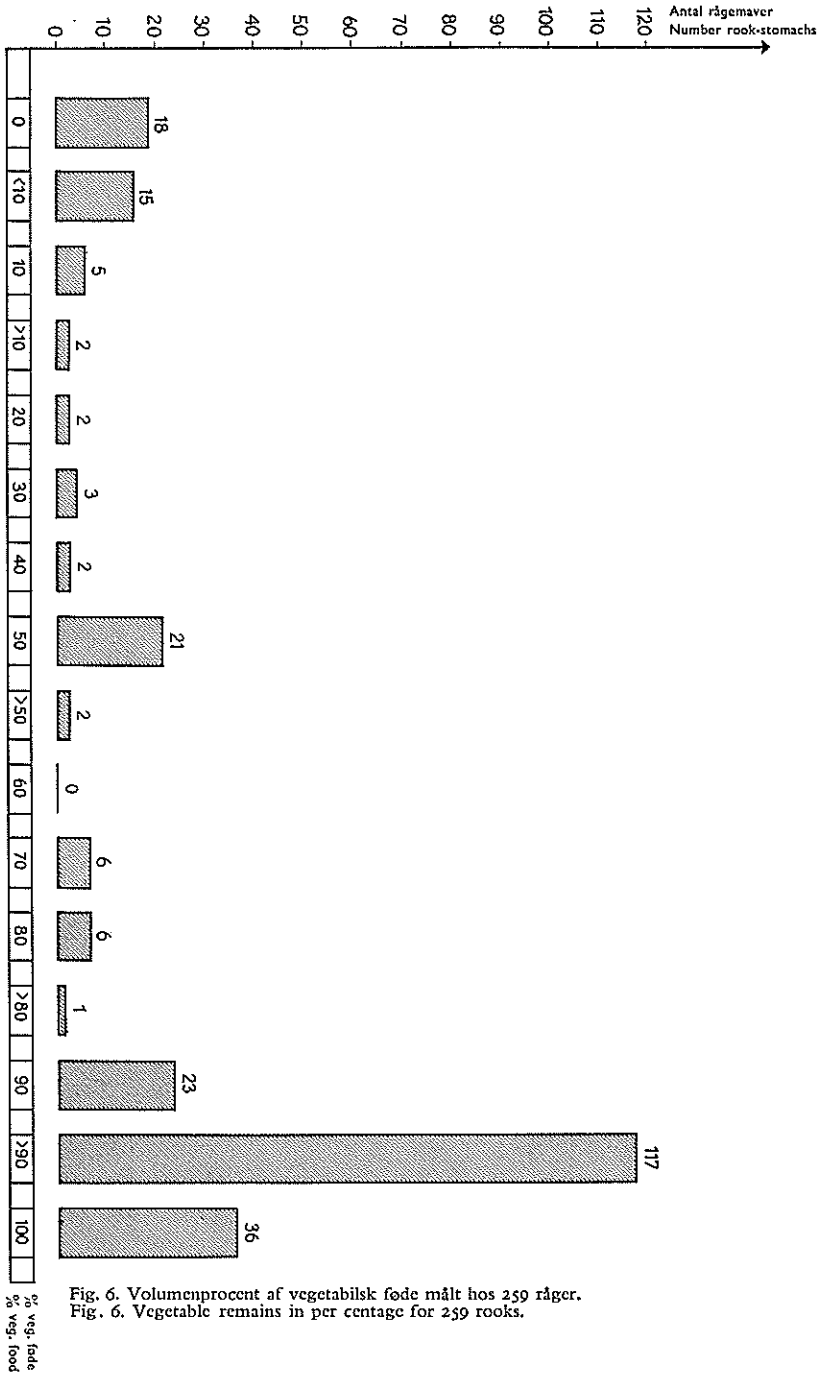

Fig. 6. Volumenprocent af vegetabilsk føde målt hos 259 råger.
Fig. 6. Vegetable remains in per centage for 259 rooks.

