DANISH REVIEW OF GAME BIOLOGY Vol. 5 no. 1.

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(Med et dansk resumé: En undersøgelse af knortegåsen *(Branta bernicla)* i Danmark.)

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Status of the Brent Goose up to 1960

Two subspecies of the Brent Goose occur as migrants in Denmark, viz. *Branta bernicla bernicla* and *Branta bernicla hrota.*

As described by SALOMONSEN (1958), the number of wintering birds in West Europe is much smaller today than it was formerly. Unfortunately, records in the literature on the number of geese are so imprecise that no true estimate can be obtained of the size of earlier populations. ATKINSON-WILLES and MATTHEWS (1960) estimate that the present population represents 25% of the population in the last part of the 19th century.

SALOMONSEN is of the opinion that the number has been decreasing since the end of the last century, and he states that this trend has been accellerating in the last few years. Among other things, SALOMONSEN mentions figures from the official Danish bag statistics, and he states that the annual yield of Brent Geese has gone down from 7000 in 1941 to 2500 in 1951. Later an account will be given of the questionaire sent to Danish sportsmen which forms the basis of the bag statistics, but at this stage it is reasonable to point out that – although there can be no doubt about the decline in the Brent Goose population – it is now known that the existence of fluctuations in the population cannot be substantiated on the basis of bag statistics in the period 1941–1951. Previously, distinction was made in the license between geese killed at sea and geese shot on land, and SALOMONSEN (1954 and 1958) regards the geese which, according to the bag statistics, were killed at sea as being principally Brent Geese. Today we know that this is not quite correct, since, in the first place, many geese of the genus *Anser* are killed at sea, and secondly, it has appeared that the distribution made by the sportsmen in the two columns in the questionaire is so full of mistakes that a distinction made on this basis is misleading. This is the reason why a distinction between geese shot on land and geese killed at sea is no longer made in the questionaire.

The cause or causes of the decline in number of the Brent Geese is not known for certain, but many theories have been set forth. The decline was especially striking when *Zostera marina* was struck by disease in the beginning of the 1930's, when this growth disappeared over vast areas in West European waters. The Brent Geese feed mainly on *Zostera* when they stay in West Europe (BURTON 1961 a), and it is easy to suggest that this disappearance had serious consequences. The disease in the *Zostera,* however, cannot be accepted as the only cause of the decimation of the goose population. *Zostera marina* has spread considerably again, at any rate in Danish waters (verbal information by Dr. TYGE CHRISTENSEN and Dr. AAGE J. C. JENSEN as well as the author's own observations), and the goose population has not regenerated in proportion.

It is, however, the general impression that the number of dark-bellied Brent Geese has been increasing somewhat in recent years. BURTON (1962) confirms this impression on the basis of counts of Brent Geese in the winter quarters, first and foremost in Great Britain.

The shooting has been regarded by many people as reducing population numbers. In recent years the Brent Geese have been totally protected in many countries, where they were previously

shot and captured. Despite less shooting the population has not reached the level of earlier times, so shooting cannot be the main cause of the decline.

It seems easy to suggest that several factors together are responsible for the decline, and although no data are available, it is tentatively suggested that a change in the climate in the breeding places has been unfavourable to the birds, and that this may be one of the most essential causes.

Although there is a fairly comprehensive literature on the Brent Goose there are still gaps in our knowledge of the biology of the species.

Concrete knowledge of the Brent Goose in Denmark has hitherto been scarce, and this is the reason why, since 1960, Game Biology Station at Kalø has undertaken a number of investigations, the results of which are mentioned below.

The material comprises, in the first place, data obtained by applications from sportsmen in Denmark, secondly, statistical material obtained by the Game Biology Station during the investigations on the island of Jordsand situated in Vadehavet (the Wadden Sea), and thirdly, the results of counts of Brent Geese in Danish waters together with data of 168 Brent Geese which were placed at the disposal of the Game Biology Station by sportsmen in 1963 and 1965.

Data received from sportsmen

In Denmark it is only permitted to shoot geese in the autumn. The Barnacle Goose *(Branta leucopsis)* is totally protected. It is permitted to shoot the other species from 1st August to 31st December. In 1965 the period of protection for the Brent Goose was extended, and it is not permitted to shoot it before the 1st October.

All sportsmen in Denmark have to apply for a license to shoot. Every holder of a license must return this when the season is over with a statement of the number and species of game killed by him, listing the name of the county where the game was shot. To every license is therefore attached a questionaire (Fig. 1) for this purpose.

The sportsmen have to submit this questionaire duly filled in to the police who will then issue the new license. A license can only be renewed if the old one is submitted, and according to STRANDGAARD (1964) an average of 83% of the questionaires are returned.

Denmark is divided into a number of police districts, and each district collects the submitted licenses and sends them to the Game Biology Station, where this enormous statistical material is treated in different ways. As the submitted questionaires bear the name and address of the license holders it is possible later on to communicate with the individual sportsmen if further information is required.

This procedure was used when investigations on geese were started in 1960. Application was made to the sportsmen of 1961-62, which means the people who had killed geese in the autumn of 1961, as the licenses are valid from 1st April to 31st March, and – as said above – it is only permitted to shoot geese in the autumn.

Reneval of the license only if this questionaire is returned to the police office. Also in case renewal of the license is not desired, it is requested that the questionaire is completed, signed and handed in to the police office not later than 1st December 1967.

Bag killed at sea, in fjords or in bays can be entered at the nearest county.

Bag taken by license holder personally between 1st April 1966 and 31th March 1967.

	Name of county where the bag was killed			
Red deer				
Fallow deer				
Sika deer				
Roe-deer				
Hares				
Rabbits				
Squirrels				
Foxes				
Badgers				
Otters				
Polecats				
Stoats				
Other martens				
Seals				
Black grouse				
Partridges				
Pheasants				
Wood pigeons				
Mallards *)				
Other surface ducks				
Eiders				
Other diving ducks				
Geese				
Gulls				
Other swimming birds				
Woodcocks – spring				
Woodcocks – autumn				
Snipes				
Curlews				
Herons				
Other waders				
Crows				
Magpies				
Rooks				
Birds of prey				
Total				
Signature				

*) killed from 1st August – 15th September .....
killed later than 15th September .....

Every sportsman received a letter stating the purpose of the investigation, and a questionaire by means of which data were collected in order to elucidate the distribution of the bag on species and subspecies, and a more detailed mapping of the localities where the birds stayed throughout the shooting season (Fig.2).

At the same time the sportsmen were asked to give details of the geese in the localities where they went shooting. In this way many interesting and valuable particulars were obtained.

WHICH GOOSE SPECIES ARE KILLED?

In the questionaire, distinction is primarily made between Black Geese (species of *Branta*) and Grey Geese (species af *Anser*), and here the data on Black Geese are first discussed.

It should be borne in mind when evaluating the material that it comprises only one year group of geese killed, viz. that from the autumn of 1961, and from the time of shooting to the date when the questionaries were sent out, more than 18 months elapsed.

Altogether 2234 questionaires were sent out, since 2234 persons had stated on their license that they had shot geese during the season 1961-62. However, only 2160 received questionaires, because a number of sportsmen had moved in the meantime, and in 74 instances it was not possible to trace the new addresses.

As shown by Table 1, 59% of the questionaires were completed, which, according to conditions in Denmark, is not a very high percentage. The cause of the low percentage may be that the questions were sent out so late after shooting took

Fig. 1. Questionaire attached to license.

Fig. 1. Sporgeskemaet, der er vedhæftet jagttegnet.

place that many did not remember sufficient details. In addition, the questionaires were sent out at the beginning of the summer holidays which, naturally, is not a good time.

Table 2 shows that by far the greater number had shot Grey Geese, and this is not surprising, as, in the first place, many more Grey Geese than Black Geese pass through Denmark, and in the second place, we have a relatively big population of breeding Grey Lag Geese (*Anser anser*).

Table 2 further shows that by far the greater part of the questionaires sent out in 1963 were correctly completed, only

Game Biology Station,
Kalø pr. Rønde.
Telefon Rønde 244.

Dear Sir,

It appears from the bag statistics in your license 1961-62 that you have killed ..... geese in the autumn of 1961.

How many were »Black Geese« .....

How many were »Grey Geese« .....

If it is possible now to remember please state how many of the »Grey Geese« were

Bean Geese .....

Pink-footed Geese .....

Grey Lag Geese .....

White-fronted Geese .....

Lesser White-fronted Geese .....

The localities, where the geese were shot (as exact as possible):
For the »Black Geese«. For the »Grey Geese«.

If any further details are available please write on the back of this note.

Fig. 2. Application sent to 2234 sportsmen.

Fig. 2. Henvendelsen, der blev udsendt til 2234 jægere.

		% of 2160 *% af 2160*
No. of tables sent out *Antal udsendte skemaer*	2234	
Addressee moved *Adressaten flyttet*	74	
No. of sportsmen receiving table *Antal jægere, der modtog skemaet*	2160	
Tables returned *Returnerede skemaer*	1272	58,8
No replies received *Ubesvarede henvendelser*	888	41,2

Table 1. No. of tables sent out and returned in 1963.

Tabel 1. Antal udsendte og returnerede skemaer i 1963.

	No. of sportsmen *Antal jægere*	% of 1272 *% af 1272*
Only Grey Geese killed *Kun nedlagt grå gæs*	964	83,3
Both Grey and Black Geese killed *Både nedlagt grå og sorte gæs*	59	21,4
Only Black Geese killed *Kun nedlagt sorte gæs*	204	
Total of geese killed *Nedlagt gæs i alt*	1227	96,5
Unintelligible replies *Uforståelige svar*	15	1,2
No geese killed *Ingen gæs nedlagt*	26	2,0
Dead *Døde*	4	0,3

Table 2. Distribution of the 1272 applications returned. Only 59 sportsmen had killed both Grey and Black Geese.

Tabel 2. Fordelingen af de 1272 returnerede henvendelser. Kun 59 jægere havde skudt både grå og sorte gæs.

15 replies (slightly more than 1%) had to be rejected as unintelligible.

There were 26 sportsmen (2%) who had made mistakes when completing the list. Most of them had confused the columns and listed gulls and diving ducks under »geese«. Four sportsmen had died in the period between the completion of the license and the time when the questionaire was sent out.

THE BLACK GEESE

As mentioned above, the data relating to the Black Geese will be discussed primarily. The term »Black Geese« was used in the questionaire for practical reasons, as many sportsmen are unable to distinguish between the different species and subspecies of geese. There was, however, space for a specific distinction for sportsmen who were able to make such distinction.

263 sportsmen out of 1272 had shot Black Geese in the autumn of 1961 (Table 2). Five stated that they had shot other Black Geese than Brent Geese, three had shot Canada Goose *(Branta canadensis)*, and two stated that they had killed Barnacle Goose. More than half of the remaining 258 stated directly that they had shot Brent Geese, while the rest only stated that they had killed Black Geese (Table 3).

It can be assumed in the following calculations that the 258 sportsmen had killed Brent Geese, since these are much more common in Denmark than the other species of *Branta*.

BAG OF BRENT GEESE IN 1961

On the basis of data received an attempt is made to calculate how many sportsmen shot Brent Geese in the particular season and the total number of these birds killed in the autumn of 1961. It is presupposed that the reply percentage gives a representative picture of the actual conditions, see also p. 30.

Species *Art*	No. of sportsmen *Antal jægere*	% %
Branta canadensis	3	1,1
Branta leucopsis	2	0,8
Branta bernicla	156	59,3
Branta sp.	102	38,8

Table 3. Bag of Black Geese 1961 distributed on species.

Tabel 3. Udbytte af sorte gæs 1961 fordelt på arter.

Replies were received from 1246 sportsmen who had shot geese. Of these 258 had killed Brent Geese which corresponds to 21% of the sportsmen.

A total of 2234 persons stated that they had killed geese in the autumn of 1961. If – with reference to the remark on p. 30 – it is assumed that 2% made mistakes when completing the list and did not shoot geese at all, there were 2189 sportsmen who had killed geese in 1961. If 21% of these killed Brent Geese the number of sportsmen in that particular season would have been 460. It is however known from the official Danish bag statistics that not all license holders return a completed list after the close of the season, and H. STRANDGAARD states that after the close of the season 1961-62 only 83% of the issued licenses were received. If correction is made for non-returned licenses the total number of sportsmen who had killed geese was 2215 in 1961-62, and of these 465 probably have shot Brent Geese.

In this season there were – again according to the official Danish bag statistics – 109.906 license holders in Denmark, and this means that only about 0.4% of all sportsmen had shot Brent Geese in the autumn of 1961.

