THE MALLARDS
FROM THE ESTATE OF
KONGSDAL

(dispersal, hunting pressure, survival and productivity)

BY

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CONTENTS

INDHOLD

INTRODUCTION

An analysis of the Mallard ringing data obtained by the Game Biology Station during the years 1950–1960 was published by the present author in Danish Review of Game Biology, vol. 4 part 3: 1–57.

The Mallards had been marked in several localities throughout the country. While analyzing this material some ringing data from the estate of Kongsdal near Mørkøv in NW Zealand became avaiable. In many respects, this new material contained interesting information on the exploitation and turnover of this local population. It was, therefore, decided to treat the material in a separate report with a special view to a comparison of the theoretical maintenance production and the production of young actually found.

The report comprises not only the ringing data already published, but in addition recoveries obtained up to the end of 1963 and recoveries from the marking programme of the estate for which rings from the Zoological Museum of the Copenhagen University were used.

The Game Biology Station extends its sincere thanks to kammerherre, hofjægermester J. Estrup, the owner of Kongsdal who kindly gave his permission to the marking operations and consented to our publishing these data concerning management and exploitation of the local Mallard population. Furthermore, Mr. J. Estrup kindly read the manuscript and gave his comments.

We are grateful to Mr. Chr. Larsen, Game Warden of Kongsdal, who carried out the ringing, forwarded rings and information on recoveries to the Station, provided a census of the Mallard population of the estate and all details of the management practices followed at Kongsdal.

Finally, the author is grateful to Mr. N. O. Preuss, cand. mag., who supplied information on the ringing operations carried out by the Zoological Museum and permitted the use of his notes on clutch sizes in Mallards.

The manuscript was translated by professor C. Overgaard Nielsen.

Jørgen Fog

THE LOCALITY

The estate of Kongsdal is situated between Kalundborg and Holbæk in Zealand, near the small town of Mørkøv. The shooting-grounds amount to 1000 ha with main buildings and the park almost at the centre.

The Mallard population is distributed on the moat and nine small ponds in the immediate vicinity of the moat. Moat as well as most of the ponds are almost devoid of vegetation. The total area of water surface is estimated at 14664 sq. metres (data supplied by Mr. Larsen) with a total length of water margin of about 1880 metres. The depth nowhere exceeds two metres (see Table 1).

Water areas Vandområderne	Water area, sq. metres Vandareal, m²	Length of bank, metres Breddens længde, meter	Max. depth of water, metres Største vanddybde, meter
Voldgraven The moat	6015	770	2,0
Bæverdammen	455	96	1,3
Gartnerdammen	825	116	0,7
Guldfiskdammen	700	110	0,5
Islænderhullet	600	100	0,7
Mellemste Dam	2262	194	1,5
Nederste Dam	1682	174	1,5
Røde Park	1200	148	0,7
Sømarken I	285	68	1,0
Sømarken II	640	104	
Total I alt	14664	1880	

Table 1. The duckponds on the estate of Kongsdal. Water-area, circumference and maximum depth measured by Mr. Chr. Larsen, July 1964.

Skema 1. Andedammene på Kongsdal, deres areal, omkreds og maximale dybde (opmålt af skytte Chr. Larsen i juli 1964.

THE MALLARD POPULATION

During autumn and winter the moat and ponds harbour a very large number of Mallards (up to 600). At the beginning of the breeding period the majority

of Mallards have disappeared, only leaving a breeding population of about 40 pairs. Mr. Larsen informs us that the size of the breeding population varies very little between years. Part of the drakes usually leave the place in early summer.

The population at the beginning of the open season in August comprises about 300 ducklings in favourable years, but only about 200 in poor years. Thus, according to the Warden's estimate, the average production of fledged ducklings per female varies between c. 5 and 7.5. Cold and wet weather just after hatching causes heavy mortality among the ducklings.

No. of ad. Mallards Antal voksne gråænder	No. of ducklings Antal ællinger
9 ♂	
7 ♀ without ducklings	
34 ♀ with broods	about 121 (age estimated: 6–9 weeks) ca. (alderen skønnet: 6–9 uger) - 65 (age estimated: 3–6 weeks) (alderen skønnet: 3–6 uger) - 42 (age estimated: 1–3 weeks) (alderen skønnet: 1–3 uger)

The average brood size per succesful female:
Det gennemsnitlige ællingeantal pr. and, der har ællinger: $\dfrac{228}{34} = 6{,}7$

The average brood size per female present:
Det gennemsnitlige antal ællinger pr. tilstedeværende hun: $\dfrac{228}{41} = 5{,}6$

Table 2. The Mallard population on the estate of Kongsdal 10 July 1964 (census by Mr. Chr. Larsen).

Skema 2. Skytte Chr. Larsens optælling af gråænder på Kongsdal den 10.7.1964.

On 10 July 1964, Mr. Larsen made a census of the population (Table 2). During feeding the ducks were counted from a post in one of the windows of the castle from where it was possible to count the birds and determine their age when the family flocks approached the feeding site. The table shows that a total of 9 drakes, 41 adult females and 228 ducklings were counted, and Mr. Larsen believes the error of the estimate negligible. The average number of ducklings

per female was 5.6. On excluding the females without ducklings the average number is 6.7 ducklings per female.

The number of colour deviates in the population is fairly low. During the census of 10 July only 4 adult females and 19 ducklings had deviating plumage.

GAME MANAGEMENT AND SHOOTING PRACTICES

A large part of the ringing material from Kongsdal was considered in the publication »Dispersal and survival of released Mallards« (FOG, 1964), although the Mallards were not artificially reared. They were included because they came from a population which, after all, comprised colour deviates, and because they had been exposed to conditions not directly comparable to those of genuinely wild birds.

Mr. Larsen has provided more than 30 wooden duck-houses for moat and ponds, and the majority of these houses are usually inhabited. In 1964 the first breeding-basket was introduced. It was placed in a tree in the park and was soon occupied by a Mallard.

According to Mr. Larsen, the exploration and final selection of breeding sites is made by the drakes in the early spring. The same observation has been recorded from Holland (ANONYMOUS, 1964).

The duck-houses are placed immediately above the water surface (Fig. 1), and the entrance has no particular orientation. Many of the houses are constantly shaded. The houses were designed by Mr. Larsen, who also made them. According to his experience the ideal house measures 40×35 cm, the entrance 15×15 cm, height in front 30 and at the back 24 cm. He thinks it important that the floor be lowered by about 12 cm relative to the lower edge of the entrance.

In the early spring a little nest material is supplied.

