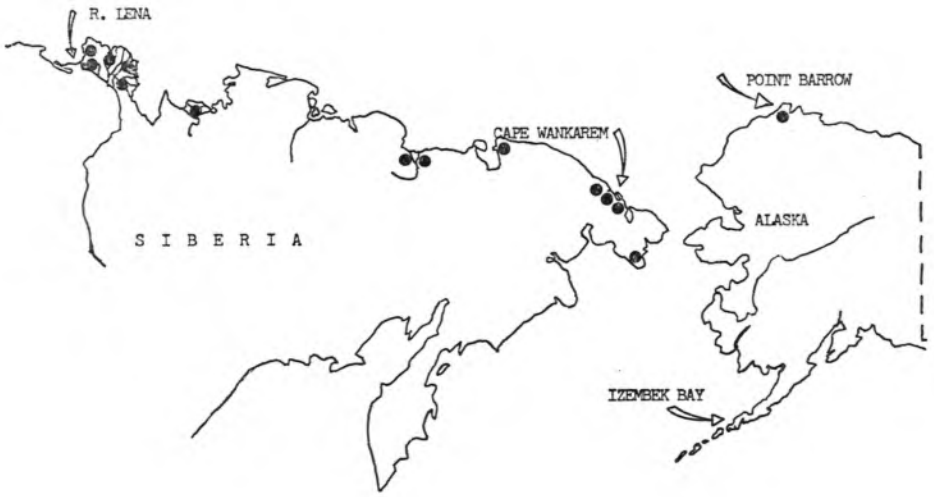

completion of the post nuptial moult.

These returns suggest that the eiders were moving eastward either slower or later than in the earlier years, but offer no clue as to why this disparity in behaviour should occur. In Alaska winter was slow to release its grip in the spring of 1964 and waterfowl nesting was consequently two to four weeks late. One might suppose that this was also true of Siberia. If so, it would explain the late migration in 1964, but offers no explanation for the late one in 1963. Clearly, if we are to answer these unknowns we must look to a Soviet observer in Siberia.

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The prospects for wild geese in the Netherlands

T. LEBRET

Summary

During their stay in winter quarters most species of wild geese are dependent upon the presence of suitable roosts. Various types of roosts, the factors responsible for their presence, and their prospects are discussed. Several State programmes (the 'Delta Project' and various drainage plans) will endanger a number of roosts in the Netherlands within the next 25 years.

White-fronted, Pink-footed and Bean Geese choose those localities where they may feed undisturbed rather than select special types of vegetation. Only the Brent Goose mainly feeds on the vegetation of the tidal zone of salt waters. The Greylag Goose shows a strong preference for tidal *Scirpus* fields along fresh and brackish estuaries.

Drainage and reallotment schemes tend to open up the regions concerned for agricultural development, which invariably leads to an increase of disturbance and to the departure of the wild geese. In the Netherlands great numbers of wild geese feed on well-drained fields, provided they are left undisturbed. The effect of drainage and reallotment schemes can be partly offset by the institution of disturbance-free sanctuaries elsewhere.

Since increasing numbers of wild geese will be concentrated on a decreasing acreage, the carrying capacity of the refuges must be in the focus of the protection plan for the wild geese in the Netherlands.

In the Veerse Meer, the first estuary closed as a part of the Delta Project, a nature reserve will be managed as a special goose refuge by the sowing of grasses. Further refuges of this type will be urgently required as the Delta Project goes on.

I. Introduction

The position of the wild geese in the Netherlands is a matter of concern since Atkinson-Willes (1961) has pointed out that in northwest Germany large areas where great numbers of wild geese used to winter have been permanently drained. Other areas in this region have been evacuated by the wild geese due to over-disturbance (Mörzer Bruijns, 1961). Most of these birds are now wintering in the Netherlands, so that a big proportion of the continental winter areas of the wild geese in Western Europe are now situated in this country. The Dutch Government, however, is carrying out several large-scale drainage and reallotment schemes, while others are in preparation. Moreover the Delta Project aims at the closure of the estuaries in the southwest. Started in 1954, it is to be finished in 1978. All these activities of the hydraulic and agricultural engineering services are a serious menace to the survival of wild geese in the Netherlands.

A detailed study of the factors determining the distribution of the roosts and feeding grounds of the wild geese seems urgently required. All possibilities of management in favour of the wild geese should be applied in all reserves where this is possible.

II. The roosts

In the years 1941–1946 the present writer was collecting data for an inventory of duck decoys in the Netherlands. This brought him into touch with other fowling practices, among which was the netting of wild geese. In most of the regions where it had formerly been common practice, netting had either died out or had lost most of its importance. In all cases this was said to be due to a decrease of the wild geese, attributed to the effect of drainage works carried out in the regions concerned. Formerly the meadows in these regions had been flooded from November to the beginning of March. Parts of the areas were completely inundated, while others were merely swamped. The geese were said to have fed during the day in the swampy parts of the area, concentrating at dusk on the wetter places.