655 stomachs contained vegetable food, showing a percentage of 97, while 633 or 95% of the rooks had eaten animal food.

The percentages do not indicate which food items are most important quantitatively. Unfortunately, the quantitative ratio between vegetable and animal food has been estimated only in 259 instances.

Figs. 5 and 6 illustrate the volume content of vegetable food remains in 259 rooks.

Fig. 5 shows the estimated volume percentage in these birds, while fig. 6 shows that the gizzard content in three-fourths of the rooks consists of at least 50% vegetable remains.

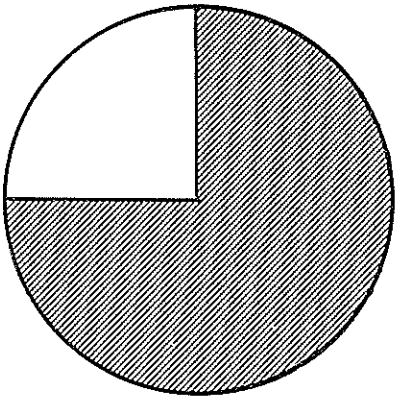

Fig. 6. Trefjerdedel af 259 råger indeholdt 50% eller mere planterester i kråsen.
Fig. 6. Three-fourths of 259 rooks contained 50% or more vegetable remains in their gizzards.

This means that by far the greater part of the stomach contents of the rooks consists of vegetable food remains, and this also agrees with the observations which I have made myself by analysing 57 gizzards.

As regards crows, Rörig (1903) examined how rapidly the different food items are digested. The result was that animal food disappeared in a very short time, whereas grains could be found in the stomachs several hours after they had been eaten.

The same presumably applies to the rooks, for which reason it must be realized that the just mentioned percentage of occurrence and volume percentages may not give a fully correct picture of the ratio between vegetable and animal food consumed by the rooks.

Practically all stomachs contained gravel and small stones. A number of the rooks shot on Vorsø had eaten gastropod shells. Many gizzards contained rook feathers.

What kind of vegetable items have the rooks eaten and how much?

By far the greater part of the vegetable items eaten by the rooks is corn, especially barley and oat. Winter corn [rye and wheat] is practically not represented in the material. Most of the birds were shot in spring where normally they had no access to rye and wheat. However, they have also eaten some potatoes.

Vegetable food items Vegetabilske fødeemner		Found in number of gizzards Set i antal kråser	% of 665 % af 665
Grains of barley	Bygkorn	321	48
Grains of oat	Havrekorn	119	18
Grains of wheat	Hvedekorn	16	2
Grains of rye	Rugkorn	2	0,3
Chaff	Avner	247	37
Seeds of grass	Græsfrø	8	1
Seeds of hemp	Frø af hamp (Cannabis sativa L.)	5	1
Seeds of Polygonacea	Frø af pileurter (Polygonaceae)	5	1
Seeds of chickweed	Frø af Fuglegræs (Stellaria media)	2	0,3
Seeds of hornbeam	Frø af avnbøg (Carpinus betulus)	1	0,2
Seeds of brooklime speedwell	Frø af vedbend-ærenpris (Veronica hederifolia)	1	0,2
Tissue of pea	Frøvæv af ært	1	0,2
Unknown seeds	Ukendte frø	6	1
Potato	Kartoffel	66	10
Grass (leaves and root fragments)	Græs (blade og rodstykker)	48	7
Moss	Mos	2	0,3
Piece of wood	Træstump	2	0,3
Fibres of leaves	Bladtrævler	2	0,3
Leaf of clover	Blad af kløver	1	0,2
Leaf of rowan	Blad af røn	1	0,2
Leaf of medick or clover	Blad af sneglebælg eller kløver	1	0,2
Stalk of apple or pear	Stilk af æble eller pære	1	0,2
Cherry-stone	Kirsebærsten	1	0,2
Indeterminable vegetable parts	Ubestemmelige plantedele	206	31

Skema 8. Den kvalitative forekomst af vegetabilske fodeemner i 665 rågekråser. Forekomstprocenten angivet i højre kolonne.