The Mallards at Kongsdal are fed all year, at a definite spot at the edge of the moat, where food is provided twice a day. At first, the ducklings are offered coarsely ground barley. Later, when they have grown bigger, all receive grain, mostly barley but after the harvest also undersize wheat.

During the period when the marking operations were carried out no sex preference was practiced during the shooting. The only way of shooting used to any extent affects the Mallards during their evening movements between ponds and bogs on the estate. The Mallards are never exposed to shooting in the moat and the nine ponds, and only once a year are they raised from the pond while participants of a shoot are posted at a distance of a few hundred metres.
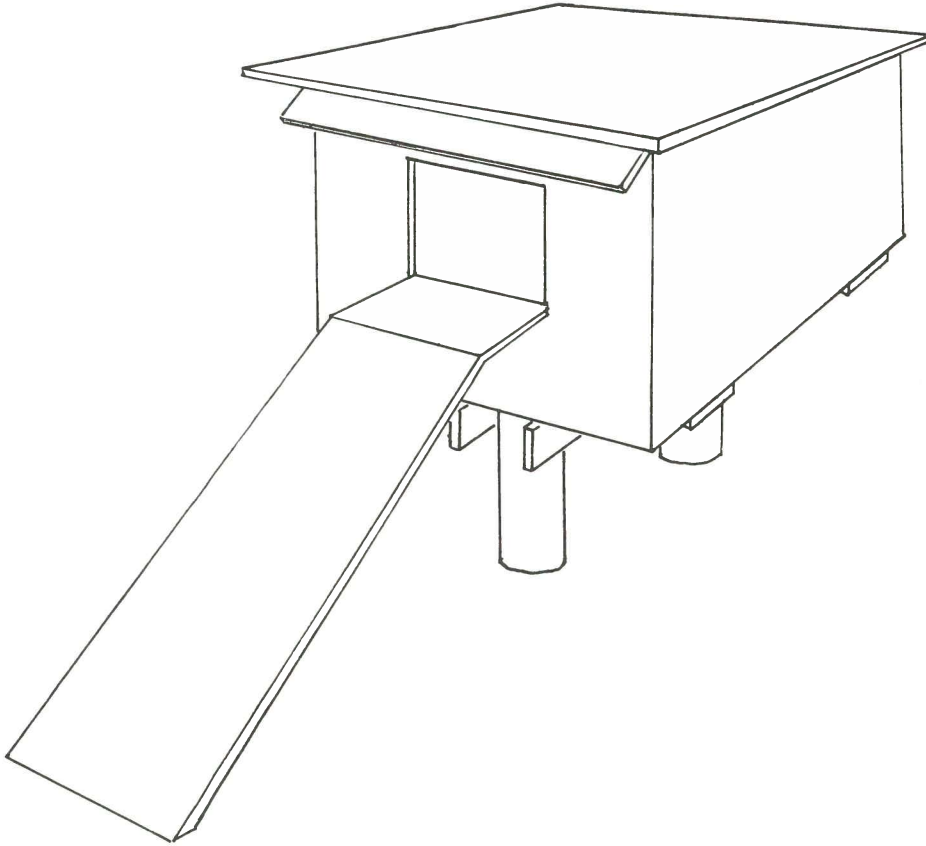
Fig. 1. Duck house from Kongsdal.

Fig. 1. Et af Kongsdals andehuse.

NUMBER OF MALLARDS MARKED AND RECOVERED

During the years 1953–61 Mr. Larsen has caught and ringed a good many Mallards at Kongsdal. In the present context only ducklings and adults ringed or wing-tagged during the period 1 May to 31 August will be considered since, with this limitation, the material comprises only ducks from the local population. Table 3 shows that a total of 323 ducklings and 30 adults were marked, most of them ringed, only 17 ducklings and one adult bird received wing-tags. From among the 353 Mallards marked 199 recoveries were obtained, i.e. the percentage recovery was 56.4.

Nos. marked Antal mærket		Nos. recovered Antal genmeldt			
		From Kongsdal Fra Kongsdal	From Denmark outside Kongsdal Fra det øvrige Danmark	From abroad Fra udlandet	Total I alt
Juvv. Ællinger	323	160	22	2	184
Ad. Voksne	30	12	1	2	15
Total I alt	Nos. Antal 353	172	23	4	199
	% of 199 % af 199	86,4	11,6	2,0	100,0
			13,6		
	% of 353 % af 353	48,7	7,7		56,4

Table 3. Mallards marked (ringed and wing-tagged) at the estate of Kongsdal 1953–61 and the recoveries obtained from the estate, from other parts of Denmark and from abroad before the end of 1963.

Skema 3. Antallet af gråænder, der er ring- og vingemærket på Kongsdal fra 1953–61, og de deraf genmeldte fra selve godset, fra det øvrige Danmark og fra udlandet indtil udgangen af 1963.

The bulk were recovered from the estate, 48.7 per cent, only 7.7 per cent being recovered from other places in Denmark or abroad.

The percentage recovery seems very high when compared to the percentage of 22.7 recorded from the more comprehensive material (FOG, 1964).

It appears from Table 4 that by far the greater part of the 199 Mallards were shot, viz. 96.5 per cent. It is interesting that a hunting-ground of considerable size enables one to harvest such considerable proportion of the local Mallard population, and it is no less interesting to find that only about 8 per cent of the marked Mallards were recovered from outside the estate.

Appendix 1 contains a list of recovered Mallards not mentioned in the previous paper (FOG, 1964). Only Mallards recovered from distances exceeding 5 km from the marking site have been included.

How recovered Årsag til genmelding	The recoveries Tilbagemeldingerne			
	Marked as ducklings Mærket som ællinger	Marked as ad. Mærket som voksne	Total I alt	
			Nos. Antal	%
Shot or found wounded Skudt eller fundet anskudt	177	15	192	96,5
Done away Aflivet	2		2	
Killed by dog Taget af hund	1		1	
Found dead Fundet død	2		2	} 3,5
Ring read Aflæst	1		1	
Only ring recovered Kun ringen fundet	1		1	
Total I alt	184	15	199	100,0

Table 4. Cause of death or source of information.

Skema 4. Genmeldingsårsagerne.

RECOVERY DISTANCES

It appears from Table 3 that 86.4 per cent of the 199 recoveries were obtained from the estate of Kongsdal, 11.6 per cent from other places in Denmark, and 2.0 per cent from abroad.

Since the bulk of birds were recovered from Kongsdal most recoveries are to be found in the first columns of Table 5 which shows the distance between points of marking and recovery for 198 birds. No less than 85.3 per cent were shot or found 0–2 km from Kongsdal, while only 13 Mallards, or 6.5 per cent, reached more than 10 km distance.