The 258 sportsmen had together killed 731 Brent Geese, i.e. 2.83 geese per man on average. The 465 sportsmen, who according to the above calculation had been in Denmark in the autumn of 1961, shot a total of 1316 Brent Geese.

It seems probable that the bag of Brent Geese in proportion to the aggregate number of geese killed was of this volume. Altogether, a little more than 8000 geese were killed in this year according to the official Danish bag statistics.

BAG PER SPORTSMAN

Table 4 shows in detail how many Brent Geese each sportsman killed. It is evident that most sportsmen shot only a few geese.

Out of 258 sportsmen 230 shot five geese or less. Conversely it is surprising that the remaining 28, together, shot about 40% of the total bag.

No. of sportsmen *Antal jægere*	Bag per sportsman *Udbytte pr. jæger*	Total bag *Nedlagt ialt*
1	27	27
1	24	24
2	22	44
1	17	17
1	13	13
1	11	11
2	10	20
2	9	18
3	8	24
3	7	21
11	6	66
13	5	65
13	4	52
26	3	78
73	2	146
105	1	105
258		731

Table 4. Brent Goose bag per sportsman 1961.
Table 4. Knortegåseudbytte pr. jæger 1961.

DISTRIBUTION OF THE SPORTSMEN ACCORDING TO THEIR PROFESSION

In Table 5 the sportsmen are listed according to their profession. More than 50% belong to the groups: assistans, labourers, artisans and traders, only just over 12% are fishermen by profssion. It might seem striking at a first glance that this percentage is not greater, but if these percentages are compared to a similar calculation made by STRANDGAARD (1964) it appears that only 1.7% of all Danish sportsmen are fishermen: by far the greater number is engaged in farming.

But of sportsmen shooting Brent Geese only about 12% are engaged on farming and similar occupations and this seems to indicate that many people shooting at sea live in towns and have no land area on which to shoot.

Profession *Erhverv*	%
Farmers, Foresters, Gardeners *Landbrugere, skovbrugere, gartnere*	12,4
Fishermen *Fiskere*	12,4
Assistants, labourers *Medhjælpere, arbejdere*	33,1
Artisans, traders *Håndværkere, handlende*	26,8
Liberal profession *Beskæftiget i liberale erhverv*	3,5
Others *Andre*	10,8
Without profession *Uden erhverv*	0,8

Tabel 5. Sportsmen shooting Brent Geese distributed according to profession (shooting season 1961-62).

Tabel 5. Knortegåsejægerne fordelt efter erhverv (jagtsæsonen 1961-62).

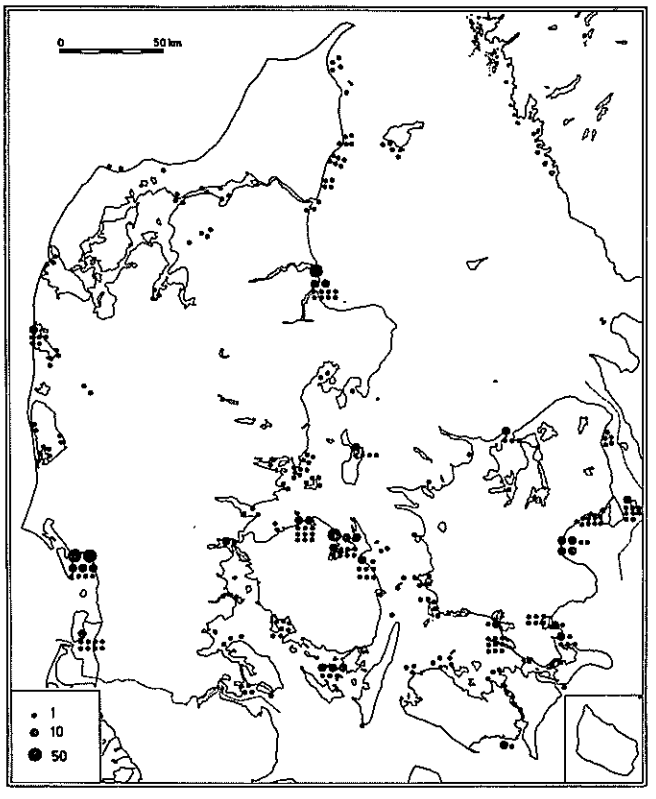


Fig. 3. Geographical distribution of 731 Brent Geese killed in Denmark in 1961.

Fig. 3. Den geografiske fordeling af 731 knortegæs nedlagt i Danmark i 1961.

PRINCIPAL HABITATS OF BRENT GEESE IN THE AUTUMN

In the questionaires, detailed information of the locality where the geese were shot was requested. The map Fig. 3 was worked out on basis of the replies received.

Although the map only shows the localities of geese killed in a single season, it probably gives a good survey of the places in Danish waters where Brent Geese occur in the autumn. This map, with the particulars given by the sportsmen in the questionaire, can be compared with the data procured in the course of the years through conversations with sportsmen throughout the country, and with a report prepared by a Danish game consultant (FYNBOE, 1958).

According to the map the most important autumn localities are the following: Vadehavet, Nissum Fjord, the fjords of Randers and Mariager, the waters round Samsø, Odense Fjord, the waters round Sydfyn (South Funen), the Saltholm area, Køge Bugt, Faxe Bugt, and the fjords of Dybsø and Avnø. On the map Fig. 4 most of the localities can be seen.

The vast majority of the geese were killed near the coasts. It is also here that most of the sportsmen come, as only very few of them have good seagoing boats, but it is here, too, that the geese remain during the greater part of their stay in Denmark, which is, no doubt, due to their feeding habits. The Brent Geese are vegetable feeders, and are not capable of diving for food.

Field studies on the Brent Goose in Denmark

THE WADDEN SEA RESERVE AND JORDSAND

In Vadehavet a game reserve extends a good distance northward from the Danish-German boundary. It covers altogether about 10.000 ha and comprises among other areas the only »hallig« of Denmark, the small island of Jordsand (Fig. 5). Today this island is only 4.5 ha (measurement taken by pacing in October 1963). Formerly, it was much bigger, and once it was inhabited. Every year the sea takes away part of the island and it is constantly decreasing in size.

Jordsand is privately owned and can only be visited by permit from the owner and the Council for Reserves. The island harbours a great population of breeding Herring Gulls (*Larus argentatus*).

Since 1960 Game Biology Station has used the island as an experimental area. By permission from the Council for Reserves and the owner, a field station has been erected, a small woodden hut standing on high poles, where an observer can live (Fig. 6).

The station was established first and foremost for studies on Brent Geese, since the geese were known to roost near this island, both in spring and autumn.

Observers stayed at the station from September 1960 till December 1961, apart

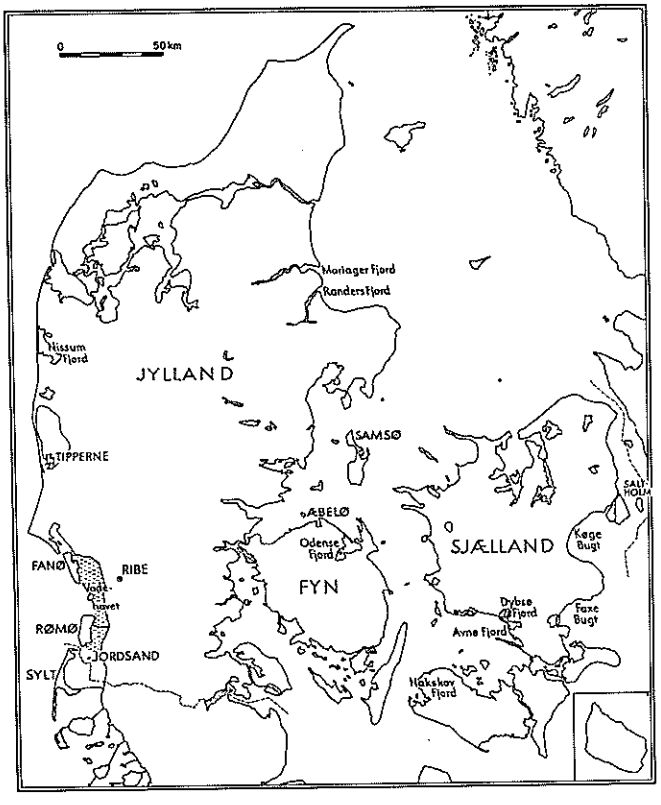


Fig. 4. The most important geographical designations occurring in the paper.

Fig. 4. De i afhandlingen vigtigst forekommende geografiske betegnelser.

from a few short periods. During this period the observers became so familiar with the conditions that, later on, it was only necessary to make observations there at the time when species which were to be studied were known to remain there.

As far as the Brent Geese are concerned, attempts were made in the first place to catch the birds in order to ring them. The time of their arrival in the autumn and their departure in spring was studied, and notes were made daily, as far as possible, of the number of geese seen. Until now Game Biology Station has been the only ringing station to ring *Branta bernicla bernicla*, and all dark-bellied geese have been ringed at the island of Jordsand.

THE SITUATION IN THE AUTUMN

The geese arrive at Jordsand in the latter half of September (p. 21), and as seen from Appendix 1, there are generally many geese there in October and November, they disappear during December and do not return until February-March.

As seen from Fig. 7, considerable flocks were observed round the island in the autumn of 1960 and 1961. The greatest number was seen on 29th September 1961 when more than 4000 geese appeared. Besides the observations from the hut scattered counts have been made in the area between Jordsand and Jylland (Jutland) in recent years. Some of these data are inserted in Fig. 7. The name »Renderne« indicates that between this island and Jylland there is an area which is seldom dry at ebb tide. In the 1960's *Zostera nana* spread enormously in this area, where the geese, especially in 1965, preferred to stay. On 5th and 11th October 1965 the observer from the Game Biology Station counted 3000–4000 and 5000–6000 resp., near Renderne and 8th November he saw 3000–4000. On 8th November furthermore 800 Brent Geese were seen near the Rømø dam, where they very often roost.

Fig. 7 further shows that in 1962 there were not nearly so many geese as in the two preceding years. According to BURTON (1965), we know that the percentage of young was low both in the autumn of 1961 and 1962, in 1961 it was 7 and in 1962 5. In the last few autumns no permanent observations have been made at Jordsand, but we have the impression, that the number of Brents here has been decreasing in the autumn.

Fig. 7 shows how much the maximum number of geese observed may vary from one day to another. Despite these great variations in number, observed over a long period from the island, we have

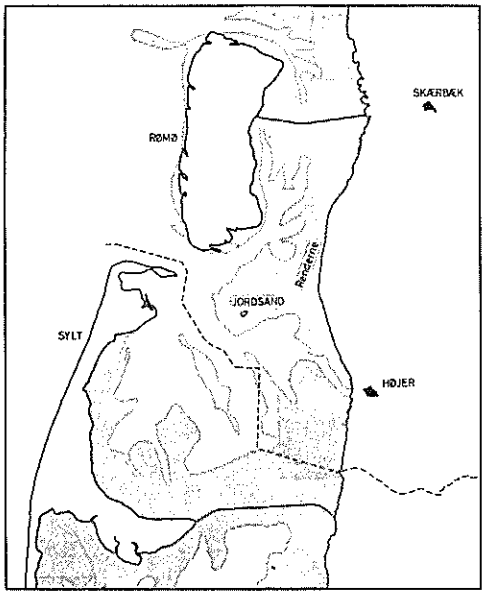


Fig. 5. The southern part of Vadehavet with the island of Jordsand.

Fig. 5. Den sydlige del af Vadehavet med øen Jordsand.

Photo MERETE THAARUP

Fig. 6. The island of Jordsand with the observation hut.