Diagram 8. Qualitative occurrence of vegetable food items in 665 rook gizzards. Percentage occurrence in right column.

In diagram 8 are indicated the different botanical food items and their percentage of occurrence. Diagram 9 is an abbreviation of diagram 8; only the most important food items are mentioned here.

Vegetable food items Vegetabilske fødeemner		In no. of gizzards I antal kråser	% of 665 % af 665
Grains or chaff	Korn eller avner	488	73
Seeds	Frø	29	4
„Other things"	„Andet"	58	19
Potato	Kartoffel	66	10
Indeterminable remains	Ubestemmelige rester	206	31

Skema 9. En sammenfatning af de forskellige kategorier af plantefode, rågerne har ædt.
Diagram 9. Summing up the different categories of vegetable food eaten by the rooks.

It appears that corn or remains hereof occur in 73% of the stomachs.

In diagram 10 the percentage of occurrence of the different vegetable food items are compared in nestlings and adults.

Vegetable food items Plantiske fødeemner		103 nestlings 103 redeunger		273 adults killed in the course of the year 273 adulte, nedlagt i løbet af året		70 adults from January-March 70 adulte fra jan.-marts		189 adults from April-June 189 adulte fra april-juni		14 adults from July-December 14 adulte fra juli-december	
		In number of gizzards i antal kråser	% of 103 % af 103	In number of gizzards i antal kråser	% of 273 % af 273	In number of gizzards i antal kråser	% of 70 % af 70	In number og gizzards i antal kråser	% of 189 % af 189	In number of gizzares i antal kråser	% of 14 % af 14
Grains and chaff	Korn og avner	83	81	256	94	65	93	180	95	11	79
Seeds	Frø	6	6	6	2	3	4	2	1	1	7
"Other things"	„Andet"	18	18	16	6	2	3	13	7	1	7
Potato	Kartoffel	22	21	25	9	5	7	19	10	1	7
Indeterminable plant remains	Ubestemmelige planterester	16	16	11	4	3	4	5	3	3	21

Skema 10. Forekomst og forekomstprocenter af de forskellige planterester hos 376 aldersbestemte råger. 103 er redeunger, 273 adulte. De adulte er i de tre sidste kolonner inddelt efter, hvilken årstid de er skudt på. Forekomstprocenten af korn og avner er større hos de adulte, end den er hos redeungerne. Til gengæld har ungerne ædt flere frø og mere kartoffel end de voksne fugle.

Diagram 10. Occurrence and percentage occurrence of the different plant remains in 376 age-determined rooks. 103 are nestlings, 273 adults. In the three last columns the adults are grouped according to the seasons in which they were killed. The percentage occurrence of grains and chaff is greater in the adults than in the nestlings. In return the young have eaten more seeds and more potato than the adult birds.

In the last three columns distinction has been made between adults from the different seasons. 70 rooks were shot in January, February or March, 189 are in April, May or June, while the last 14 were killed in the remaining part of the year.

The percentage of corn and chaff is somewhat smaller in the nestlings than in the adults, while the opposite is the case with "the indeterminable vegetable remains". These remains mainly originate from corn. The parents may divide the food of the young into fine particles before they feed them, and therefore the vegetable items are dissolved more quickly in the stomachs of the young so that the remains are not so easy to determine.

In percentages the young have eaten much more of potatoes than the adults; even when the nestlings are compared with the adult birds from the spring months this feature clearly manifests itself.

It can be concluded from the above analysis that the greater part of the vegetable food eaten by the rooks is *corn-* mainly *barley*.

The animal food of the rooks.

In 678 gizzards remains of animal food items were found. Of these 678 birds 164 are nestlings, 305 are adults, and 209 belong to the group which is shot in May or June whose age is unknown.