Among the latter 13 Mallards 9 were recovered from other parts of Denmark: nos. 301057, 301080, and 301081 were all marked as ducklings on 1 July 1954 and recovered respectively from Tølløse on 19 Jan. 1955, Lammefjord on 26

Distance in km Afstand i km	0–1	0–2	3–4	5–10	11–20	40	70	130	140	210	350	550	600	Total I alt
Nos. Antal	64	105	12	4	4	1	1	2	1	1	1	1	1	198
%	32,3	53,0	6,1	2,0	2,0	0,5	0,5	1,0	0,5	0,5	0,5	0,5	0,5	99,9
	85,3		8,1		3,0			3,5						99,9

Table 5. Distances between points of marking and recovery for 198 of the 199 recovered Mallards.

Skema 5. Afstand mellem mærknings- og tilbagemeldingslokalitet for 198 af de 199 genmeldte gråænder.

Dec. 1954, and Ågerup on 19 July 1955. The distance between Kongsdal and the three points of recovery is within 10–20 km.

Nos. 303787, 303827, 303837, and 303879 were marked as ducklings in the summer of 1958. No. 303787 was shot on 26 Dec. 1961 near Bjerregrav in Jutland, no. 303827 on 2 Oct. 1958 near Korsør, no. 303837 near Åbenrå on 27 Oct. 1963, and the last one was shot near Fjenneslev, 19 km from Kongsdal on 22 Dec. 1959.

Two Mallards carrying rings from the Zoological Museum also reached rather far away from Kongsdal. The first one was marked as adult drake on 28 May 1960 and shot on 13 Oct. 1963 at Snogbækhage in S. Jutland. The last one was marked as duckling by Mr. Larsen on 8 June 1960, and it was later shot on the island Amager near Copenhagen.

Only four Mallards, or 2.0 per cent of all marked, were recovered from abroad. Female no. 303885 was caught and marked on 12 July 1958, then a duckling. On 21 Jan. 1959 it was killed in a bird-trap in Holland. An adult drake, marked with a Zoological Museum ring no. 486681 was shot in Holland on 5 Sept. in the following year. Two Mallards, nos. 406336, and Zool. Mus. no. 486686, were shot in W Germany on 12 Dec. 1955 and 6 Jan. 1961 respectively. The former was marked as duckling on 1 July 1954 and the latter as adult female on 1 June 1960. In the countries W and SW of Denmark the open season for Mallards covers a varying part of the winter. Apparently, only few of the Mallards from Kongsdal leave Denmark during the winter, otherwise a greater winter recovery from abroad would be expected.

SEASONAL DISTRIBUTION OF SHOOTING

Table 6 contains 188 Mallards, all *shot* in *Denmark*. No less than 106, or 56.4 per cent, were shot during the last month of the year. Among them 102 were shot at Kongsdal. This shows that the majority of Kongsdal Mallards are stationary throughout the open season. As mentioned above, shooting takes only place near the moat once a year, always in December.

Months of open season Jagtsæsonens fem måneder		VIII	IX	X	XI	XII	Total I alt
The recoveries Genmeldingerne	Nos. Antal	12	18	31	21	106	188
	%	6,4	9,6	16,5	11,2	56,4	100,1

Table 6. Mallards *shot* in Denmark during the open season (VIII–XII).

Skema 6. Fordelingen på jagtsæsonens fem måneder af gråænder genmeldt som *skudte* i Danmark.

MEAN ANNUAL MORTALITY

The distribution on age groups of all Mallards recovered is shown in Table 7 where the first column comprises birds recovered during the year of marking, the second those recovered during the first year after the year of marking a.s.o.

In Table 8 we disregard the first age-class and focus the attention on Mallards reported back as adults. The mean annual mortality among this category of Mallards is calculated at 60.2 per cent ± 4.9. This mortality is of the same order as in the already published, and much larger, material (58.8 per cent ± 2.6).

In order to obtain the largest possible material for the calculations birds marked as adults as well as ducklings are included in Tables 7 and 8, while Table 9 only shows the recoveries resulting from Mallards marked as ducklings. In Table 10 the figures are used for calculating the mortality. It can be seen that the mean first-year mortality is estimated at 70.3 per cent (against 73.4 per cent in the comprehensive material), the second age class has a mortality of 61.1 per cent, second and following age classes 60.0 per cent as a mean value.

Year of marking Mærkningsår	Nos. marked Antal gräænder mærket	Distribution on age-classes (1.1.–31.12.) Tilbagemeldingernes fordeling på aldersgrupper											Total, age-class 1.–12. I alt 1.–12. aldersgr.	Age unknown Alder ukendt	Total I alt Nos. Antal	Total I alt %
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.				
1953	4	0	0	1	0	0	0	0	0	0	0	0	1		1	
1954	148	50	24	5	3	2	0	0	0	0	0		84		84	
1955	37	9	3	4	2	0	0	0	0				18		18	
1956	9	5	1	1	0	0	0	0					7		7	
1957	0															
1958	121	66	3	1	1	1	1						73	1	74	
1959	0															
1960	33	7	5	0	1								13	1	14	
1961	1	1	0	0									1		1	
Total I alt	353	138	36	12	7	3	1	0	0	0	0	0	197		199	56,4
⁰/₀₀ of 197 ⁰/₀₀ af 197		700,5	182,7					116,8					1000,0			

Table 7. Number of Mallards marked (juvv. + ad.) 1953–1961 and the recoveries obtained before 31.12.1963. No further recoveries are expected.

Skema 7. Gräænderne (både voksne og æællinger), der er mærket på Kongsdal fra 1953–1961, og de deraf genmeldte indtil den 31. december 1963. Teoretisk set kan man ikke forvente, at de mærkede fugle vil give yderligere genmeldinger.

x	d_x	xd_x
1	36	36
2	12	24
3	7	21
4	3	12
5	1	5
	59 = N	98

Table 8. *Mean annual mortality among adult Mallards from Kongsdal.*

$x:$ 1–5 represents age-groups 2–6 in Table 7.

Column d_x: recoveries from each age-group. The annual survival factor, $\hat{s}$, is calculated according to LACK:

$$\hat{s} = 1 - \frac{N}{\Sigma\, xd_x} = 0,3980$$

S.D.: $\sigma = 0,6020 \, \sqrt{\dfrac{0,3980}{59}} = 0,0494$

For the calculation of $\hat{s}$ the first age-group comprising Mallards dying between the time of marking (May–August) and the first 1 January was disregarded. The annual percentage survival for ducks alive on the first 1 January is 39,8 % ± 4,9 % and the annual mortality consequently 60,2 % ± 4,9 %.