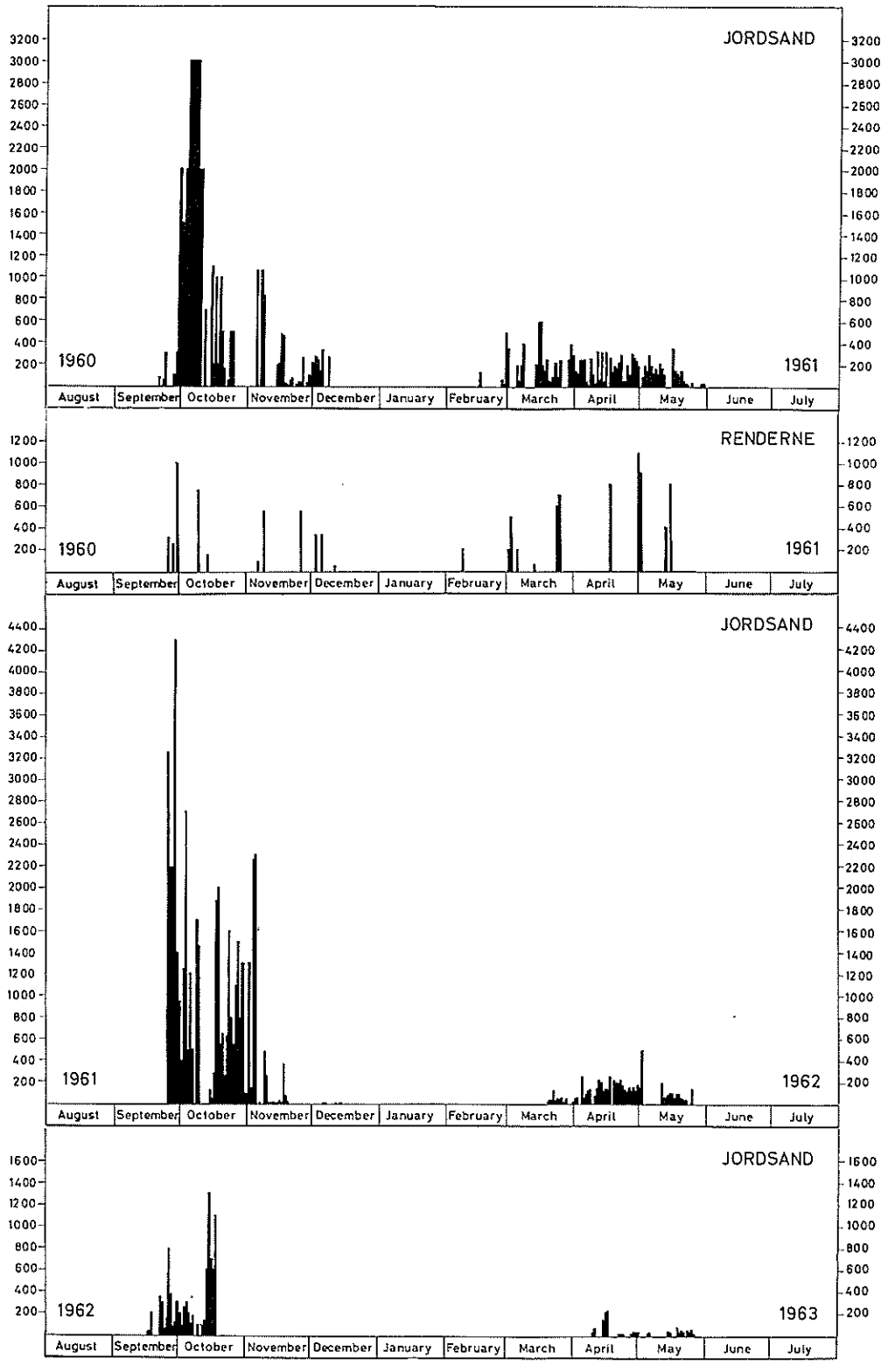
Fig. 6. Jordsand med observationshytten.

often seen ringed geese, and we got the impression that they were the same individuals. There is a number of recoveries of ringed geese from the spring which shows that the same birds may remain at the island for fairly long periods, and that the same geese return year after year. In this connection it should also be mentioned that on 14th April 1964, 13 ringed Brent Geese were seen in a flock of 283 individuals, which remained at Jordsand. Three days later 18 ringed birds were observed in a flock of 249. These observations are most probably of birds which were ringed earlier on Jordsand, as only one goose was ringed in 1964, and this one was provided with a plastic collar round its neck so that it was individually recognizable.

Also in the spring of 1965 ringed *Branta bernicla bernicla* were observed at Jordsand, on 4th May, 3 geese and on 6th May, 4. These birds were ringed earlier than 1965.

Fig. 7. Maximal number of *Branta b. bernicla* seen from the hut on Jordsand and in Renderne between Jordsand and Jylland in the years 1960–63. The geese were counted at high tide.

Fig. 7. Det maksimale antal Branta b. bernicla iagttaget ved Jordsand og i Renderne mellem Jylland og Jordsand i årene 1960-63. Gæssene blev talt ved højvande.


JORDSAND
1960
1961
August
September
October
November
December
January
February
March
April
May
June
July
RENDERNE
1960
1961
JORDSAND
1961
1962
JORDSAND
1962
1963

The considerable variation in number from one day to another is probably due to the fact that the geese use great parts of Vadehavet for roosting and foraging, and that it is not possible to survey more than a very limited area from the island. All observations were made from the hut, and from here it is only possible to identify the birds up to a distance of 2000 m.

On the 20th October 1960 Dr. K. PALUDAN saw how the geese in the large flocks were distinctly divided into small parties, probably family groups. There were numerous repulses of individuals which came too near to the groups, attacks with head and neck extended, and occasional returns to the group with triumphal ceremonies. Unfortunately, the geese were 300–400 m away, so it was difficult to estimate the »depth distance« between the individuals and thereby their greater or lesser association with a definite group. At 12 o'clock 19 groups were seen distributed as follows:

6 groups with 1 individual
5 groups with 2 individuals
2 groups with 3 individuals
1 group with 4 individuals
1 group with 5 individuals
4 groups with 6 individuals

and at 3 p.m. 34 groups were seen with the following distribution:

5 groups with 1 individual
6 groups with 2 individuals
4 groups with 3 individuals
9 groups with 4 individuals
4 groups with 5 individuals
5 groups with 6 individuals
1 group with 7 individuals

On the same day Dr. PALUDAN also observed that the foraging geese seemed to seek the pools on the highest parts of the sea bed which was exposed at ebb tide. Strange by, it appeared however to be the more elevated areas which were richest in *Zostera nana*, but Dr. PALUDAN is of the opinion that it is difficult for the geese to graze on the low-lying *Zostera*. He also noticed a number of »artificially« made holes, often with a diameter of about 30 cm and a depth of about 15 cm. These holes may have been made by the geese, and Dr. PALUDAN has observed that the foraging geese sometimes performed trampling movements and grubbed in the mud. He cannot explain this phenomenon, but suggests that the geese are seeking for the root system of the *Zostera* or for molluscs. The trampling movements are performed quickly, both legs alternating. Generally the body faces the same direction, but may be turned somewhat during the movements. BURTON (1961 a) states that Brent Geese have been seen to behave in the same way in Essex and that they seize *Arenicola marina* by these trampling movements.

In the autumn attempts have been made to capture Brent Geese on Jordsand. For this purpose so-called air nets (Fig. 8) were used. This catching method is very old and was formerly much used by sportsmen in Vadehavet. As seen in Fig. 8 big nets were suspended between vertically placed poles. The birds were expected to fly into these nets, which they could not see during the night. The nets had to be inspected every half hour, if the birds were to be captured undamaged, and they could only be used on very dark nights. Unfortunately, we did not succeed in catching many Brent Geese with these nets, possibly because the technique was not sufficiently good. Geese were caught in the autumn of 1960, 1961, and 1962 at Jordsand, since then they have only been caught in spring. During these three seasons 55 dark-bellied Brent Geese and 1 light-bellied goose were captured, while a total of 110 geese were caught in spring. Detailed ringing data will be given later.

THE SITUATION IN SPRING

As early as February the Brent Geese begin to return to Vadehavet round Jordsand. As seen from Appendix 1, two geese were seen on 12th February 1961, 134 on 16th February the same year, and on 28th February about 500 geese were lying round the island; not until 14th March 1961 geese were seen daily near Jordsand.

In Fig. 7 the daily number of Brent Geese for three spring seasons are listed. In 1961 and 1962 there were geese in varying numbers from the middle of March till the middle of May, after that time the number decreased somewhat, and as seen from p. 21 the geese disappeared about 1st June.

In 1963 there was a distinct decline in the number, but – as stated above – the percentage of young was very low in 1961 and 1962, and two unfavourable breeding seasons will no doubt clearly influence the number of geese migrating through Denmark.

There is a great difference in the behaviour of the geese round Jordsand in spring and autumn, since in spring the geese go ashore in order to forage, which they will never do in the autumn. The geese are known to go ashore in spring in other places too. This happens according to notes made by the Board of Nature Preservation at Tipperne in Ringkøbing Fjord and according to observa-

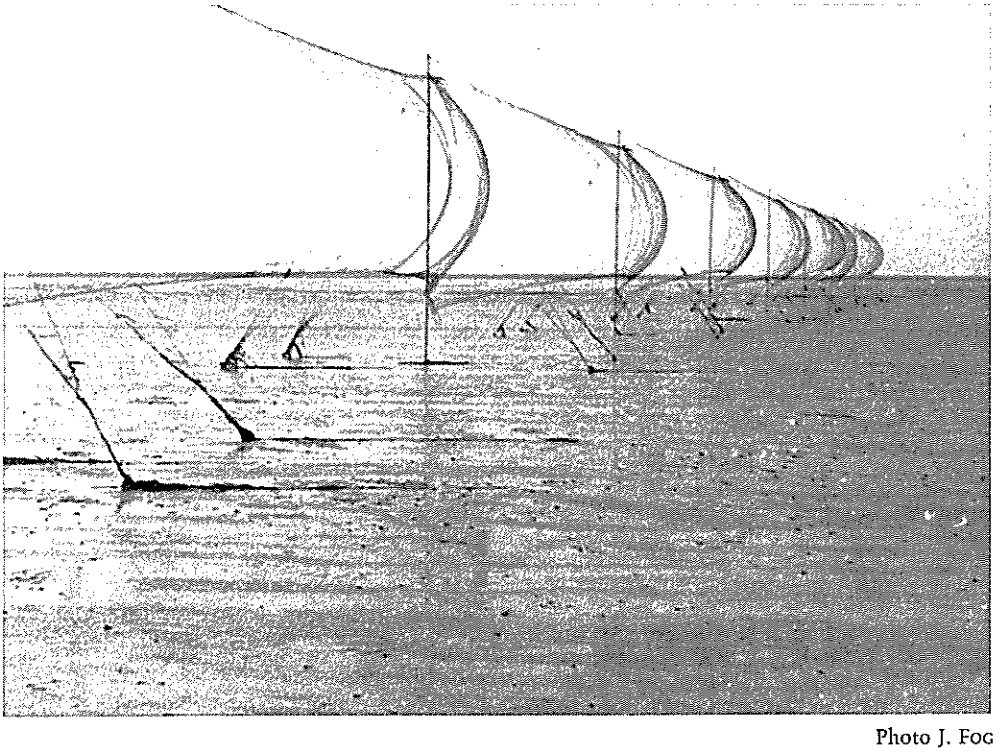


Photo J. Fog

Fig. 8. Air nets for catching birds at dark nights.

Fig. 8. Flyvenet til fangst af fugle i morke nætter.

tions made by the Game Biology Station in Nissum Fjord, and on an island in Nakskov Fjord in East Denmark. Probably it also occurs in other places.

In the spring of 1961, on the most favourable days, between 200 and 300 foraging geese were seen on Jordsand. That spring the first geese went ashore on 15th March. In 1962 the first geese were observed on the island proper on 5th April, next year after 16th April (but before that time excrement had been seen), and in 1964 the first geese foraged on Jordsand on 14th April.

Several observers on Jordsand have noticed that some interaction takes place between Brent Geese and Herring Gulls, since the Brent Geese will immediately leave the island when they hear the warning cries of the Herring Gulls. The geese often graze with the Herrings Gulls, and in the spring of 1965 L. KORTEGAARD PEDERSEN saw Brent Geese feed voraciously on the regurgitated matter of Herring Gulls which mainly contained grain.

The possibility to capture geese is better in spring than in the autumn, as it is easier to catch them on the island than on the tidal flats. In the spring of 1961 attempts were made for the first time to catch the geese on land. For this purpose simple clap nets were used which when released were thrown over the geese.

This method functioned excellently, but as the area covered by the nets was small, canon nets of the American type were procured in 1962, the two nets measure 15 m × 30 m when opened. These nets were brought into use in May 1962. They are electrically released and can be operated at a fairly great distance so that the operator can sit in the hut, observe the geese and release the nets from there. The spring catch of geese was good in 1961 and 1962 when a total of 81 new geese were obtained, in 1963 only 16 were caught, in 1964 13, and in 1965 none at all. Since then the capture of geese on Jordsand has been given up. In recent years only relatively few geese have been on land. The cause is not known, but a change may have occurred in the foraging conditions on the tidal flats so that the geese no longer have to forage on Jordsand. During the period in which Game Biology Station has had this area under observation *Zostera nana* has spread over great areas of the bottom of Vadehavet, and in July 1966 the present author observed *Zostera marina* in several places between Jylland and Jordsand.

Altogether 110 dark-bellied Brent Geese were ringed in spring.