Diagram 11 shows the animal food items occurring and the percentage of occurrence, partly in the nestlings, partly in the adults. As in diagram 10 distinction has been made in the last three columns between adults from different seasons. There are 68 from January–March, 230 from April–June, and 7 from the remaining part of the year. The diagram has been made according to the percentage in the nestlings.

It looks as if different kinds of beetles are the most favoured animal food of the rooks.

Flies and fly larvae are also common food items. In diagram 11 no distinction has been made between larvae, pupae and imagines, but in appendix 2, where all animals occurring are arranged systematically, such distinction has been made.

Earthworms probably play a great rôle in the diet of the rooks. Diagram 11 shows that the percentage of occurrence of setae of earthworms is very great. Intact earthworms are seldom found, but this may be due to the fact that the very soft parts are easily and quickly digested and disappear, and only the setae are left. The setae are however rather inconspicuous and may easily be overlooked during the analysis of the gizzard if not specifically looked for.

Animal food items Animalske fødeemner	In 164 nestlings Hos 164 redeunger		In 305 adults Hos 305 adulte		In 69 adults from January-March Hos 69 adulte fra januar-marts		In 230 adults from April-June Hos 230 adulte fra april-juni		In 7 adults from July-December Hos 7 adulte fra juli-december	
	In number of gizzards i antal kråser	Percentage occurrence forekomst-procent	In number of gizzards i antal kråser	percentage occurrence forekomst-procent	In number of gizzards i antal kråser	percentage occurrence forekomst-procent	In number of gizzards i antal kråser	percentage occurrence fore-komst-procent	In number of gizzards i antal kråser	percentage occurrence fore-komst-procent
INVERTEBRATA:										
Scarabaeidae...	121	74	152	50	23	34	125	54	4	57
Curculionidae ..	83	51	104	34	13	19	91	40	0	0
Other Coleopt. .	64	39	57	19	11	16	46	20	0	0
Carabidae	56	34	48	14	6	9	42	18	0	0
Diptera	47	29	92	30	15	22	75	33	2	29
Silphidae.....	45	28	49	16	3	4	46	20	0	0
Elateridae.....	29	18	49	16	8	12	40	17	1	14
Ubest. Biller...	21	13	19	6	5	7	13	6	1	14
Interminable Beetles										
Oligochaeta....	16	10	24	8	14	21	10	4	0	0
Myriopoda.....	15	9	16	5	1	1	15	7	0	0
Staphylinidae ..	13	8	30	10	2	3	28	12	0	0
Aracneida	12	7	17	6	6	9	11	5	0	0
Hymenoptera ..	8	5	11	4	1	1	10	4	0	0
Rhynchota	6	4	2	1	0	0	2	1	0	0
Lepidoptera ...	7	4	38	13	5	7	32	14	1	14
Mollusca	3	2	14	5	5	7	9	4	0	0
Forficula.....	3	2	5	2	2	3	3	1	0	0
Acarina.....	2	1	5	2	1	1	4	2	0	0
Amphipoda....	1	1	0	0	0	0	0	0	0	0
Indeterminable Insecta.....	0	0	10	3	5	7	4	2	1	14
VERTEBRATA:										
Pisces.....	4	2	1	0,3	1	1	0	0	0	0
Amphibia	0	0	1	0,3	0	0	1	0,4	0	0
Reptilia.....	0	0	0	0	0	0	0	0	0	0
Aves.....	1	1	3	1	1	1	2	1	0	0
Mammalia.....	2	1	0	0	0	0	0	0	0	0
"Other things" „Andet" = eks. kødtrævler. e.g. shreds of meat	7	4	12	4	5	7	7	13	0	0
Regnorme-børster..... Earthworm setae	107	65	190	62	36	53	142	62	2	29

Skema 11. Forekomst og forekomstprocenter af de forskellige dyriske føderester hos 469 aldersbestemte råger. 164 er redeunger, 305 adulte. Ligesom i skema 10 er de tre sidste kolonner opstillet efter, hvilken årstid de adulte råger er nedlagt på.