Skema 8. *Den gennemsnitlige, årlige dødelighed blandt de voksne gråænder på Kongsdal.*

$x = $ 1–5 svarer til 2.–6. aldersgruppe i skema 7.

d_x angiver antallet af genmeldinger i hver aldersgruppe. Den årlige overlevelsesfaktor, $\hat{s}$, beregnes med LACK's formel således:

$$\hat{s} = 1 - \frac{N}{\Sigma\, xd_x} = 0,3980$$

Standardafvigelsen: $\sigma = 0,6020 \, \sqrt{\dfrac{0,3980}{59}} = 0,0494$

Ved beregningen af $\hat{s}$ blev 1. aldersgruppe (omfattende ænder, der er døde mellem mærkningstidspunktet og den følgende 1. januar) udeladt. For gråænder, der har overlevet det første årsskifte efter mærkningen, er den årlige overlevelsesprocent 39,8 % ± 4,9 % og den årlige dødelighed blandt voksne ænder følgelig 60,2 % ± 4,9 %.

Year of marking / Mærkningsår	Nos. marked / Antal ællinger mærket	The recoveries / Tilbagemeldingerne												Total, age-classes 1.-12. / I alt 1.-12. aldersgr.	Age unknown / Alder ukendt	Total / I alt	
		Distribution on age-classes (1.1.-31.12.) / Tilbagemeldingernes fordeling på aldersgrupper														Nos. Antal	%
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.				
1953	4	0	0	1	o	o	o	o	o	o	o	o	1		1	
1954	141	46	24	5	3	2	o	o	o	o	o		80		80	
1955	36	9	3	4	2	o	o	o	o	o			18		18	
1956	6	3	1	o	o	o	o	o	o				4		4	
1957	0															
1958	121	66	3	1	1	1	1						73	1	74	
1959	0															
1960	14	3	2	o	o								5	1	6	
1961	1	1	o	o									1		1	
Total / I alt	323	128	33	11	6	3	1						182	2	184	57,0
‰ of 182 / ‰ af 182		703,3	181,3	115,4									1000,0			

Table 9. Number of marked ducklings 1953–1961 and the recoveries obtained before 31.12.1963. No further recoveries are expected.

Skema 9. Antal gråænder mærket som ællinger på Kongsdal 1953–1961 og de deraf genmeldte indtil den 31. december 1963. Der kan teoretisk set ikke forventes yderligere genmeldinger i årene fremover.

The age-classes Aldersgrupperne x	Alive at beginning of each age-class Antal i live ved hver aldersgruppes begyndelse l_x	Nos. recovered during each age-class Antal genmeldt i hver aldersgruppe d_x	Mortality rate per year Dødelighedsprocent q_x
1	182	128	70,3
2	54	33	61,1
3	21	11	
4	10	6	58,3 } 60,0
5	4	3	
6	1	1	
Total I alt	272	182	

Table 10. Mortality rate per annum. The figures from Table 9 are used.

Skema 10. Tallene fra skema 9 brugt til beregning af den gennemsnitlige dødelighed i 1. og 2. aldersgruppe.

The percentage mortality calculated is, in all cases, based on a very small body of data, but although they cannot be considered quite representative, and not very reliable from a statistical point of view, they are, nevertheless, believed to be fairly realistic, and thus to reflect a general picture of conditions within the Kongsdal Mallard population.

The adult and the first-year mortality are of the same order as previously found by the author and reported from abroad (Table 12 in FOG, 1964) although the percentage recovery is higher than in any other material known to the author. The highest percentage recovery is reported by Hunt et al. (1958) who, in Wisconsin, had a recovery of 26.9 per cent among 10.371 Mallards released. HARRISON and WARDELL (1963) in Great Britain released 29.004 Mallards, and 7.7 per cent were reported back. However, it must be remembered that the percentage recovery of different materials cannot be directly compared since the percentage of recovered bands that are reported varies with time and between places. In this study it must be presumed that the percentage recovery approximates the game harvest taken from the population. All rings and wing-tags from birds shot at Kongsdal are at hand, and even on assuming that this would only apply to half the marks recovered outside the estate, the percentage recovery would only be too low by a figure of 7.7. In the previous Danish material as well as in most studies abroad the percentage of rings which has come to hand

is presumably much lower than the percentage of marked birds actually shot or recovered in other ways. Hence it cannot be concluded e.g. that the Kongsdal Mallards have been exposed to an exploitation of twice the size of the one applying to the Wisconsin Mallards.

Being generally familiar with shooting conditions in Denmark, the present author is inclined to believe that the exploitation of the Kongsdal Mallards is not significantly heavier than in the country as a whole, and that in all probability the percentage mortality reflects real conditions in the Kongsdal Mallard population.

PRODUCTION OF EGGS AND DUCKLINGS

No information is available on the number of eggs in the Mallard nests at Kongsdal, but it has been possible to collect data concerning 84 clutches from other parts of Denmark. It applies to all that either the bird has been seen on the nest or the eggs were still warm when found. Some of the clutches may not have been completed (most of the nests were only visited once), hence the numbers must be considered minimum numbers.

Appendix 2 presents the data concerning sites and dates for the 84 nests, and in Appendix 3 the mean number of eggs per nest is calculated at 9.6 ± 2.1. It appears from Fig. 2 that the most common clutch sizes are 8, 9, 10, and 11 eggs. The columns 8–11 contain 74 per cent of the 84 clutches.

It has not been possible to obtain data on the number of eggs hatching per nest but, as mentioned already, 5.6 ducklings per female present was calculated at Kongsdal on 10 July 1964 (Table 2). Among the 228 ducklings observed, Mr. Larsen estimated 121 to be 6–9 weeks old, 65 at ages 3–6 weeks, and 42 at 1–3 weeks. The mean number of ducklings per female actually with ducklings was 6.7.

Since part of the ducklings were »green« on 10 July, it must be assumed that the mean number of ducklings per old female actually on the wing is somewhat lower than 5.6. The variation between years in the number of ducklings per female present at the beginning of the open season on 15 August is within the interval 5.0 and 7.5 (according to Mr. Larsen).

During the years 1959, 1963, and 1964 Mr. N. O. Preuss observed 27 broods of ducklings in different localities in Zealand (Table 11). Mr. Preuss estimates the age of the ducklings to be 5 weeks or more and the mean number of duck-

Fig. 2. Frequency distribution of clutch sizes among 84 Mallard clutches (further data in Appendix 2 and 3),

Fig. 2. Fordelingen af 84 gråandekuld efter antal æg observeret i hvert kuld (se data om kuldene i bilag 2 og 3).

lings per brood was 7.4. This figure is of the same order as the 6.7 ducklings per succesful mother duck at Kongsdal in 1964.