RINGING DATA

Appendix 2 is a list of all recovered and registered Brent Geese from Jordsand, and Fig. 9 shows the localities of the recoveries.

Only a single light-bellied goose was caught and ringed, an adult which was captured on 7th November 1961, and shot at Randers Fjord on 20th December 1964.

Of dark-bellied geese a total of 165 were ringed in the spring and autumn, and up to 1st August 1966 24 were reported as dead from different places in Denmark (exclusive of Jordsand) and abroad (Fig. 9). This gives a recovery percentage of 14.5 which is somewhat lower than for Grey Lag Geese (PALUDAN 1965), for which it was 20.6. On Jordsand proper, 13 additional geese have been recovered, two even twice, and one of the registered geese was later recovered abroad. Finally, one was found dead on Jordsand the day after it was ringed.

The aggregate number of ringed geese of the dark-bellied subspecies which were later recovered, is thus 24 + 12 + 1, i.e. 37, and this corresponds to 22.4 %.

In the year of ringing 12 = 32.4 % were recovered.
The year after the ringing 10 = 27.0 % were recovered.
Two years after the ringing 10 = 27.0 % were recovered.
Three years after the ringing 5 = 13.5 % were recovered.

There are no later recoveries, but single recoveries may be received in the future (p. 40).

Of the 24 recoveries 8 are from Denmark, 7 geese were shot, but one was found dead. Four of the geese were ringed in 1960, three in 1961, and one in 1962. All eight birds were ringed *in the autumn.*

Four of them were shot the same year in which they were ringed, in the immediate vicinity of Jordsand, see map Fig 9, two at Rømø, one at Vidå, and one near Ribe. One was found dead at Sam-

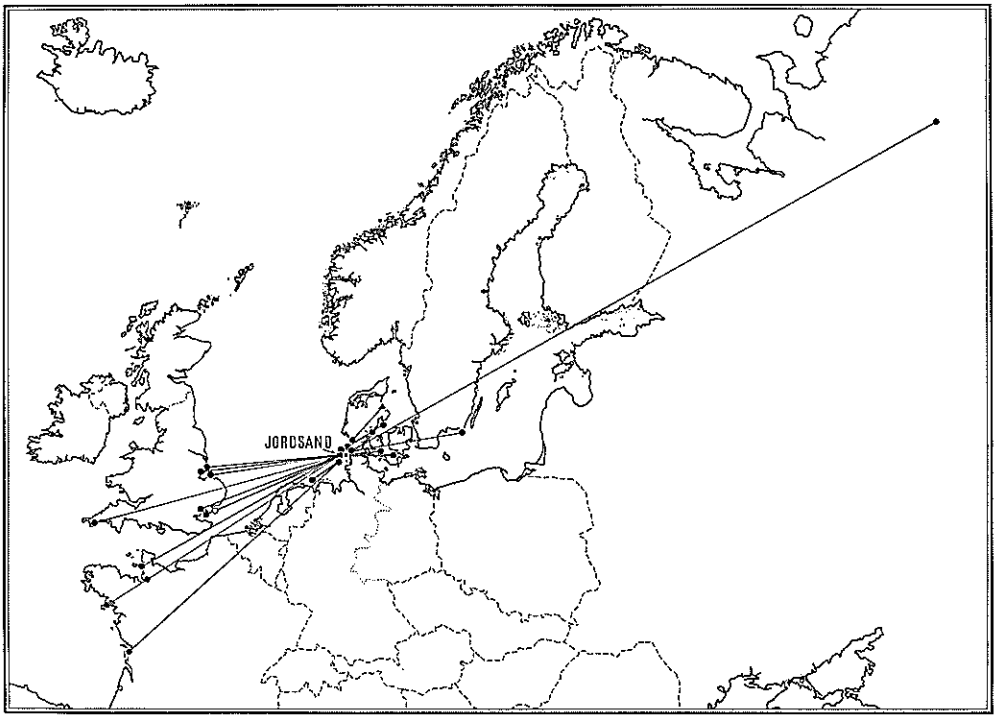


Fig. 9. Recoveries of *Branta bernicla* ringed on Jordsand. Only a single light-bellied goose was ringed, and it was later recovered in Denmark.

Fig. 9. Genmeldinger af Branta bernicla ringmærket på Jordsand. Kun een lysbuget blev mærket, og den blev senere genmeldt fra Danmark.

△ = Recovery of light-bellied goose *(genmelding af lysbuget gås).*

● = Recovery of dark-bellied goose *(genmelding af mørkbuget gås).*

○ = The exact topographical situation of the locality could not be traced *(den nærmere geografiske beliggenhed af lokaliteten har ikke kunnet opspores).*

sø during the following spring migration. Two were shot in the autumn after being ringed, one at Lolland, the other at Æbelø north of Fyn, and finally one was shot three years later near Langeland, in October.

The remaining 16 recoveries came from abroad, of these only two geese were ringed in the autumn, the rest in spring. The first two were shot one month after ringing, one in France, the other in England. Ten of the other fourteen were shot or found dead (dying) in January or February. Five came from England, two from Germany, and three from France. Besides one was found dead in England and one was shot at Sylt, both in the year after ringing, a third was found dead in Blekinge, Sweden, a little more than three years later in July. This goose may have been ill and unable to keep up with the others during migration. The last recovery is a goose which was ringed on Jordsand on 11th May 1961 and was shot 7 days later near Pechora, U.S.S.R., i.e. some distance on its way to the breeding place.

Furthermore there are thirteen registrations from Jordsand itself. One of the geese was later recovered in France. Two individuals, a male and a female, (306998 and 307000) which were ringed at the same time on 17th May 1962 were later recovered twice, and on both occasions they were caught together (11th May 1964 and 14th May 1965). In 1965 they remained together on Jordsand for a long period of time. There are three recoveries of geese which were ringed 14–21 days before. One goose, which was ringed on 5th May, was later seen every day throughout the summer at Jordsand, and when it was registered in July it could be caught by hand. Its wing had been broken, but had grown together; after being released in July, it disappeared, and it has not been seen since. The remaining 9 recoveries are birds which had returned from Jordsand during migration in other years. All the recovered birds were ringed and registered during the spring migration.

In 1964 attempts were made to provide the ringed geese with a plastic collar round their necks, and altogether 19 birds were provided with such collars. By means of these it was easier to follow the geese on their migration route and identify them at a distance. Institutions in the various countries which the geese would pass during migration were notified of this marking and were requested to hand in possible observations. No reports were ever received. Three of the geese were later reported dead, two from France and one from Germany, and it is known that one of the »French« geese still wore the collar when it was found nine months after it was ringed. Nos. 306998 and 307000 – mentioned above – were provided with collars when registered in 1964, but when they were recovered in 1965 the collars had fallen off.

The collar system has been used for ringing Grey Lag Geese in Norway (LUND 1965). This method has now been abandoned by the Game Biology Station.

Recoveries of *Branta bernicla hrota*

In 1954 74 light-bellied Brent Geese were ringed at Spitsbergen, and in the course of six years 28 of these were recovered in Denmark (Fog 1965).

These 74 geese were ringed in the same place, and they were all adult birds which were captured in the moulting stage.

All the 28 Danish recoveries were shot birds, in addition, there are three British recoveries of geese which were found dead in winter. The recovery percentage for these light-bellied geese is fairly high, viz. about 42 %.

By far the greater number of Danish recoveries were from the fjords of Mariager and Randers in Northeast Jylland, where 18 ringed geese were shot in November and December. A goose from Vorså in East Jylland was also shot in November, and according to Holgersen (1957) one was shot near »Amager Fjord« in December. The statement of the locality is probably wrong, since there is no fjord of this name. Most likely it has been confused with Mariager Fjord. The last 7 recoveries are from West Jylland where two were shot in September, two in October, and three in November, (Fig. 15).

On basis of these recoveries Salomonsen (1958) put forward the theory that the light-bellied geese arrive at West Jylland early in the autumn, where they remain, especially in Vadehavet. During November and December a number migrate to the northeast, to the areas round the fjords of Mariager and Randers which places they leave later to fly to the British Isles, where they generally arrive between the end of December and the beginning of February.

This theory cannot be rejected at the present time, since, according to the ringing data, ligth-bellied geese do occur in Vadehavet early in the autumn, whereas they do not appear in East Jylland until the end of October, see p. 21. If the theory is right Brent Geese should migrate through Jylland. Perhaps the geese which, according to the map Fig. 3, were shot on a couple of localities in Central Jylland are just such light-bellied geese.

Distribution according to age

It is very striking that the number of juvenile Brent Geese varies so much from one year to another. Burton (1965) gave a survey of the percentage of juveniles based on observations made at roosting places in Britain. This applies to the dark-bellied Brent Geese.

1954–55	40 %	juveniles
1955–56	26 %	–
1956–57	7 %	–
1957–58	53 %	–
1958–59	0 %	–
1959–60	20 %	–
1960–61	50 %	–
1961–62	7 %	–
1962–63	5 %	–
1963–64	35 %	–

From Jordsand the age of the ringed birds is known, and in addition, 167 shot

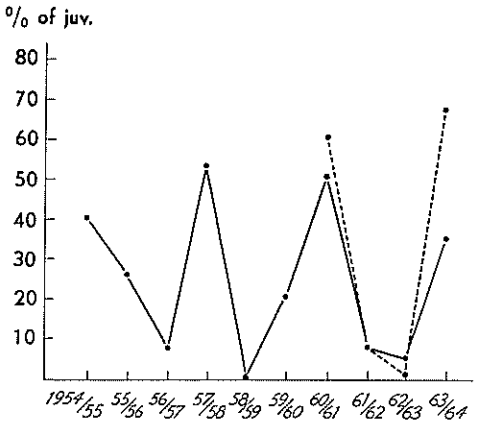


Fig. 10. The percentage of juvenile birds among *Branta b. bernicla* calculated from BURTON (1965) (———) and from data collected by the Game Biology Station (– – – –).

Fig. 10. Procenter af ungfugle blandt Branta b. bernicla beregnet på grundlag af BURTON *(1965) (———) og Vildtbiologisk Stations materiale (– – – –).*

Brent Geese were collected in Danish waters in the autumn of 1963; of these 138 were dark-bellied, while 29 were light-bellied.

Among the light-bellied geese 12 were juveniles which gives a percentage of about 41.

As regards the dark-bellied geese, the table below shows the percentage of juveniles among the geese whose age was determined in Denmark in the following seasons:

1960–61	28 juveniles out of 47 age-determined geese = about 60 %.
1961–62	6 juveniles out of 87 age-determined geese = about 7 %.
1962–63	0 juveniles out of 17 age-determined geese = 0 %.
1963–64	101 juveniles out of 150 age-determined geese = about 67 %.

In Fig. 10 the percentage of juveniles is given in a diagram, and, in broad outline, the Danish and British observations agree. In the season 1962–63 there were no juveniles at all among the Danish geese, but the material was small, only 17 birds were captured on Jordsand in the autumn of 1962 and the spring of 1963. In the following season the percentage of young is somewhat higher in Denmark than in Britain, but the Danish figures are mainly based on shot birds, since the capture on Jordsand in the spring of 1964 yielded only 12 geese. As it is probably easier to shoot juveniles than old Brent Geese, this may explain why the percentage of juveniles registered in Britain is lower than the above mentioned percentage in Denmark.

It is quite clear that there is a great variation from one year to another in the number of Brent Goslings which get on the wings, and in this connection the climatic conditions in the breeding places are probably of great importance.

Date of departure and arrival of the geese

Under the leadership of Prof. H. M. THAMDRUP waterfowl was counted in many places in Denmark from August to April in the years 1951 to 1957. On basis of these counts data of Brent Geese have been extracted, and Fig. 11 shows the results obtained in these four localities: a locality in West Jylland, one in East Jylland, one in Central Denmark, and one in East Sjælland (Zealand). The

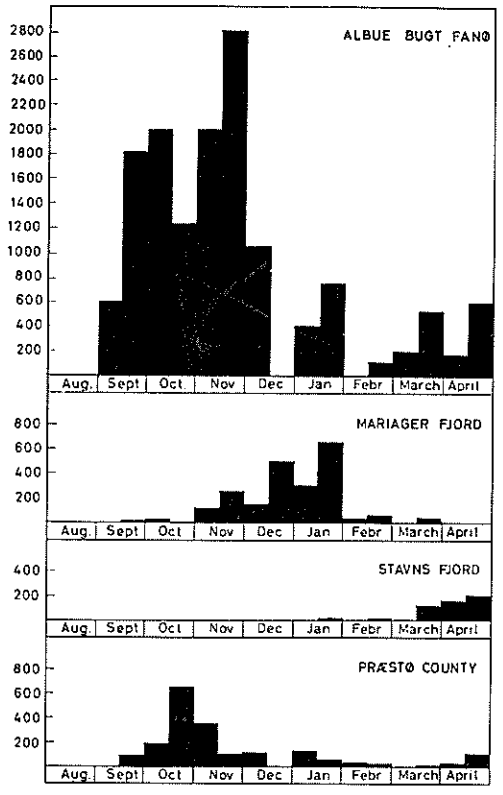


Fig. 11. Average number of Brent Geese seen on four different localities during a period of seven years.