Fødeemnerne står ikke systematisk, men efter forekomstprocentens størrelse hos ungerne.

Skemaet viser tydeligt, at forskellige biller og fluer er de dyr, rågerne æder flest af.

Diagram 11. Occurrence and percentage occurrence of the different animal remains in 469 age-determined rooks. 164 are nestlings, 305 adult birds. As in diagram 10, the three last columns are listed according to the seasons in which the adult rooks were shot.

The food items are not listed systematically but according to the size of the percentage occurrence in the young.

The diagram clearly shows that different kinds of beetles and flies are the food items preferred by the rooks.

Animal food items Animalske fødeemner	In number of gizzards I antal kråser	Percentage occurrence Forekomst-procent
INVERTEBRATA:		
Oligochaeta	16	10
Mollusca	3	2
Arthropoda		
Amphipoda	1	1
Myriopoda	15	9
Aracneida	12	7
Acarina	2	1
Coleoptera		
Silphidae	45	28
Staphylinidae	13	8
Elateridae	29	18
Scarabaeidae	121	74
Curculionidae	83	51
Carabidae	56	34
Hymenoptera	8	5
Diptera	47	29
Rhynchota	6	4
Lepidoptera	7	4
Forficula	3	2
Other beetles. Andre biller	64	39
Indeterminable beetles. Ubest. biller	21	13
Earthworm setae. Regnormebørster	107	65
VERTEBRATA:		
Pisces	4	2
Aves	1	1
Mammalia	2	1
Other things (e.g. shreds of meat). Andet (eks. kødtrævler)	7	4

Skema 12. Forekomst og forekomstprocenter af animalske føderester hos 164 redeunger. Emnerne opstillet systematisk.

Diagram 12. Occurrence and percentage occurrence of animal remains in 164 nestlings. The items listed systematically.

Vegetable food items Plantiske fødeemner		Percentage occurrence in 103 nestlings Forekomst-procent hos 103 redeunger	Percentage occurrence in 189 adults Forekomst-procent hos 189 adulte
Grains and chaff	Korn og avner	81	95
Potato	Kartoffel	21	10
"Other things" (see diagr. 8)	„Andet" (se skema 8)	18	7
Indeterminable remains	Ubestemmelige rester	16	3
Seeds	Frø	7	1
Animalske fødeemner Animal food items		**Percentage in occurrence 164 nesdluigs Forekomst-procent hos 164 redeunger**	**Percentage occurrence in 230 adults shot April June Forekomst-procent hos 230 adulte skudt april juni**
	Scarabaeidae	74	54
	Curculionidae	51	40
Other beetles	Andre biller	39	20
	Carabidae	34	18
	Diptera	29	33
	Silphidae	28	20
	Elateridae	18	17
	Ubestemte biller	13	6
Whole earthworms *)	Hele regnorme	10	4
	Myriopoda	9	7
	Rovbiller	8	12
	Aracneida	7	5
	Hymenoptera	5	4
	Rhynchota	4	1
	Lepidoptera	4	14
	Mollusca	2	4
	Forficula	2	1
	Acarina	1	2
	Amphipoda	1	0
Indeterminable insects	Ubestemte insekter	0	2
	Pisces	2	0
	Aves	1	1
	Mammalia	1	0
	Amphibia	0	0,4
"Other things"	„Andet"	4	3
Earthworm setae *)	Regnormeborster	65	62

Skema 13. Forekomstprocenterne for de forskellige fødeemner er sammenlignet mellem redeunger og adulte fra april-juni.

Fødeemnerne er opstillet efter procentens størrelse hos ungerne, for dyrenes vedkommende er invertebrater dog nævnt før vertebrater.

Med hensyn til planteføden ser det ud til, at ungerne æder en noget mere varieret kost end de voskne fugle, der tilsyneladende udelukkende tager korn og kartofler.

Det er stort set de samme dyr, de unge såvel som de gamle råger tager.

Diagram 13. Percentage occurrence for the different food items compared with nestlings and adults from April-June.