DUCKLING PRODUCTION AND MORTALITY

Based on data from HICKEY (1952) BALHAM and MIERS (1959) arrive at an equation which enables one to calculate the production of fledged young required in any population with given first-year mortality and adult mortality to balance production and mortality. The equation only applies to species which reproduce at an age of 1 year:

Age of ducklings Ællingernes alder	Brood-sizes Ællingekuldenes størrelse	No. of broods Antal ællingekuld	No. of ducklings Antal ællinger
≧ 5 weeks (estimation) 5 uger og derover (skøn)	2	1	2
	3	2	6
	4	2	8
	5	2	10
	6	3	18
	7	3	21
	8	5	40
	9	2	18
	10	3	30
	11	1	11
	12	2	24
	13	1	13
Total I alt		27	201

Mean:
Gennemsnitlig kuldstørrelse: $\frac{201}{27} = 7{,}4$

Table 11. Mallard broods observed by cand. mag. N. O. Preuss 1959, 1963 and 1964 in the following localities in Zealand: Gisselfeld near Haslev, Hillerød Slotssø, Magleby Lyng near Skelskør, Rye Gaard N.E. of Tølløse, St. Kattinge Sø N.W. of Roskilde, Trekantsøen in Amager and Utterslev Mose N. of Copenhagen.

Skema 11. Ællingekuld af gråænder observeret af cand. mag. N. O. Preuss på følgende sjællandske lokaliteter i somrene 1959, 1963 og 1964: Gisselfeld ved Haslev, Hillerød Slotssø, Magleby Lyng ved Skelskør, Rye Gaard NØ for Tølløse, St. Kattinge Sø NV for Roskilde, Trekantsøen på Amager og Utterslev Mose ved København.

$$x = \frac{M_w}{50\,(1-M)}, \text{ where}$$

x = the number of young per pair at time of banding,

M_w = the annual loss per 100 adults (mean mortality rate),

M = first-year mortality rate per cent,

50 indicating 50 pairs.

On substituting the mortality rates from Kongsdal we obtain:

$$x = \frac{60.2}{50\ (1-0.703)}$$

$$x = 4.1$$

According to the equation each female must contribute an average of 4.1 fledged ducklings per year in order to balance production and mortality. On considering the figures from Kongsdal, it is seen that the population meets these requirements, and that even a higher mortality might be tolerated.

The calculations require that the mortality be identical in either sex, and that the sex ratio be 1:1 among the ducklings produced.

SUMMARY

1. An analysis of the Mallard ringing data obtained by the Game Biology Station during the years 1950–1960 was published by the author in Danish Review of Game Biology, vol. 4, part 3. The present publication contains a special analysis of the markings made on the estate of Kongsdal, partly marking data from the previous publication, partly recoveries obtained since then (up to the end of 1963), and partly data resulting from the estate markings based on rings from the Zoological Museum of the Copenhagen University.

2. The estate of Kongsdal is located between Kalundborg and Holbæk in Zealand. The shooting-ground covers an area of 1000 ha. The Mallard population inhabits the moat and nine small ponds. The area of water surface amounts to 14,664 sq. metres, and the total length of water edge 1880 metres.

3. The local breeding population counts approximately 40 pairs each year, the number varying little between years. On 10 July 1964 a census resulted in 41 adult females and 228 ducklings or, on an average, 5.6 ducklings per female present. On disregarding females without ducklings the number of ducklings per female is 6.7. The estate game warden reports the number of ducklings at the beginning of the open season in August to vary between 200 and 300 according to the year. On 10 July 19 ducklings and 4 adult females were reported to be colour deviates.

4. The Mallards breed partly in 30 duck-houses and partly free in the area surrounding the castle. The ducks are fed throughout the year.

5. Selective shooting relative to sex is not applied. Shooting takes place, almost exclusively, while the ducks move between ponds and bogs on the estate.

6. During the years 1953–61 a total of 353 Mallards were marked between the dates 1 May and 31 August. The recoveries total 199 ($= 56.4$ %). The bulk (48.7 % of all marked) were recovered from the estate, and 7.7 % from other places in Denmark or abroad. Among the 199 ducks 96.5 % were reported shot.

    The percentage recovery is very high, and it is believed that practically all rings and wing-tags in human hands were available. This is hardly true

as far as the previously published material is concerned since it comprised markings from all over the country, and where the percentage recovery was found to be 22.7. Presumably, the exploitation of the Kongsdal Mallard population is not appreciably heavier than the Danish Mallard population in general.

7. Among the recovered Mallards 85.3 % were shot or found at a distance of 0–2 km from the points of marking, only 6.5 % reaching distances in excess of 10 km.

    Four birds, or 2.0 % of those marked, were recovered from abroad.

    Among the 199 Mallards recovered 188 were *shot* in *Denmark*. Among them, 106 were shot in the month of December (102 on the estate). Generally, it must be concluded that a very small proportion of the birds leave Denmark during the winter, and that the majority are stationary in the vicinity of Kongsdal.

8. The mean annual mortality among adult birds is calculated at 60.2 % $\pm$ 4.9 %, and the first-year mortality at 70.3 %.

    The percentages calculated are based on rather scanty data, hence they may not be statistically significant. There is, however, reason to believe that they reflect the true conditions in a fairly realistic way.

9. The mean number of eggs per nest is estimated at 9.6 $\pm$ 2.1 on the basis of data obtained from 84 Mallard nests from various parts of Denmark. The most common clutch sizes were 8, 9, 10, and 11 as minimum figures.

    The mean number of ducklings per female was, as mentioned already, 5.6 at Kongsdal on 10 July 1964. The mean number observed in broods in other places in Denmark was 7.4 (data derived from 27 broods observed in 1959, 1963, and 1964) at an estimated age of 5 weeks or more. This figure corresponds well with 6.7 ducklings counted at Kongsdal.

10. The actually found percentage mortality requires a mean production of 4.1 fledged ducklings per female present in order to balance mortality and duckling production at Kongsdal. The population seems to meet this requirement.

DANSK RESUMÉ

INTRODUKTION

I Danish Review of Game Biology, vol. 4, part 3, analyserede forfatteren i 1964 resultaterne af Vildtbiologisk Stations gråandemærkninger fra 1950 til 1960.

Ænderne var mærket på mange lokaliteter landet over. Ved materialets bearbejdelse viste det sig, at mærkningerne på godset *Kongsdal* ved Mørkøv i Nordvestsjælland i flere henseender havde givet så interessante oplysninger om den lokale bestands udnyttelse og dens omsætningsforhold, at resultaterne fortjente at blive behandlet i en speciel rapport, hvor det endvidere var muligt at sammenligne det teoretiske produktionskrav med oplysninger om den realiserede ællingeproduktion på godset.