Generally speaking the goose areas in the interior of the Netherlands have been evacuated. Those where the geese are still present or into which they have moved are all coastal regions, with the exception of Central Friesland, where winter floods still cover large areas. This suggests that the presence of suitable roosts is of prime importance for the distribution of wild geese in their winter quarters, in so far as they are not feeding in the tidal zone as Brent Geese and Greylag Geese prefer to do. For such species roosts and feeding grounds are more or less identical.

Roosts being of such dominant importance it seems necessary to have a clear picture of the ecological components of the roosts in this country. For this reason the roosts which have so far been described (Lebret, 1959, Philippona, 1962, 1963 and *in litt.*, Den Daas, 1963, Timmerman, personal communication) are listed below (Table I), classified according to their origin. The list is, of course, not a complete one, but includes practically all important roosts.

Table I. Goose roosts in the Netherlands. Locations with more than 500 roosting geese are printed in capitals. Wildfowl reserves are indicated by an asterisk.

GL Greylag Goose *Anser anser*
WF White-fronted Goose *A.a.albifrons*
BE Bean Goose *A.f.fabalis* and *A.f.rossicus*
PF Pink-footed Goose *A.brachyrhynchus*
BA Barnacle Goose *Branta leucopsis*

A. *Roosts on the Waddenzee*
Type: tidal sands and mudflats

1.	LAUWERSZEE	GL	WF		
2.*	MUDFLAT off the BANTPOLDER	BA			
3.*	Mudflat off the Noorderleegh	WF			

B. *Roosts in the Biesbos, on the Hollands Diep and the Haringvliet*
Type: sands and mudflat in tidal, fresh and brackish waters

4.	BIESBOS	GL	WF	BE	
5.*	SASSE PLAAT in the Hollands Diep	GL	WF	BE	
6.	TIDAL MARSH CROMSTRIJEN	GL	WF	BE	
7.*	VENTJAGERSPLATEN	GL	WF	BE	BA
8.	BENINGEN	GL	WF	BE	
9.	SANDBAR DIRKLANDSE SAS	GL	WF	BE	BA
10.*	SCHEELHOEK	GL	WF	BE	BA

C. *Roosts in the salt water estuaries in the southwest*

Type: sandbars

11.	ZEEHONDENPLAAT in the Volkerak	BE		
12.	ROGGEPLAAT in the Oosterscheldt	BA		
13.	SANDBARS in the Grevelingen	BE		
14.*	KATSE PLAAT in the Zandkreek	BE	WF	
15.	HOGE PLATEN in the Westerscheldt	WF	BE	
16.*	SANDBARS in the upper part of the Westerscheldt	WF	BE	

D. *Roosts on the IJsselmeer off the province of Friesland*

Type: sandbars in static shallow fresh waters of the IJsselmeer

17.	SANDBARS off GAAST	PF	GL	
18.	STEILE BANK near OUDE-MIRDUM	GL	WF	BA

E. *Roosts on the border lakes between the former coast of the IJsselmeer and the new IJsselmeerpolders*

Type: shallow places in static fresh waters

19.*	Shallows in the Zwarte Meer	WF	
20.*	Shallows in the Veluwe Meer	BE	

F. *Roosts in flooded meadow areas*

Type: floods

21.	FLOODS west of BEETSTERZWAAG	WF		
22.	FLOODS near the GROTE BREKKEN to the north of Tacozyl	WF		
23.	FLOODS in the HAAGSE BEEMDEN	WF	BE	
24.	FLOODS in the PUTTING, Zeeuws-Vlaanderen	WF	BE	
25.	FLOODS on the GROOT-EILAND, Zeeuws-Vlaanderen	WF	BE	

G. *Roosts in 'closed estuaries'*

Type: former tidal sands in static waters, closed from the sea as a part of the Delta Project

26.*	MIDDELPLATEN in the Veerse Meer	WF	BE
27.*	Shallows in the Braakmankreek	WF	

H. *Lakes and 'vennen'*

Type: static fresh waters of some size; 'vennen' are oligotrophic waters in the pleistocene

28.	IDSEGASTERPOEL, province of Friesland	PF	BA
29.*	Vennen near Duurswoude, east of Beetsterszwaag	WF	
30.*	Vennen in the Kampina, province N. Brabant	BE	
31.*	Vennen in the Strabrechtse Heide, N. Brabant	BE	

J. *Roosts on extensive frozen waters*

Type: any of the roosts mentioned above, most lakes in Friesland and

32. IJSSELMEER, west of the Noordoostpolder

General characters of the roosts

The roosts in our list have some basic characters in common. (a) The geese want to be surrounded by an extensive area of open waters, ice, sands or bare mudflat, where (b) vegetation is absent or at least very low and thin; and (c) they want to be undisturbed.

A fourth component should be mentioned here, as has been pointed out by Mulder (*in litt.*). This is (d) the geese want to roost where firm soil is present.