Fig. 11. Det gennemsnitlige antal knortegæs iagttaget på fire forskellige lokaliteter i en syvårig periode.

figures show maximal and minimal numbers of Brent Geese in these localities.

At the locality in West Jylland, which forms part of Vadehavet, the geese arrive during September, but the birds are most numerous in October and November. The number in spring is not nearly so great as in the autumn. At the locality in East Jylland, viz. Mariager Fjord, the geese do not arrive, as we know, until late in the year, viz. in November, with peak in December-January. In spring the number is small. The late date of peak may be due to the fact that the figures are averaged over seven seasons, and in this period three mild winters were included, viz. 1951–52, 1952–53 and 1956–57 (PALUDAN 1962 b) when many geese may have gathered there. A count on 13th January 1963 in Denmark gave about 700 Brent Geese, and these all remained north of Mariager Fjord.

The locality in Central Denmark is the island of Samsø, and apparently most geese are seen here in spring. We know, however, from the map Fig. 3 that Brent Geese are shot there in the autumn.

The East Danish locality apparently harbours Brent Geese at almost the same time as the West Jylland locality, since the geese are most numerous in the autumn, the peak here occurs in October. In spring the migration is not nearly so great.

At the Game Biology Station data are available from Jordsand on the arrival and departure of the dark-bellied geese. These data are listed in the table below:

Year	First geese seen	Last geese seen
1960	20th September	28th May (observations stopped 28th May)
1961	26th September (observation started 26.9.)	1st June
1962	15th September	25th May (observations stopped 25.5.)
1963	No observations in September	28th May
1964	25th September (no observations between 19. and 25.9.)	17th May
1965	No observations in September	17th May (observations stopped 17.5.)
1966		1st June near the Rømø dam

LIND (1956), in a table, gives data on the time of departure from Tipperne of the Brent Geese in the springs from 1929 till 1954. Separation into subspecies was only possible in 1954, showing that dark-bellied geese were involved. It appears from this table that the main migration from Tipperne generally stops about 20th May; small flocks may be seen till about 1st June.

By courtesy of the Board of Nature Preservation an abstract is given below of the journals from Tipperne from 1960 till 1966, listing the time of departure during these seven years (there is no separation of subspecies).

Last observation of Brent Geese at Tipperne

Year	Date	Number
1960	30th May	17
1961	20th May	20
1962	5th June	30
1963	31st May	110
1964	1st June	30
1965	20th May	300
1966	about 28th May	(number unknown)

The difference in date of departure at Jordsand and Tipperne is not great. It is evident that most of the Brent Geese leave West Jylland in the latter half of May, and the last geese depart in the first days of June. There are no observations of geese later than 5th June.

Mr. V. M. FYNBOE has stated verbally that the Brent Geese west of Gedser, according to the experience of sportsmen, leave Denmark at a very late date, generally in the first days of June, and Mr. J. BJERG-THOMSEN, Kalø, saw thousands of Brent Geese pass Öland i Sweden on 30.5.1966. According to EDBERG (1961) a fairly considerable number of migrating Brent Geese uses to pass Kalmarsund (the sound between Öland and Sweden).

The first geese are seen at Jordsand in the autumn as early as the middle of September, but the main invasion is not seen until the end of September and beginning of October (Fig. 7).

The above mentioned data apply mainly to the dark-bellied geese. As regards the light-bellied geese we know from ringing and collecting in the autumn of 1963 that they arrive at the roosting places round Fanø and Mandø in South-West Jylland at the end of September and beginning of October, and they are not seen in and round the fjords of Randers and Mariager in East Jylland until the end of October and beginning of November. In spring the light-bellied geese leave Nissum Fjord at the end of May, according to observations from the Game Biology Station and statements given by local sportsmen, and from 5th June no more Brent Geese are seen there.

From Tipperne autumn observations are very scarce, since there is normally no observer there at that time. During the last seven years an observer stayed there for only one complete autumn season. During the other years observations were made in one week in October and in two weeks from the end of December till the beginning of January, but there are no notes on Brent Geese observed during these periods. We know, however, from the map Fig. 3 that Brent Geese were shot in Ringkøbing Fjord in the autumn of 1961, it also appears from the map Fig. 14 that in the autumn of 1963 two light-bellied Brent Geese and one dark-bellied were sent to the Game Biology Station from the area round Ringkøbing Fjord. This fjord is, however, so large that geese can easily roost there without being seen from the observation tower at Tipperne in the south part of the fjord.

Counts in Denmark

In the winter quarters of the Brent Geese in Western Europe an estimate of the size of the populations of light-bellied and dark-bellied geese has been attempted over a number of years.

As early as 1954–55 counts of Brent Geese are counted in May on one or more 1958–59 other countries have participated, and Denmark joined in 1960–61. The Game Biology Station has been responsible for these counts from 1961–62.

During the first years when Denmark participated in the Inter-European counts, Brent Geese were counted in the middle of the winter, generally in January. The data collected were treated by Mr. P. BURTON, who published the results in the Annual Reports from the Wildfowl Trust.

The counts of Brent Geese now form part of the Inter-European counts of all species of geese started by a group of investigators within the IWRB (International Wildfowl Research Bureau).

From these counts the number of the different species and subspecies of geese (exclusive of Brent Geese) is calculated once a month in the winter half year from September to April. The Brent Geese were started in England. From fixed dates i.e. at the time when they are about to leave their winter quarters.

In Denmark the Brent Geese are count-

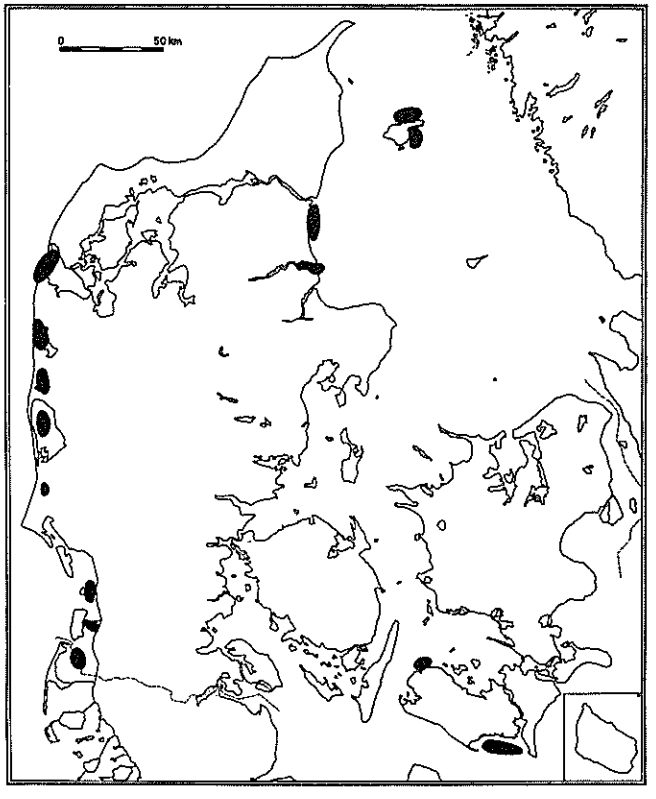


Fig. 12. The black areas show places where Brent Geese were observed during the counts in the years 1963-66. In 1963-65 counts were made in the middle of the winter; the count in 1966 took place in May.

Fig. 12. De sorte felter viser områder, hvor man ved optælling i årene 1963–66 iagttog knortegæs. I 1963–65 blev der talt en gang midt om vinteren, mens tællingen i 1966 fandt sted i maj måned.

ed from small airplanes. The results of the counts, which have been performed throughout Denmark during the last four years, are seen below:

1963	Middle of January	about 770 Brent Geese
1964	Middle of January	about 230 Brent Geese
1965	Middle of January	about 700 Brent Geese
1966	14th May	about 4000, of these

about 1000 were seen in Nissum Fjord, where observations from land about this time showed that the geese were mainly light-bellied.

Compared with Fig. 3 Fig. 12 shows, where the geese remained in 1964, 1965, and 1966.

On the basis of observations and counts extending over eight years in England BURTON (1963) and BOYD (1963) are of the opinion that there is a tendency for the number of dark-bellied geese to increase.

BOYD (1963) lists the maximal number of dark-bellied geese in England over a period of eight years:

1954–55	10.800	*Branta bernicla bernicla*
1955–56	10.000	– – –
1956–57	8.500	– – –
1957–58	10.600	– – –
1958–59	12.200	– – –
1959–60	8.300	– – –
1960–61	14.800	– – –
1961–62	13.900	– – –

BURTON (1963 and 1965) gives the number of Brent Geese counted in Western Europe. He points out, however, that the counts are not complete, West Germany produced no figures.

1960–61	21.000–26.000 dark-bellied geese were counted in winter
1961–62	about 24.000 dark-bellied geese were counted in winter
1962–63	23.000–25.000 dark-bellied geese were counted in winter
1963–64	23.000–25.000 dark-bellied geese were counted in winter

No figures of later counts have been published.

When the geese are counted from an airplane it is generally impossible to determine the subspecies of the Brent Geese. Ringing, shooting and observations, however, show that we have a fairly good knowledge of the habitats of the light-bellied geese in Danish waters.

From Nissum Fjord there are observations of light-bellied geese from the spring season; thus on 30.4.1964, 600 were seen under very poor observation conditions. A gale was blowing that day, and local sportsmen said that the geese had been much more numerous the preceding days.

Mr. P. UHD JEPSEN, collaborator at the Game Biology Station, made observations in Nissum Fjord in the spring months 1965 and 1966. According to his reports there were between 1500 and 2000 light-bellied geese in the area in the spring of 1965, whereas the following spring he saw at most about 1000 geese, and of these some were dark-bellied. NORDERHAUG (1966) is of the opinion that the population of light-bellied geese at Spitsbergen has decreased considerably in the last few years, and even if there is no evidence of this decline he has the impression that the populations at Spitsbergen and Franz Joseph Land together no longer comprise 4000 individuals as estimated by SALOMONSEN (1958).

Distribution of the two subspecies in Danish waters

The proportionate occurence in Denmark of the two subspecies can be estimated partly from the 28 recoveries of light-bellied Brent Geese, ringed at Spitsbergen in 1954, partly from a collection of 167 Brent Geese af both subspecies, which Game Biology Station received in the autumn of 1963 (+ 1 from 1965) from sportsmen throughout Denmark after advertisement in sportsmen's magazines, partly from observations made in different places in Denmark, and finally, from data which the Zoological Museum of the University of København (Copenhagen) has kindly placed at our disposal. These consisted of skins, kept at the Zoological Museum, and it has been possible to determine 26 to subspecies. The oldest skin is from 1862, and the youngest from 1930. Fourteen skins were dark-bellied, while twelve were light-bellied. As these geese again are slightly outside the main material because of their age, the shooting localities are indicated in a separate map (Fig. 13). The figure of each locality indicates the month in which the said goose was shot or found dead.

THE DARK-BELLIED GEESE

Besides the above mentioned exact data, Game Biology Station has re-

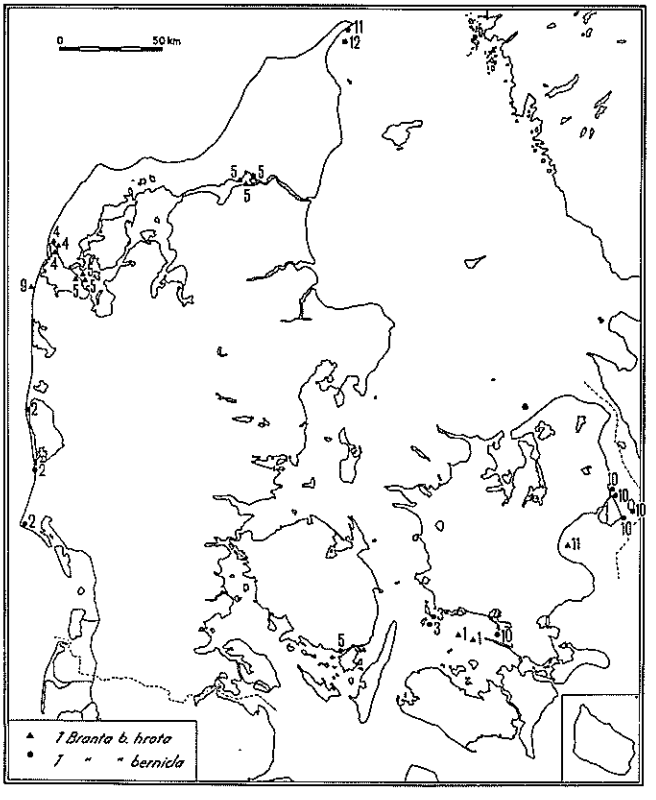


Fig. 13. Localities of Brent Geese in the collection of the Zoological Museum of Copenhagen; the geese were collected in the years 1862 to 1930. The figure beside the dot indicates the month in which the goose was killed or found dead.