Rapporten omfatter ikke blot det tidligere publicerede mærkningsmateriale, idet dette dels er suppleret med genmeldinger, der er indløbet indtil udgangen af 1963, dels med resultaterne af godsets mærkninger med ringe fra Københavns Universitets Zoologiske Museum.

Vildtbiologisk Station retter en varm tak til Kongsdals ejer, kammerherre, hofjægermester J. Estrup, som har tilladt, at der blev mærket ænder på godset, og at Vildtbiologisk Station måtte publicere data vedrørende vildtplejen og den jagtlige beskatning, som gråandebestanden er underkastet.

Kammerherren har endvidere været så elskværdig at gennemlæse og kommentere manuskriptet.

En tak skal rettes til skytte Chr. Larsen, Kongsdal, der har udført mærkningerne, returneret ringe med oplysninger om genmeldte fugle, foretaget optælling af andebestanden og givet beskrivelse af godsets jagt- og vildtplejeteknik.

Forfatteren takker endvidere cand. mag. N. O. Preuss, Zoologisk Museum, København, der har stillet oplysninger om museets ringmærkninger på Kongsdal og notater om æg- og ællingeantal hos gråænder til hans disposition.

For kritisk gennemsyn af tabeller og bilag og for oversættelse af manuskriptet til engelsk takkes professor C. Overgaard Nielsen, København.

LOKALITETEN

Kongsdal gods ligger på Sjælland mellem Kalundborg og Holbæk nær stationsbyen Mørkøv. Kammerherre J. Estrups jagtrevir omfatter 1000 ha, der ligger samlet med hovedbygningen og parken nogenlunde i centrum.

Gråandepopulationen findes i voldgraven, der omgiver slottet, og i mindre damme i dets umiddelbare nærhed. Voldgraven og de fleste af dammene er så at sige blottede for vegetation. Det totale vandareal har skytte Chr. Larsen groft opmålt til 14.664 m², medens den samlede bred omtrentlig beløber sig til 1880 meter. Vanddybden overstiger ingen steder 2 meter (se skema 1).

GRÅANDEBESTANDEN

Efteråret, vinteren og det tidlige forår igennem ligger der et meget stort antal gråænder i voldgraven og dammene (op til 600). Ved yngletidens begyndelse er flertallet af fuglene væk. Resten – den lokale ynglebestand – er ca. 40 par. Chr. Larsen oplyser, at yngleparrenes antal varierer meget lidt fra år til år. En hel del af andrikkerne plejer at forsvinde i løbet af forsommeren.

Når jagten går ind i august, huser området i dårlige år omkring 200, i gode år ca. 300 ællinger. Ifølge skyttens oplysninger varierer den gennemsnitlige produktion af flyvedygtige ællinger pr. tilstedeværende hun altså mellem ca. 5 og ca. 7,5. Koldt og vådt vejr lige efter klækningen forårsager stor dødelighed blandt ællingerne.

Den 10. juli 1964 foretog hr. Larsen en optælling af bestanden (skema 2). Ænderne blev talt i forbindelse med fodringen, hvor det er muligt at sidde i et af slottets vinduer og notere fuglenes antal og alder, når de familievis svømmer hen til fodringspladsen. Som det fremgår af skemaet, optaltes i alt 9 andrikker, 41 voksne hunner og 228 ællinger. Skytte Larsen mener ikke, at tællingen er behæftet med nogen større fejl. I gennemsnit var der 5,6 ælling pr. hun. Tager man kun hensyn til de 34 ænder, der havde ællinger, er gennemsnittet 6,7.

Der er ikke noget stort indslag af misfarvede ænder i bestanden. Ved tællingen den 10. juli registreredes kun 4 voksne hunner og 19 ællinger, der farvemæssigt afveg fra det normale.

VILDTPLEJE OG JAGTTEKNIK

En stor del af mærkningsmaterialet fra Kongsdal er behandlet af FOG (1964) (Dispersal and survival of released Mallards), skønt ænderne ikke er opdrættet

Jørgen Fog

kunstigt. De blev medtaget på grund af tilstedeværelsen af misfarvede ænder i bestanden, og fordi fuglene lever under sådanne forhold, at man ikke umiddelbart tør sidestille dem med egentlig vildtlevende.

Skytte Chr. Larsen har opstillet godt 30 andehuse af træ i voldgraven og dammene, og flertallet af disse plejer at blive benyttet. I 1964 afprøvede han for første gang en redekurv, som han anbragte i et af parkens træer. Den blev hurtigt taget i besiddelse af en and.

Skytte Larsen har iagttaget, at det er andrikken, der i det tidlige forår begynder at undersøge redemulighederne, og at det er den, der vælger redestedet. Den samme iagttagelse har man gjort i Holland (ANONYM, 1964).

Andehusene er anbragt umiddelbart over vandspejlet (fig. 1), og indgangshullet er ikke vendt mod noget bestemt verdenshjørne. Mange af husene står i konstant skygge. Skytte Larsen laver dem selv. Grundplanen i et ideelt hus bør ifølge skyttens erfaringer måle 40 cm × 35 cm, indgangshullet er 15 cm × 15 cm, husets højde fortil er 30 cm og bagtil 24 cm, og skytte Larsen anser det for vigtigt, at bunden er forsænket ca. 12 cm i forhold til indgangshullets basis.

I det tidlige forår anbringer man lidt redemateriale i samtlige andehuse.

Ænderne på Kongsdal fodres hele året – altid på samme sted på voldgravens bred, hvor der udlægges foder to gange om dagen. Man giver ællingerne bygrutning i begyndelsen. Når de bliver større, får de ligesom de voksne ænder korn, mest byg, men efter høst også småhvede.

I den periode, mærkningerne har stået på, har ænderne ikke været udsat for selektiv beskydning med hensyn til de to køn. Jagten drives næsten udelukkende som trækjagt, når ænderne om aftenen søger ud til vandhuller eller moser på godset. Man beskyder aldrig fuglene, når de ligger i voldgraven eller i de ni damme. Kun en enkelt gang om året jages ænderne op fra voldgraven og beskydes af jægere, der er stillet på post nogle hundrede meter borte.