Food items are listed according to the size of the percentage in the young, as far as the animals are concerned, invertebrates are however mentioned before vertebrates.

As regards the vegetable food it looks as if the young have a somewhat more varied diet than the adult birds, which apparently exclusively live on corn and potatoes.

Practically the same animals are taken by the young and the adult rooks.

Therefore, the percentages given for the occurrence of earthworm setae could be regarded as minimum figures.

A comparison of the percentages of animal food items in nestlings and adults shows that these percentages are greatest in the nestlings, and this might indicate that these, in a higher degree than the adults, live on animal food.

It is a matter for surprise that so few vertebrate remains occur in the stomachs. The remains of fishes which have been found derive from rooks shot at Aakirkeby, and it might be thought that some young have been fed with offal from a midden or the like.

In diagram 12 the percentages of occurrence in the nestlings are listed systematically. The diagram was made for the sake of clearness, as it shows the same as the first column in diagram 11.

In diagram 13 the percentages of occurrence for vegetable as well as for animal food items have been compiled. Here the nestlings are compared with the adults from the spring months (April–June), viz. the time during which there should be equal access to the different food items for all.

The percentage of corn is greatest in the adults, while the percentages for the animal food is greatest in the young. Setae of earthworms are equally common in the two age groups.

Do the rooks do damage to the agricultural crops?

A number of farmers are of opinion that the rooks do a lot of damage in the fields by eating newly sown corn and potatoes. Other people maintain that the damage, if any, is counterbalanced by the fact that the rooks eat many of the insects which are detrimental to agriculture.

A stomach investigation like the present one can only, to a very limited extent, throw light on the problems. It is true that the rooks take both corn and potatoes, but the investigation says nothing about how great a percentage of the corn

sown on a field may end in the stomachs of the rooks. Do the rooks only take the uncovered corn, or can the inhabitants of a rookery completely empty a field of corn? The same question may be asked for potatoes. Many farmers state that the rooks do not find the potatoes, if these have been placed sufficiently deep into the soil.

It is difficult to say whether the rooks are useful or not by eating noxious insects. It is not known how great a percentage of the insects of a field haunted by rooks are eaten by the birds. On the other hand, far from all the insects occurring in the stomachs of the rooks belong to the noxious insect fauna of the corn fields.

In appendix 2 are listed all the animals occurring in the stomachs of the rooks. It is to be regretted that most of the insects have only been identified as to genus which is not always sufficient when judging where the rooks have caught them. When we look at the eight most commonly occurring forms—see app. 3—it appears that they are beetles which, according to DANMARKS FAUNA, live mainly in dung. This applies to the most frequently eaten insect, viz. Aphodius, which in many cases has been identified as to species (A. fossor and A. fimetarius) and the different Silphids and Geotrupes. These insects have no doubt mainly been taken in the cow droppings in grass fields.

Elaterids and their larvae (especially Agriotes, Athous and Corymbites) occur, as is seen from appendix 2, in a number of stomachs; they belong to the most noxious insects of the corn field. But—as said above—the stomach analysis does not reveal whether so many insects are actually eaten that the rook—from the point of view of agriculture—can be designated as a useful animal.

Do the rooks eat eggs?

It is presumably beyond all question that rooks steal eggs. It can thus be stated that sometimes a great number of dead rooks are found in places where poisoned eggs have been laid out for crows. On the other hand, there is nothing to indicate that eggs is an important and regularly eaten food item.

No remains of eggs have been found in the gizzards examined. This does not exclude, however, that the birds may have eaten eggs. Corvidae have the habit to peck a hole in the shell and then eat the contents. With the technique used in the investigation a possible content of egg yolk or white in the stomach can not be discovered.

I 1959 I allied myself with Mr. EGON SØRENSEN, game warden, who every year lays out eggs for the crows poisoned with phosphorous. He promised to send the dead rooks which he found, and which he suspected to have died

from eating the phosphorous. The experiment was made at the estate "Engeholm" on Zealand, where the ranger was kind enough to assist in the investigation.