Fig. 13. Lokaliteter for knortegæs i Zoologisk Museums (København) samling, indsamlet i årene 1862 til 1930. Tallet ved signaturen viser, i hvilken måned gåsen blev nedlagt eller fundet død.

ceived reports of subspecific determinations of Brent Geese from other quarters, e.g. through talks with sportsmen. Mr. JENS MIKKELSEN, Langør, Samsø, thus maintains that the geese seen at Samsø are dark-bellied.

In Nakskov Fjord Game Biology Station made observations in the spring of 1964, and exclusively dark-bellied geese were seen. Also at Kulhuse in North Sjælland only dark-bellied geese were observed.

Observations at Jordsand show that here almost exclusively dark-bellied geese occur, a single light-bellied goose was caught 1961, and this is the only goose of this subspecies observed here.

Also at Tipperne mainly dark-bellied geese are seen in spring.

The map Fig. 14 shows the localities of 168 geese which were collected for the Game Biology Station. The dark-bellied geese made up the great majority, numbering 138, and they came from many different parts of Denmark, especially from the southern regions.

The dark-bellied geese are found throughout the Danish waters, both in the autumn and spring. In the northern part of Vadehavet there is a number of light-bellied geese in the autumn, and local sportsmen state that the two subspecies remain together in the same flock.

THE LIGHT-BELLIED GEESE

The light-bellied geese generally remain in a few localities; they arrive in Vadehavet early in the autumn; later on

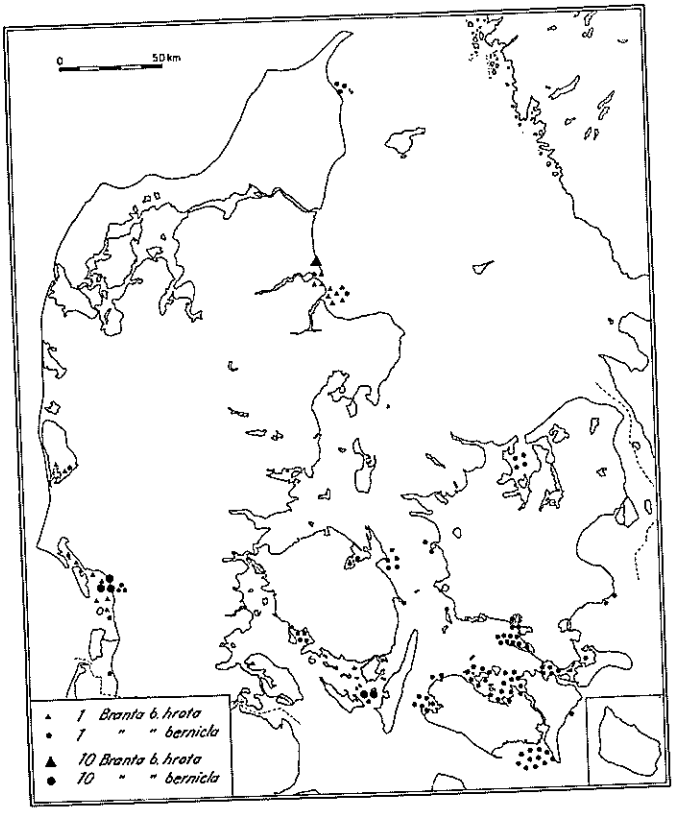


Fig. 14. In 1963 and 1965 Game Biology Station received 168 Brent Geese. The figure shows where these were killed.

Fig. 14. I 1963 og 1965 modtog Vildtbiologisk Station 168 knortegæs. På figuren ses, hvor disse gæs blev nedlagt.

they are seen in the East Jylland fjords. In winter most of them leave these places, and in spring they appear again in Nissum Fjord in West Jylland, where they remain until they fly northwards to the breeding places.

As a central point in the discussion of the distribution of the subspecies we have the 28 Danish recoveries of light-bellied geese from Spitsbergen. The recovery localities are marked in Fig. 15. There is only one recovery from East Denmark, viz. Amager, and as stated p. 19 the locality name is probably wrong. The present author has corresponded with Dr. HOLGER HOLGERSEN, Stavanger Museum, about this question which, unfortunately, cannot be further elucidated. The map illustrates the significance of the East Jylland fjords for *Branta bernicla hrota* which – as previously stated – come to these localities rather late in the autumn. It is presumed, however, that the light-bellied geese come directly from the winter quarters near the British Isles to Nissum Fjord, since there are no observations of this subspecies from other localities in spring.

GOETHE (1963) states that light-bellied geese are very seldom observed in West Germany, and according to a verbal statement from Dutch experts the same holds true in Holland. According to local sportsmen small flocks of light-bellied geese may winter in Nissum Fjord in mild winters.

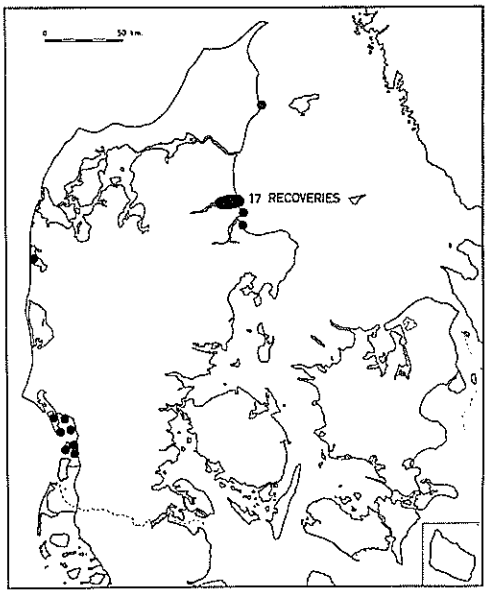


Fig. 15. Localities for recovery in Denmark of 28 light-bellied Brent Geese ringed in Spitsbergen in 1954.

Fig. 15. Genmeldingsteder i Danmark for 28 lysbugede knortegæs ringmærket på Spitsbergen i 1954.

The old collection in the Zoological Museum seems to show that previously the light-bellied geese occurred in more places in East Denmark than today.

Weight, wing measurements and neck white

A number of the geese ringed at Jordsand were weighed, and so was the majority of the 168 geese which were received by the Game Biology Station in 1963 and 1965. These two sources together gave 31 light-bellied geese from the autumn and 265 dark-bellied, of which 184 are from the autumn and 81 from spring.

Table 6 shows the distribution as to weight on the light-bellied geese.

Table 7 shows the weight of the dark-

Age *Alder*	Juv.	Ad.
Weight in g *Vægt i g*	1364 (12)	1489 (19)

Table 6. Average weight of light-bellied Brent Geese *(Branta b. hrota)*. All are from the autumn. The figure in ( ) indicates the number of birds weighed.

Tabel 6. Gennemsnitsvægte af lysbugede knortegæs (Branta b. hrota). Alle er fra efteråret. Tallet i ( ) angiver antallet af vejede fugle.

Month *Måned*	Juv.	Ad.
October	1225 g. (61)	1385 g. (36)
November	1395 g. (52)	1501 g. (25)
December	1244 g. (4)	1558 g. (6)
The whole autumn *Hele efteråret*	1301 g. (117)	1444 g. (67)

Table 7. Average weight of dark-bellied Brent Geese (*Branta b. bernicla*) from the autumn. The figure in ( ) indicates the number of birds weighed.

Tabel 7. Gennemsnitsvægte af mørkbugede knortegæs (Branta b. bernicla) fra efteråret. Tallet i ( ) angiver antallet af vejede fugle.

Age *Alder*	Juv.	Ad.
Weight in g *Vægt i g*	1336 (6)	1411 (75)

Table 8. Average weight of dark-bellied Brent Geese *(Branta b. bernicla)* from spring. All the birds are from Jordsand. The figure in ( ) indicates the number of birds weighed.

Tabel 8. Gennemsnitsvægte af mørkbugede knortegæs (Branta b. bernicla) fra foråret. Alle fuglene er fra Jordsand. Tallet i ( ) angiver antallet af vejede fugle.

bellied geese shot in the autumn. Distinction has been made between the different months in which the geese were killed or caught, and it is evident that they increase in weight during the autumn. As regards the autumn as a whole if the dark-bellied geese are compared with the light-bellied, the difference is small; but the light-bellied geese tend to be the heavier.

On Jordsand the wing length of 132 geese was measured. In table 9 a mean has been calculated. There is no great difference between the autumn and spring birds, but the juvenile geese have, on an average, smaller wing measurements than the old geese.

SCHIØLER (1925) stated that the white neck-spots of the Brent Geese do not appear until November or December. Studies of the material collected by the Game Biology Station and the geese caught at Jordsand, however, show that some of the young Brent Geese may begin to show some white on the neck as early as October.

Table 10 shows how well developed the white feathers are on the neck in 109 juvenile Brent Geese. There were 12 light-bellied and 97 dark-bellied birds.

As far as the dark-bellied geese are concerned, there is a very considerable development of neck white from October to November. Unfortunately, there were only four young geese from December, but they all had some white on the neck. All the 12 light-bellied geese had the white neck feathers more or less developed, but of these 11 geese were from November and 1 from December.

It is probably correct to say that the white feathers on the sides of the neck – at any rate in the dark-bellied geese – generally begin to develop in October-November, in December many have developed neck white.

Age *Alder*	Juvenile			Adult		
	Min.	Average *Gennemsnit*	Max.	Min.	Average *Gennemsnit*	Max.
Spring *Forår*	302	324 (6)	337	315	334 (76)	364
Autumn *Efterår*	311	326 (23)	345	321	338 (27)	364

Table 9. Average wing measurements of 29 juvenile and 103 adult dark-bellied Brent Geese *(Branta b. bernicla)*, measured in mm. The figure in ( ) indicates the number of birds measured.

Tabel 9. Gennemsnitlig vingemål af 29 unge og 103 gamle mørkbugede knortegæs (Branta b. bernicla) målt i mm. Tallet i ( ) angiver antallet af målte fugle.

	Branta b. bernicla						*Branta b. hrota*	
	October (52) No. of birds *Antal fugle*	*%*	November (41) No. of birds *Antal fugle*	*%*	December (4) No. of birds *Antal fugle*	*%*	October-December (12) No. of birds *Antal fugle*	*%*
Fully developed neck white *Fuldt udviklet halshvidt*	1	2	12	29	2	50	10	83
Not fully developed neck white *Ikke fuldt udviklet halshvidt*	23	44	13	32	2	50	2	17
No white feathers on the neck *Ingen hvide fjer på halsen*	28	54	16	39	0	0	0	0

Table 10. Development of neck white in the Brent Geese.

Tabel 10. Udviklingen af halshvidt hos knortegæssene.

Summary

1. The present material comprises bag data etc. collected from Danish sportsmen, ringing and counting data procured by the Game Biology Station during the investigations on the isle of Jordsand in the Danish Vadehav, the results of counts of Brent Geese in Danish waters, and data on 168 shot Brent Geese which Game Biology Station collected in 1963 and 1965.

2. Tentative calculations on basis of figures from the official Danish bag statistics and data received from sportsmen who had killed Brent Geese in 1961 seem to show that Danish sportsmen killed about 1300 Brent Geese in 1961. About 0.4 % of more than 100.000 license holders in Denmark had killed Brent Geese in that season according to the calculations.

3. *Branta canadensis* and *Branta leucopsis* are apparently killed in very small numbers.

4. According to the material collected, the most important roosting places of the Brent Geese in Denmark are the following: Vadehavet, Nissum Fjord, the fjords of Randers and Mariager, the waters round Samsø, Odense Fjord, the South-Fyn waters, the area round Saltholm, Køge Bay, Faxe Bay, and the fjords of Dybsø and Avnø.

5. The Game Biology Station has ringed 1 *Branta b. hrota* and 165 *Branta b. bernicla* at Jordsand. Of the latter 24 or 14.5 % were later recovered as shot, or dead in other ways, and if account is also taken of the registrations made on Jordsand, the recovery percentage is 22.4. Recovery localities etc. are discussed.