ANTAL MÆRKEDE OG GENMELDTE ÆNDER

I årene 1953–61 har skytte Chr. Larsen fanget og mærket en del gråænder på Kongsdal. I denne forbindelse skal vi kun beskæftige os med ællinger og voksne fugle, der er ring- eller vingemærket i perioden fra 1. maj til 31. august, idet materialet således udelukkende vil omfatte ænder fra den lokale bestand. Man ser af skema 3, at der i alt er mærket 323 ællinger og 30 voksne. De fleste af ænderne er *ringmærkede*, idet der blot er benyttet *vingemærker* til 17 ællinger og 1 voksen fugl. Af de 353 gråænder er senere 199 tilbagemeldt, hvilket vil sige, at *genmeldingsprocenten er 56,4*.

86

Flertallet af ænderne er genmeldt fra selve Kongsdal, nemlig 48,7 % af de mærkede, medens blot 7,7 % af de mærkede er rapporteret tilbage uden for godsets grænser (se genmeldingslisten i bilag 1).

GENMELDINGSAFSTANDE

Som anført i skema 3 er 86,4 % af de 199 genmeldte rapporteret tilbage fra Kongsdal gods, 11,6 % fra andre egne af Danmark og 2 % fra udlandet.

Da hovedparten af fuglene er genmeldt fra selve Kongsdal, falder flertallet af dem i de første rubrikker i skema 5, der viser afstanden fra mærkningssted til genmeldingslokalitet for 198 af fuglene. Ikke mindre end 85,3 % er skudt eller fundet fra 0–2 km fra Kongsdal slot, og blot 13 gråænder eller 6,5 % af samtlige genmeldte er kommet over 10 km bort.

Af sidstnævnte 13 ænder er 9 rapporteret tilbage fra forskellige egne af Danmark, medens kun fire fugle (2 % af de mærkede) er tilbagemeldt fra andre lande (Holland og Vesttyskland). I landene vest og sydvest for Danmark drives der andejagt en større eller mindre del af vinteren. Det er åbenbart få af Kongsdals ænder, der forlader Danmark om vinteren, da så få er genmeldt fra udlandet i vintermånederne.

HVORNÅR ER ÆNDERNE SKUDT?

I skema 6 finder man 188 gråænder, der er skudt i Danmark. Ikke mindre end 106 eller 56,4 % er nedlagt i årets sidste måned. Heraf er de 102 skudt på Kongsdal. Dette viser, at størstedelen af Kongsdals ænder bliver omkring godset hele jagtsæsonen igennem. Som omtalt beskydes fuglene kun een gang om året omkring voldgraven. Denne jagt holdes altid i december.

DEN GENNEMSNITLIGE, ÅRLIGE DØDELIGHED

Ændernes fordeling på aldersgrupper fremgår af skema 7, hvor den første gruppe omfatter gråænder, som er genmeldt i mærkningsåret. I skema 8 ser man bort fra den første aldersgruppe og betragter således kun fugle, der er genmeldt

efter at være blevet voksne. Den gennemsnitlige, årlige dødelighed blandt disse voksne individer er 60,2 % ± 4,9 %. Det er en dødelighed af samme størrelsesorden som i det tidligere offentliggjorte, langt større materiale (58,8 % ± 2,6 %).

Skemaerne 9 og 10 omfatter kun fugle, der er mærket som ællinger. Førsteårsdødeligheden er beregnet til 70,3 % (i det store materiale var den 73,4 %).

De fundne dødelighedsprocenter er i alle tilfælde baseret på meget små talmaterialer, hvis pålidelighed næppe vil kunne bekræftes ved kritisk, statistisk analyse, der dog næppe heller vil kunne afkræfte, at der er realiteter bag de fundne procenter.

Set med biologens øjne er der imidlertid grund til at tro, at de registrerede dødelighedsprocenter afspejler reelle forhold i Kongsdals gråandebestand.

Både dødeligheden blandt voksne og førsteårsdødeligheden ligger på samme niveau som i forfatterens tidligere arbejde og som i en del udenlandske materialer (skema 12, FOG, 1964), skønt den registrerede genmeldingsprocent blandt Kongsdals ænder er højere end i noget andet offentliggjort mærkningsmateriale, forfatteren kender. Man må huske, at genmeldingsprocenter fra forskellige materialer ikke uden videre kan sammenlignes, idet indsendelsesprocenten for ringe kan variere med hensyn til tid og sted. I dette materiale må man regne med, at den registrerede genmeldingsprocent omtrentlig svarer til den jagtlige told af bestanden. Alle ringe og vingemærker fra fugle nedlagt på Kongsdal er indleveret, og selv om man tænkte sig, at dette blot gjaldt halvdelen af mærkerne, der er kommet i menneskehænder uden for godsets grænser, var den registrerede genmeldingsprocent dog kun 7,7 for lav. I det tidligere, danske materiale og ved de fleste udenlandske undersøgelser er indsendelsesprocenten formentlig langt lavere end den procentdel af de mærkede fugle, der reelt er nedlagt eller på anden måde tilbagemeldt.

På grundlag af almen kendskab til jagtforholdene i Danmark vil forfatteren skønne, at den jagtlige beskatning af ænderne på Kongsdal ikke er væsentlig større end beskydningsintensiteten i landet som helhed, og at det er sandsynligt, at de fundne dødelighedsprocenter afspejler reelle forhold i Kongsdals gråandebestand.

ÆG- OG ÆLLINGEPRODUKTION

Man har ingen notater om antallet af æg i gråanderederne på Kongsdal, men det har været muligt at samle data om 84 kuld fra andre danske revirer (bilag 2 og 3 samt fig. 2). De hyppigste kuldstørrelser er 8, 9 og 10 og det gennemsnitlige ægantal 9,6.

Der foreligger ikke tal for antallet af klækkede æg pr. rede. Men som nævnt iagttog man den 10. juli 1964 på Kongsdal 5,6 ællinger pr. forhåndenværende hun (skema 2). Af de 228 observerede ællinger skønnede skytte Chr. Larsen, at de 121 var 6–9 uger gamle, de 65 var 3–6 uger, og at de sidste 42 var 1–3 uger. Det gennemsnitlige ællingeantal pr. hun, der lå med ællinger, var 6,7.

Da en del af ællingerne var »grønne« den 10. juli, må man regne med, at det gennemsnitlige antal ællinger, der kom på vingerne pr. gammel hun, blev lavere end 5,6. Fra år til år svinger antallet af ællinger pr. tilstedeværende hun ved jagtsæsonens begyndelse den 15. august som nævnt ifølge skytte Larsens oplysninger mellem 5,0 og ca. 7,5.

Cand. mag N. O. Preuss har i årene 1959, 1963 og 1964 observeret 27 kuld ællinger på forskellige sjællandske lokaliteter (skema 11). Ællingernes alder er af hr. Preuss skønnet at være 5 uger og derover, og det gennemsnitlige ællingeantal var 7,4. Dette tal er af samme størrelsesorden som de 6,7 ællinger, der i 1964 var gennemsnittet for de ællingeførende hunner på Kongsdal.