In 1959 seven rooks were received which were immediately handed over to Prof. M. CHRISTIANSEN, Statens Veterinære Serumlaboratorium, for investigation, who was to decide whether the rooks had died from poison or not. It appeared that five of them had injuries from shots which were mortal, while the cause of death of the two remaining ones could not be cleared up. No phosphorous could be demonstrated in any of the rooks.

Thus the available material does not give any proof that the rooks eat eggs. One might be tempted to believe that some individuals or perhaps the rooks in some colonies have the habit to eat the eggs which they might find during their foraging trips, while others have no interest in such food.

Fog-Petersen's material.

Dr. H. MADSEN has been so kind as to hand over to me a material regarding the damage or benefit done by rooks on the basis of food investigations. These investigations were formerly made by Mr. FOG-PETERSEN, Graduate in agriculture, and after his death published in Ugeskrift for Landmænd 1938, nr. 16, by Halfdan Lange.

The material is not very great, it comprises 66 rooks whose gizzards were examined. Of these 6 were empty and are not included in the investigation. On the whole, the two materials are in good agreement. Also here the rooks were killed in spring. As regards vegetable food, Fog-Petersen's percentages of corn are however slightly lower. Here too the stomachs contained barley, oat, and wheat. The percentage of potato is twice as great in this material.

Of animal food earthworms are mentioned in the first place. Fog-Petersen points out that the small setae of the earthworms can easily be overlooked during the analysis of a gizzard. As to the other animals eaten by the rooks, they are almost identical in the two materials. Here also no vertebrates have been found in any considerable number. Finally, Fog-Petersen points out that the rooks are beneficial by eating certain insects which are noxious to agriculture.

What some foreign papers show as to the food of the rooks.

There is a number of older foreign investigations on the food of the rooks. GILMOUR (1896) is very famous. He examined 355 stomachs of English rooks, and his material is conspicuous by being evenly distributed over the whole year. Unfortunately, he has not listed the different food items separately. Corn and chaff represent the most common diet—together with insects. Potato occurred in 11% of the stomachs.

W. COLLINGE (1913–16) collected 1306 rooks in England, whose stomach contents were examined according to the volumetric method. Of the total food quantity 41% were animal, while 59% were vegetable food, and of this food 35% were corn and 13% potatoes. The animal food he attempted to group according to whether the items were useful, noxious, or neutral. He found rests of eggs in the gizzards, as well as parts of voles and young birds.

In Germany investigations were made by HOLLRUNG (1895), RÖRIG (1903) and SCHLEH (1904). These materials all suffer from the fault that they are not evenly distributed throughout the year. Most of the collected birds were shot in spring, and a very great part of them are nestlings. Besides rooks, the investigations also comprise a number of crows. Both in Schleh's and Hollrung's analysis the stomach contents are listed separately. Schleh found animal food in 93% of the 154 gizzards which he examined, while there was vegetable food in 91%, i.e. in 141 stomachs, and in all these stomachs it was corn he found. He found mice in 5%, egg shells in 5% and remains of birds in 1% of the gizzards. Beetles were found in 90%.

Hollrung's material comprised 4000 rook stomachs. He found animal food in 93% of the gizzards, vegetable food in 83%. Corn was found in 70% of the stomachs. Beetles occurred in 88%, and some stomachs contained remains of mice, egg shells and birds; his percentages of occurrence for the two last mentioned items were however only ½% for each. The insects occurring in the stomachs of the German rooks appeared to be practically identical with those occurring in the Danish material. The cereals are also the same, except however that wheat plays a somewhat greater rôle in the German birds.

In countries where maize is grown the rooks eat a good deal of this corn. This applies to England, but especially in a Hungarian investigation by VERTSE (1943) maize is mentioned. The same author also underlines that the rooks in Hungary eat more animal than vegetable food. He is of opinion that the rooks only feed on corn when there is lack of sufficient animal food. It is mainly insects and small mammals which are eaten by the rooks. Dr. Vertse concludes that the rooks are beneficial animals. His material consisted of 3555 analysed stomachs.