6. Notes on the number of Brent Geese and the activities of the birds in Vadehavet are given. Only in spring the birds visit Jordsand itself, as they forage exclusively on the tidal flats in the autumn. At most 4000 geese have been counted at the same time in the area round Jordsand. The number of birds varies considerably from one day to another.

7. Of 74 *Branta b. hrota*, which were ringed at Spitsbergen, 28 were later recovered from Danish waters, most from the fjords of Randers and Mariager. In addition, three were recovered from England.

8. The percentage of juvenile *Branta b. bernicla* which were caught and/or killed in the course of four seasons varies from 0 to 60. Of 29 *Branta b. hrota* shot in 1963 12 were goslings from the same year.

9. Counts from airplanes at the best Danish localities in January 1963, 1964, and 1965 gave 770, 230, and 700 Brent Geese resp. On 14th May 1966 about 4000 were counted.

10. Observations at Jordsand, Tipperne and other localities show that in the autumn the Brent Geese begin to arrive in the latter half of September, and that in spring the last birds leave Denmark during the first days of June.

11. Dark-bellied Brent Geese may be met within most Danish waters, and in several localities they may occur in considerable numbers. The light-bellied geese are, on the other hand, more attached to definite areas, as their main habitat in the autumn is the northern Vadehav and the fjords of Randers and Mariager, while in spring they apparently roost in Nissum Fjord only.

12. Weighing shows that the weight of the geese increases during the autumn. The goslings of the year are generally lighter than the adults, and the light-bellied Brent Geese tend to weigh more than the dark-bellied. Some of the goslings of the year had white feathers on the neck as early as October.

Discussion

THE STATISTICAL MATERIAL

It is difficult to decide whether the replies received from the sportsmen represent the actual conditions with regard to the size of the bag and the distribution on the species and subspecies of the geese.

When going over the 1272 replies it appeared that surprisingly few sportsmen had made mistakes in their licenses (about 2 %), and all but 1 % of the replies

received were clear and unambiguous, thus showing that they had been given after much reflection.

The percentage of sportsmen who had made mistakes in their licenses may have been greater than 2 if one includes the license holders who did not reply, as these may have thought that the application did not concern them. The same may apply to sportsmen who had shot Grey Geese, as the letter which was sent with the questionaire contained a note to the effect that it was in the first place data on Brent Geese which were of interest.

This can, however, only mean that the calculated number of Brent Geese killed in Denmark in the autumn of 1961 (p. 8), must be a maximal figure. The number of sportsmen shooting Brent Geese in the same season is therefore probably rather smaller than the figure calculated. On the other hand, it should be borne in mind, that a much greater number of people has found relaxation in observing or shooting these birds, without however taking any bag home with them.

Since it is probably easier to shoot juvenile than old birds, the bag will be greater in some years than in others, as the number of juveniles – as stated above – varies much from one year to another. In the autumn of 1961 the juveniles were very scarce in the flocks, at any rate among the dark-bellied geese (the percentage of juvenile birds was that year calculated at about 7).

All things considered, the figures found for the number of Brent Geese killed is probably not seriously underestimated.

THE BRENT GEESE AND THE DECIMATING EFFECT OF SHOOTING

HANSEN & NELSON (1957) have calculated that the mean annual mortality rate of the adult *Brant bernicla nigricans* is about 33 %, while the mortality rate of the goslings of the same subspecies is about 45 %.

We do not know much about the mortality rate of the two subspecies which migrate through Denmark, but probably it is of the same order, so that there is also a slow turnover in the populations of the dark-bellied and light-bellied Brent Geese.

A slow reproduction rate together with a slow turnover in a population means that this population cannot stand loss through shooting as well as a species with a high reproduction rate and a correspondingly rapid turnover.

a. *Branta bernicla bernicla*

PALUDAN (1962 a) tried to calculate the number of Brent Geese which died in the course of a year, if a mean annual mortality rate of 33 % is reckoned with, and if the West-European counting data are used to determine the size of the population. PALUDAN assumes a single year group, viz. 1960-61. In February 1961 the population was estimated at 22–23.000 individuals, and it must be considered that the population was somewhat reduced so late in the season. According to his cautious estimate there should be a total loss (shooting plus other causes of death) in the order of 10.000 birds. The range of the compensating mechanisms operating when a population of Brent Geese is exposed to shooting is not known, but PALUDAN considers it reasonable that annually a total of about 6000 birds are killed without the total mortality rate comprising more than 10.000.

There is hardly any doubt that the effect of shooting might very easily become too great, if Brent Geese were killed in all the countries where they are met with as migrating or wintering birds. Conversely, there is hardly any reason to assume that the population af *Branta bernicla bernicla*

to day is exposed to such severe shooting that this would influence the level of the population. The present paper seems to show that in Denmark only a fairly limited number of geese is killed, since the aggregate bag of dark- and light-bellied geese – according to the calculations – was in the order of 1300. The bag in the other West-European countries, where the Brent Goose is not totally protected, e.g. in West Germany, is however not known, but it is desirable that data should be obtained from these countries.

b. *Branta bernicla hrota*

While the population of dark-bellied geese – after the preceding strong decline – shows a rising tendency, this unfortunately is not the case with the European population of light-bellied geese. Data on actual conditions are very scarce, but the rather low figures registered in Nissum Fjord in spring and NORDERHAUG's observations from Spitsbergen seem to indicate that the population level is low.

The Danish bag of about 1300 geese killed in 1961 cannot be divided between the two subspecies, but of the 167 killed birds which Game Biology Station collected in 1963 about 17 % were light-bellied. The figures are small and uncertain, but if they were to represent the distribution in the aggregate Danish bag about 220 light-bellied geese would have been killed in 1961. Irrespective of the actual size of the bag it would be desirable for the shooting of *Branta bernicla hrota* to be minimized, and this may possibly be done by local protection of Brent Geese in and about the fjords of Randers and Mariager, which are the principal habitats in Denmark of these birds in the shooting season.

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Dansk resumé

En undersøgelse af knortegåsen *(Branta bernicla)* i Danmark.

1. Materialet omfatter jagtudbyttedata m.m., som er indsamlet ved henvendelse til de danske gåsejægere, ringmærknings- og optællingsdata, som Vildtbiologisk Station har tilvejebragt under arbejdet på øen Jordsand i det danske Vadehav, resultater af knortegåsetællinger i danske farvande samt oplysninger om 168 skudte knortegæs, som Vildtbiologisk Station indsamlede i 1963 og 1965.

2. Der var ca. 59 % af de adspurgte gåsejægere (tabel 1), der besvarede henvendelsen (fig. 2) fra Vildtbiologisk Station. Langt de fleste havde nedlagt grå gæs, kun 263 jægere havde skudt sorte gæs (tabel 2). I tabel 3 ses fordelingen af de sorte gæs på art. Tabel 4 viser, hvor mange knortegæs hver jæger har nedlagt. Langt de fleste nedlægger kun få gæs. I tabel 5 er knortegåsejægerne opstillet efter erhverv.

3. Forsigtige beregninger på grundlag af tal fra den officielle danske vildtudbyttestatistik og oplysninger indhentet fra jægere, der havde nedlagt knortegæs i 1961, synes at vise, at de dette år nedlagde omkring 1300 knortegæs. Ca. 0,4 % af landets mere end 100.000 jagttegnsløsere havde i følge beregningerne nedlagt knortegæs den pågældende sæson.

4. Canadagåsen (*Branta canadensis*) og bramgåsen *(Branta leucopsis)* nedlægges tilsyneladende i ringe antal.

5. I følge det indsamlede materiale er knortegåsens vigtigste efterårsrastepladser følgende: Vadehavet, Nissum Fjord, Randers og Mariager Fjorde, farvandet ved Samsø, Odense Fjord, de sydfynske farvande, området ved Saltholm, Køge Bugt, Faxe Bugt, Dybsø og Avnø Fjorde. Kortet fig. 3 er udarbejdet på grundlag af besvarelserne fra gåsejægerne.

6. Vildtbiologisk Station har siden 1960 haft øen Jordsand i Vadehavet (fig. 6) som forsøgsområde. Man har herude fulgt knortegæssenes ankomst og afrejse. Desuden har man fanget gæssene med henblik på ringmærkning, og endelig har man daglig gjort notater over det maximale antal gæs. I appendix 1 findes samtlige data fra observationerne af knortegæs fra 1960 til 1966, og fig. 7 viser nogle af disse data fra forskellige perioder.

Man har fanget gæs på Jordsand både forår og efterår. I alt har man ringmærket 1 *Branta b. hrota* og 165 *Branta b. bernicla*. Af sidstnævnte er 24 eller 14,5 % senere genmeldt som skudte eller på anden måde døde, og tages der hensyn til aflæsningerne, der er foretaget på Jordsand, er genmeldingsprocenten 22,4. Fig. 9 viser lokaliteterne for de genmeldte fugle, og bilag 2 giver samtlige data for aflæste og genmeldte knortegæs.

7. Om foråret går knortegæssene på land på Jordsand for at fouragere, hvilket de aldrig gør om efteråret. Antallet af fouragerende gæs er dog faldet jævnt i de år, Vildtbiologisk Station har haft øen under observation. Årsagen hertil kendes ikke, men måske er der sket ændring af fourageringsforholdene på vaderne, der gør, at det ikke længere er nødvendigt for gæssene at græsse på land. *Zostera nana* har bredt sig meget i løbet af de sidste seks år, og også *Zostera marina* findes nu i anseelige mængder mellem Jylland og Jordsand.

8. Af 74 *Branta b. hrota*, som i 1954 blev mærket på Spitsbergen, er senere 28 genmeldt fra Danmark, de fleste fra Randers og Mariager Fjorde (fig. 15). Tre er yderligere genmeldt fra England. Den eneste lysbugede gås, som blev mærket ved Jordsand, blev skudt om efteråret ved Mariager Fjord.

9. Ungeprocenten blandt *Branta b. bernicla*, der er fanget eller nedlagt gennem fire sæsoner, varierer fra 0 til 60. Fig. 10 giver en grafisk fremstilling af disse ungeprocenter sammenlignet med engelske iagttagelser af ungfugle i samme periode. Der er stor overensstemmelse mellem de to materialer.

10. I Danmark blev der i årene 1951–1957 optalt andefugle mange steder i landet fra august til april. Fig. 11 viser resultaterne for knortegæssenes vedkommende fra fire lokaliteter.

11. Iagttagelser fra Jordsand og Tipperne viser, at knortegæssene kommer til disse lokaliteter i sidste halvdel af september. Om vinteren er her ingen eller kun få knortegæs, allerede i februar begynder de igen at vise sig ved Jordsand, antallet kulminerer i april og maj, og omkring 1. juni er de som regel alle trukket nordpå igen.

12. Vildtbiologisk Station har i Danmark forestået intereuropæiske tællinger af knortegæs siden 1961-62. De første år taltes gæssene i midten af januar, men fra og med 1966 tælles de ca. midt i maj. Man tæller her i landet fra fly, og der flyves over alle de områder, som fig. 3 angiver som vigtige opholdssteder for knortegæs om efteråret.

På p. 24 ses resultaterne af de danske tællinger 1963-1966. Til sammenligning med fig. 3 viser fig. 12, hvor de gæs befandt sig, som blev registreret ved tællingerne 1964-1966.

BURTON (1963 og 1965) anslår, at bestanden af mørkbugede knortegæs i Vesteuropa (÷ Vesttyskland) i årene 1960-1964 lå på ca. 25.000 individer.

13. Der kan træffes mørkbugede knortegæs i de fleste danske farvande, og på en række lokaliteter kan de forekomme i betydelig mængde. De lysbugede er derimod mere knyttet til bestemte områder, idet deres hovedopholdssteder om efteråret er det nordlige Vadehav samt Randers og Mariager Fjorde, mens de om foråret tilsyneladende kun raster i Nissum Fjord.

Fig. 13 viser skydelokaliteter for et materiale af skindlagte knortegæs fra Zoologisk Musem i København. Den ældste gås er fra 1862, den yngste fra 1930.

På fig. 14 ses skydelokaliteterne for de 168 *Branta bernicla*, som i 1963 (1 fra 1965) blev indsamlet til Vildtbiologisk Station.

14. Vejninger viser (tabel 6–8), at gæssenes vægt stiger i løbet af efteråret. Årets gæslinger er gennemgående lettere end de adulte, og der er en tendens til, at de lysbugede gæs vejer mere end de mørkbugede. Nogle af årets gæslinger havde allerede hvide fjer på halsen i oktober (tabel 10).