ÆLLINGEPRODUKTIONEN OG DØDELIGHEDEN

Hver hun skal gennemsnitligt yde 4,1 flyvestore ællinger om året, hvis der skal være balance mellem produktion og dødelighed. Ser man på produktionstallene fra Kongsdal, opdager man, at bestanden honorerer det stillede krav, og at der måske endda var råd til større dødelighedsprocenter end de fundne.

Ved beregningerne forudsættes, at dødeligheden er ens hos de to køn, og at kønsforholdet er 1:1 blandt de producerede ællinger.

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APPENDIX 1: MALLARDS MARKED ON THE ESTATE OF KONGSDAL
(55° 33′ N; 11° 33′ E) AND RECOVERED 5 OR MORE KM AWAY

The data of each individual Mallard occupy two lines. Above: No. of ring, age of Mallard at ringing, sex and date of marking. Below: Cause of death, date and point of recovery. Co-ordinates and direction of movements from Kongsdal are only given for recoveries from abroad.

This appendix only include recoveries not enumerated by FOG (1964).

The data on Mallards marked with rings from Zoologisk Museum, Copenhagen have been – or will be – published in the ringing reports of the museum.

BILAG 1: LISTE OVER GRÅÆNDER, DER ER MÆRKET PÅ KONGSDAL
(55° 33′ N; 11° 33′ E) OG GENMELDT 5 KM OG DEROVER FRA
MÆRKNINGSSTEDET

Hver fugls data er behandlet på to linier. Øverst er anført: Ringens nummer, andens alder ved mærkningen, dens køn samt mærkningsdatoen. Nederste linie oplyser: Dødsårsag, tilbage-meldingsdato, genmeldingslokalitet og afstand mellem Kongsdal og genmeldingsstedet. Kun for tilbagemeldinger fra udlandet er der angivet koordinater og bevægelsesretning.

Abbreviations: As by FOG (1964).
Forkortelser og tegn: Se FOG (1964).

        1: Ring from Game Biology Station, Kalø
        1: Vildtbiologisk Stations ring

303837 juv. ○ 12.7.1958
        + 27.10.1963 Bodum Mose near Åbenrå, Sønderjylland. 130 km
        2: Rings from Zoologisk Museum, Copenhagen
        2: Zoologisk Museums ringe

486681 ad. ♂ 28.5.1960
        + 5.9.1961   Oostelijk Flevoland (52° 23′ N; 05° 33′ E), *Holland*. 600 km SW

486682 ad. ♂ 28.5.1960
        + 13.10.1963 Snogbækhage, Sønderjylland. 130 km

486688 ad. ♀ 1.6.1960
        + 6.1.1961   Near Husum (54° 29′ N; 09° 04′ E) *W. Germany*. 210 km SW

486695 juv. ○ 8.6.1960
        + before 19.8.1963 Amager, near København. 70 km

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APPENDIX 2: CLUTCH SIZES

Clutch sizes of 84 Mallard nests. Only part of the nests were visited more than once. The nests were inspected at different times during spring and early summer. Undoubtedly, they represent a mixture of first and repeat clutches. Hence, the calculated mean clutch size must be considered minimum values. Data from the estates Gisselfeld and Bregentved were collected by Mr. N. O. Preuss, who kindly placed them at my disposal. The clutch sizes from Saltholm were published in FOG (1964), and the notes on clutch sizes from Hou Røn were collected by the Game Biology Station.

BILAG 2: ÆGANTAL

Ægantallet i 84 gråandereder. Kun en del af dem er besøgt mere end en gang. Rederne er observeret på forskellige tider af foråret og forsommeren og er uden tvivl en blanding af første-kuld og omlagte kuld. Den fundne, gennemsnitlige kuldstørrelse må opfattes som et minimums-tal. Oplysningerne fra godserne Gisselfeld og Bregentved er indsamlet af cand. mag. N. O. Preuss, der venligst har overladt mig dem. Kuldene fra Saltholm er publiceret af FOG (1964), og notaterne om ægantal på Hou Røn er indsamlet af Vildtbiologisk Station.

The Mallards from the estate of Kongsdal

Time and locality Tid og sted	Clutch size Antal æg i kuldet	No. of clutches Antal kuld	Mean clutch size Gennemsnitlig kuldstørrelse
Gisselfeld, Sjælland	5	1	
	8	2	
	9	1	9,3
23.4.–24.5.1952	10	3	
	11	3	
	5	1	
	8	2	
	9	3	
10.4.–30.4. 1953	10	3	10,5
	11	4	
	12	2	
	13	3	
	14	1	
Bregentved, Sjælland 14.4.1953	17	1	
Gisselfeld, Sjælland 7.4.–10.6.1957	7	2	
	10	1	
1.5.–4.5. 1958	9	1	
Saltholm, Øresund	5	1	
	6	2	
	7	5	
	8	4	
25.4.–11.5. 1959	9	8	9,3
	10	7	
	11	10	
	12	2	
	13	1	
Hou Røn, Kattegat 12.5.1964	8	5	
	10	3	9,2
	11	2	

APPENDIX 3: THE MEAN CLUTCH SIZE
BILAG 3: DET GENNEMSNITLIGE ÆGANTAL

The data from Appendix 2 used for calculation of mean clutch size.

Tallene fra bilag 2 er her brugt til beregning af det gennemsnitlige ægantal i de 84 grå-andereder.

Clutch size Antal æg i kuldet X	No. of clutches Antal kuld f	No. of eggs Antal æg	$X - M$	$(X - M)^2$	$f(X - M)^2$
5	3	15	— 4,6	21,16	63,48
6	2	12	— 3,6	12,96	25,92
7	7	49	— 2,6	6,76	47,32
8	13	104	— 1,6	2,56	33,28
9	13	117	— 0,6	0,36	4,68
10	17	170	0,4	0,16	2,72
11	19	209	1,4	1,96	37,24
12	4	48	2,4	5,76	23,04
13	4	52	3,4	11,56	46,24
14	1	14	4,4	19,36	19,36
15					
16					
17	1	17	7,4	54,76	54,76
Total Ialt	84 = n	807			358,04 = $\Sigma f(X - M)^2$

Mean:
Gennemsnitlig kuldstørrelse: $M = \dfrac{807}{84} = 9,6$

S.D.:
Standardafvigelsen: $\sigma = \sqrt{\dfrac{\Sigma f(X - M)^2}{n}} = \sqrt{\dfrac{358,04}{84}} = 2,06$

$M = 9,6 \pm 2,1$