Rörig examined 1523 rooks, of these 1204 were collected between 3rd of March and 1st of July. He does not specify the food and reckons with weight percentage. According to his results, insects are most common in the food in spring and summer with 27.2 and 21.6 resp. of the total stomach content. In 612 stomachs he found noxious insects 543 times, but beneficial insect only 91 times, 122 times there were neutral insects.

Finally, a recent English investigation should be mentioned. It was led by

J. FISHER (1948). The investigation was started in 1944 and consisted of a general analysis of stomach contents, during which it was laid down that the rooks had eaten more corn than birds from earlier investigations, but it was pointed out at the same time that the corn area of the country had been increased in recent years. Simultaneously with the stomach analysis 1944–45 138 persons were observing what fields were apparently preferred by the rooks for foraging. Totally more than half a million rooks were counted. Of these 69.000 were seen in stubble fields, where the corn must be considered wasted. 73.000 were seen in fields where every grain eaten must be regarded as a loss to the owner. On the basis of these observations a little more than half of the corn eaten thus means a loss to the farmer. The observers also noticed that the rooks more frequently sat on grass fields than on other kinds of fields. The reader is referred to p. 88, where it was laid down that the eight insects most commonly occurring in the gizzards of the rooks were just animals which the rooks had found in the grass fields.

Summary.

1. The present paper gives a survey of the distribution of breeding rooks in Denmark 1960–63, as well as the results of stomach analyses of 760 rooks.

2. The census of rookeries, which was made in 1960–63, is compared partly with a similar census made in 1909, partly with the number of shot rooks listed in the official national bag record.

In spite of the fact that in 1960–63 there are one and a half times as many rookeries as in 1909, it does not look as if we have more rooks today than at that time. For in 1909 the rookeries were considerably larger.

The rookeries are most densely situated on Bornholm, Zealand and Funen and in East-Jutland. There are no breeding rooks in the sandy West-Jutland.

As said above, the rookeries are most densely situated on Bornholm, but the number of nests per rookery is smaller here than in the rest of the country. A comparison with the data of the National bag record showed that on Bornholm only one-fourth so many rooks per colony is shot as in the remaining part of the country.

3. For the stomach analyses a total of 760 rook gizzards were collected in the years 1942–60. Most of the rooks were shot in the months March to June. 32 stomachs were empty.

The rooks had fed on both animal and vegetable food. The percentage occurrence of vegetable food was 97, that of animal food 95.

In 259 rooks the percentage volume was estimated, and it appeared that three-fourths of these birds had 50% or more vegetable matter in their gizzards.

Regarding vegetable food it was in the first place corn which the rooks had fed on, mainly barley and oat. A quantity of potatoes was however also found.

Among the animal remains beetles and fly larvae represented by far the greater part.

Earthworms were only found in few gizzards, but setae of earthworms were very commonly found. It might be thought that the soft parts of the earthworms dissolve very quickly in the stomachs of the rooks, so that only the setae are left, and if this is true, earthworms must be a very important food item of the rooks.

There were practically no vertebrates in the gizzards.

There is no doubt that the rooks eat eggs occasionally. It was however not possible to demonstrate any remains of eggs whatever in the stomach contents.

The percentage occurrence of animal food is greater in the nestlings than in the adults. At the same time more adults contained vegetable food than did the young.

4. It cannot be decided, on basis of the stomach analyses, whether the rooks are beneficial or noxious animals, seen through the eyes of the farmer. The investigation says nothing about how great a percentage of the seed corn or potatoes which ends in the stomachs of the rooks. Nor is it known how great a part of the noxious insects of a field is actually eaten by the rooks. However, it looks as if the rooks take the majority of their food in the grass field.

5. The results of the stomach analyses is in good agreement with an older Danish investigation. The foreign papers mentioned at last also do not deviate from the Danish results.

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