15. Mens bestanden af mørkbugede gæs efter den forudgående dybe bølgedal nu viser en stigende tendens, er dette næppe tilfældet med den europæiske bestand af lysbugede gæs. De få data, der foreligger til belysning af dette forhold, synes at vise, at bestandniveauet er lavt og stadig i tilbagegang.

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APPENDIX 1

Number of *Branta bernicla bernicla* seen at high tide at Jordsand.

Antal Branta bernicla bernicla set ved højvande ved Jordsand

Year / *År*	1960								1961											
Date / *Dato*	Month / *Måned* V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1.		÷	÷	0	0	1500		248			361	150	0	5	1			950	100	
2.		÷	÷	0	0	1500		158			÷	136	100	1	1			400	1300	
3.		÷	÷	0	0	2000		350			÷	250	200	0	1			1250	150	
4.		÷	0	0	0	3000	1050	÷			0	250	150	1	0			2700	2250	0
5.		0	0	0	0	3000	×	÷			200	250	300	1	1			500	2300	0
6.		0	0	0	0	3000	1045	275			54	50	206	÷	1			1200	0	7
7.		0	0	0	0	3000	830	×	0		200	25	132	÷	1			500	3	4
8.		0	0	0	0	3000	×	0	0		400	260	164	÷	0			(0)	÷	0
9.		0	0	0	0	2000	÷	0	0	0	(0)	115	127	÷	0			1700	475	0
10.		0	0	0	0	2000	÷	0	0	0	÷	41	211	÷	0			1470	250	0
11.		0	0	0	0	×	÷	0	0	0	÷	330	182	÷	0			÷	2	0
12.	0	0	0	0	0	700	÷	×	0	2	÷	75	125	0	1			÷	2	1
13.	0	0	1	÷	0	×	200	0	(0)	0	÷	310	125	1	0			÷	2	0
14.	1	÷	0	0	0	×	214	0	0	0	209	54	÷	1	0			÷	2	6
15.	50	÷	0	0	0	1100	489	0	0	5	600	335	÷	1	0			÷	2	0
16.	46	0	0	0	0	200	483		0	134	600	5	0	1	0			125	25	0
17.	25	0	0	0	0	1000	24		(0)	0	200	270	360	1	÷			52	4	0
18.	25	0	0	0	÷	200	4		0	0	150	150	160	1	÷			280	375	
19.	24	0	0	0	0	1000	61		0	0	250	200	133	1	÷			1850	75	
20.	12	0	0	0	70	500	83		(0)	0	60	181	96	0	÷			2000	2	
21.	9	0	0	0	0	150	÷		0	Few	50	225	150	1	÷			550	0	
22.	8	0	0	0	52	few	9		0	0	100	300	54	1	1			650		
23.	÷	0	0	0	300	30	31		0	0	225	50	31	1	0			250		
24.	÷	0	0	0	×	500	35		0	0	100	50	19	0	1		÷	630		
25.	÷	0	0	0	0	500	256		0	0	250	200	1	0	1			1600		
26.	8	0	0	0	×	0	×			52	÷	125	39	1	1		3250	800		
27.	3	0	0	0	100		32			39	÷	300	1	1	1		2200	550		
28.	÷	0	0	0	×		100			500	÷	284	0	1	1		2200	1100		
29.	÷	0	0	0	300		211				250	250	0	1	1		4300	1500		
30.	÷	0	0	0	2000		273				400	200	28	1	÷		1400	800		
31.	÷		0	0							300		28		÷			1300		

÷ = no counts *(ingen tælling)*.

0 = no Brent Geese heard or seen. Observation conditions good *(ingen knortegæs hørt eller set. Observationsbetingelser gode)*.

(0) = no Brent Geese heard or seen. Observation conditions poor *(ingen knortegæs hørt eller set. Observationsbetingelser dårlige)*.

× = Brent Geese heard, but not seen *(knortegæs hørt, men ikke set)*.

Year *År*	1962					1963		1964			1965			1966		
Date *Dato*	Month *Måned* III	IV	V	IX	X	IV	V	IV	V	IX	IV	V	X	III	V	VI
1.		54	157		300		28		17			÷				÷
2.		60	500		200		31		23			÷				0
3.		÷	÷		82		÷		÷			24				0
4.		250	÷		250		÷		19			3				
5.		64	÷		300		÷		22			150	×			
6.		94	÷		200		6		13			56	×			
7.		116	÷		100		16	16	42		25	22	×			
8.		139	÷		178		÷	75	19		8	÷	400			
9.		(0)	÷		(0)		÷	100	42		9	÷	200			
10.		75	÷		100		÷	178	19		2	6	210			
11.		149	200	÷	0	32	÷	30	36		320	23				
12.		215	60	0	92	56	÷	67	58		278	102				
13.		200	55	0	138	÷	÷	97	56		450	63				
14.		120	90	0	600	÷	÷	283	6		650	35				
15.		140	100	2	1300	÷	÷	137	83		58	0		0		
16.		135	100	0	700	144	42	430	115	0	100	2		16		
17.	÷	250	60	12	600	208	25	249	2	0	110	2		2		
18.	0	÷	100	27	1100	210	÷	115	0	0	350					
19.	14	215	100	200		÷	÷	24	0	÷	127					
20.	40	200	50	0		÷	84	36	0	÷	125					
21.	40	200	42	0		÷	24	80		÷	86					
22.	125	218	42	0		÷	32	27		÷	18					
23.	30	175	3	346		16	28	41		÷	32					
24.	50	132	4	300		7	÷	34		÷	66				1	
25.	45	118	140	50		12	41	43		91	9				14	
26.	60	150		150		0	32	61		13	129				4	
27.	17	126		791		0	50	49		150	179				3	
28.	50	150		374		÷	6	72		250	36				÷	
29.	(0)	124		72		12	0	45		400	23				÷	
30.	(0)	175		105		32		24		140					÷	
31.	23														÷	

APPENDIX 2

All recoveries and recaptures of *Branta bernicla* ringed on Jordsand, Vadehavet (55° 01′ N, 08° 32′ E).
Samtlige genmeldinger og genfangster af Branta bernicla mærket på Jordsand.

juv. = first year *(1. årig)*
ad. = older than one year *(ældre end 1 år)*
\+ = shot *(skudt)*
v = registered *(aflæst)*
× = found dead or dying *(fundet død eller døende)*
♂ = male *(han)*
♀ = female *(hun)*

Branta bernicla hrota

306933	ad.	7.11.1961	Jordsand.
	+	20.12.1964	Randers Fjord, Jylland, Denmark (56° 33′ N; 10° 15′ E).

Branta bernicla bernicla

305604	ad.	7.10.1960	Jordsand.
	+	19.10.1963	Dageløkke, Langeland, Denmark (55° 05′ N; 10° 49′ E).
305616	juv.	18.10.1960	Jordsand.
	×	19.10.1960	Jordsand.
305623	juv.	22.11.1960	Jordsand.
	+	29.12.1960	Veys Bay, Brevand commune, FRANCE (49° 00′ N; 01° 30′ W).
305625	juv.	22.11.1960	Jordsand.
	+	4.12.1960	1½ km S of Havneby, Rømø, Denmark (55° 05′ N; 08° 30′ E).
305628	ad.	23.11.1960	Jordsand.
	+	17.9.1961	Near Ærbelø, Fyn, Denmark (55° 40′ N; 10° 10′ E).
305632	juv.	23.11.1960	Jordsand.
	+	15.12.1960	Vidåen, S Jylland, Denmark (54° 55′ N; 08° 40′ E).
305643	ad.	5.4.1961	Jordsand.
	v	25.4.1962	Jordsand.
305646	ad.	13.4.1961	Jordsand.
	×	31.1.1963	Northey Island, Maldon, Essex, ENGLAND (51° 45′ N; 00° 40′ E).
305647	juv.	♂ 11.5.1961	Jordsand.
	+	18.5.1961	Ust-Shtshugor, Pechora, U.S.S.R. (64° 15′ N; 57° 36′ E).
305649	ad.	5.5.1961	Jordsand.
	v	22.7.1961	Jordsand.
305650	juv.	5.5.1961	Jordsand.
	×	26.7.1964	Videskär, Torhamns E skärgård, Blekinge, SWEDEN (56° 03′ N; 15° 48′ E).
306908	ad.	10.10.1961	Jordsand.
	+	3.11.1961	S of Rømø, Denmark (55° 05′ N; 08° 30′ E).
306910	ad.	10.10.1961	Jordsand.
	×	21.4.1962	Langør, Samsø, Denmark (55° 50′ N; 10° 30′ E).
306911	ad.	11.10.1961	Jordsand.
	+	26.12.1961	Helford River, Cornwall, ENGLAND (50° 05′ N; 05° 05′ W).

306919	ad.		22.10.1961	Jordsand.
	+		10.12.1961	Near Ribe, Jylland, Denmark (55° 20′ N; 08° 47′ E).
306947	ad.		22.4.1962	Jordsand.
	×		23.1.1963	Blakeney, Norfolk, ENGLAND (52° 58′ N; 01° 00′ E).
306948	ad.		22.4.1962	Jordsand.
	×		14.1.1964	Sarzeau, Morbihan, FRANCE (47° 32′ N; 02° 46′ W).
306950	ad.		22.4.1962	Jordsand.
	×		16.2.1963	Saltings at Hullbridge, Essex, ENGLAND.
306955	ad.	♀	22.4.1962	Jordsand.
	v		15.5.1962	Jordsand.
306956	ad.		23.4.1962	Jordsand.
	v		19.4.1963	Jordsand.
306958	ad.		25.4.1962	Jordsand.
	v		11.5.1964	Jordsand.
306972	ad.		30.4.1962	Jordsand.
	+		14.1.1964	Sylt, GERMANY.
306974	ad.		1.5.1962	Jordsand.
	v		11.5.1964	Jordsand.
306977	ad.	♀	1.5.1962	Jordsand.
	v		15.5.1962	Jordsand.
306978	ad.	♂	1.5.1962	Jordsand.
	v		15.5.1962	Jordsand.
306984	ad.		1.5.1962	Jordsand.
	×		(9.4.1963)	West Mersea Island, Essex, ENGLAND (51° 45′ N; 00° 50′ E).
306985	ad.		1.5.1962	Jordsand.
	v		29.4.1964	Jordsand.
306988	ad.		1.5.1962	Jordsand.
	+		12.11.1963	Rantumer Wattenmeer, Sylt, GERMANY (54° 50′ N; 08° 30′ E).
306993	ad.	♀	13.5.1962	Jordsand.
	v		19.4.1963	Jordsand.
306996	ad.	♀	15.5.1962	Jordsand.
	v		11.5.1964	Jordsand.
	+		1.1.1965	Baie de Vey, Isigny, FRANCE (48° 37′ N; 01° 10′ W).
306998	ad.	♀	17.5.1962	Jordsand.
	v		11.5.1964	and 14.5.1965 Jordsand.
307000	ad.	♂	17.5.1962	Jordsand.
	v		11.5.1964	and 14.5.1965 Jordsand.
307016	ad.		15.10.1962	Jordsand.
	+		13.10.1963	Vigsø near Lolland, Denmark (54° 54′ N; 11° 40′ E).
307018	ad.		24.4.1963	Jordsand.
	×		7.2.1965	Freiston, Lincolnshire, ENGLAND (52° 55′ N; 00° 08′ E).
307019	ad.	♂	24.4.1963	Jordsand.
	×		0.1.1965	River Witham on the »Wash«, ENGLAND (52° 55′ N; 00° 05′ E).
308208	juv.	♀	29.4.1964	Jordsand.
	+		21.1.1966	La Rochelle, FRANCE (46° 10′ N; 01° 10′ W).
308212	ad.	♂	29.4.1964	Jordsand.
	×		0.2.1966	Borkum, Ost Friesische Inseln, GERMANY (53° 35′ N; 06° 40′ E).

Four recorveries were received by the Game Biology Station after the manuscript was finished.

305618	ad.		25.10.1960	Jordsand.
	+		10.10.1966	Odense Fjord, Denmark (55° 24′ N; 10° 25′ E).
306977	ad.	♀	1.5.1962	Jordsand.
	+		7.10.1966	Stenodden, Lunkebugten, Denmark (55° 00′ N; 10° 40′ E).
307000	ad.	♂	17.5.1962	Jordsand.
	+		20.10.1966	Westerhaver, Husum, GERMANY (54° 29′ N; 09° 04′ E).
306997	ad.	♀	15.5.1962	Jordsand.
	+		5.6.1966	Mys Vkhodnoy (Dikson), Taimyr, U. S. S. R. (ca. 73° 52′ N; 86° 45′ E).

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