The significance of these components may be the following: Component (a): first of all the geese want to be safe from predators and during the hours of darkness they have to retreat to the most open type of habitat. Completely open surroundings make it impossible for them to be approached unperceived. Component (b) may have the same significance.

Components (c) and (d) are closely related, as tidal sandbars and extensive coastal shallows, where the geese can stand on firm soil when roosting, are as a rule free from all kinds of disturbance. Deeper waters, lakes and streams in the Netherlands are for the greater part integrated into the national transport system and therefore greatly disturbed by all kinds of shipping, nocturnal fishing, etc. It is with some doubt that component (d) – the possibility for the geese to stand on firm soil – is mentioned, but it is striking that it is present in all types of roosts in our list except in type H (lakes and 'vennen'). This suggests that the geese have a very pronounced preference for roosts with firm soil. The cause of this preference could be that it allows them to stand or to lie sleeping without sinking in the mud. They may stand sleeping with the water up to

their bellies, but apparently they prefer not to be afloat. In tidal waters, however, this may occur for a few hours before and after high tide. Markgren (1963) describing the behaviour of Bean Geese *A.f.fabalis* on their roosts in southernmost Sweden says: 'Particularly when geese sleep on the water, involuntary collisions must occur comparatively often...The repeated contact notes that are heard periodically from flocks lying on open water, are much rarer when the geese roost on ice'. These observations suggest that the preference for a roost where the geese can stand or lie on firm soil or on ice might also be due to the fact that it allows them to maintain individual distance and prevents involuntary collisions. On the Swedish roosts described by Markgren, the geese have no opportunities to stand on shallows with firm soil in places where they are surrounded by open waters of sufficient size.

There is detailed information on the roosting habits of the geese in Scotland and England (Boyd, 1963). Greylags have most of their roosts on inland lakes, only a small proportion roosting on estuaries. Whitefronts in England roost on estuaries and floodwaters, but there is an increasing use of large reservoirs as roosts. Bean Goose roosts are all inland, on floodwater or hill lochs. Pinkfoot roosts are about equally distributed between the coast, nearly all in estuaries, and inland, mostly on lakes but several on peat mosses.

All these data from S. Sweden, Scotland and England suggest that the habit of roosting on firm soil, so pronounced in the Netherlands, is not a general one. The conclusion may be that the wild geese have a strong preference for such roosts, though they may well do without it, but that in the Netherlands with its dense human population, the presence of shallows is extra favourable as a safeguard against disturbance.

All this does not apply to Brent Geese and to those Greylags living in extensive tidal areas, which follow a tidal cycle and do not roost at night.

Ecological factors favouring the presence of roosts

The combination of the factors mentioned under (a), (b) and (d) is not a probable one. It is unlikely to occur except in very special conditions and even where the combination does occur at a given time, it is unlikely to be permanent. On the contrary, it tends to be short-lived by nature, because shallow places are either gradually eroded by the current or the effect of the waves or they tend to be grown over by Cord Grass (*Spartina* sp.), Club-rush (*Scirpus*) or Reed (*Phragmites*). In static waters shallow places with firm soil are practically always densely overgrown.

If the various types of roosts are compared, the following factors appear to be responsible for their existence.

Those of group A, B and C are a result of the influence of the tide. In types D and E it is the size of the waters and their exposure to the southwestern winds which favour the presence of these shallows. The roosts of group F (floods) seem to be a stable type. Grazing keeps the vegetation short during the summer. The turf, soaked though it may be, seems sufficiently firm for the geese to roost. In group G, the 'closed' estuaries, the roosts have what might be called a 'tidal past' and this, no doubt, is responsible for their present state. Lake roosts of type H are a matter of wind effect, but they are different from all other roosts, extensive open surroundings (factor a) being the only advantage they offer.

Prospects for the future

We still have to study the prospects of the various roosts, as their survival is not beyond all doubt. Moreover a number of them will be affected by the Delta Project and the drainage schemes.

1. The factor tide which plays such an important role, will be eliminated by the Delta Project in the roosts of group B and numbers 11–14 of group C, in which group only roosts numbers 15 and 16 will remain untouched. Where the tide is eliminated, the sand bars will either be too deep under water or they will be overgrown by rushes and reeds. In some cases new roosts will come into existence and it will be of great importance to manage such places by grazing and mowing so as to prevent the development of vegetation. It is not improbable that the water level in these closed estuaries will be lowered considerably during winter, so that bare mudflat might be available. These future roosts might be of the same type as those of group G. Our experience of these roosts is very short, as the Veerse Meer (No. 26) has been closed only since 1961 and the Braakman (No. 27) since 1952. In the former the water will be salt until 1978, which will prevent the development of a high and dense vegetation.

2. The main body of the Waddenzee (group A) will remain tidal for some 30 to 50 years and the wild geese will probably find excellent roosting conditions here for a long time. The present roosts in the Waddenzee area, however, will be lost within a few years. In the Lauwerszee a roost of type G might be possible, but all shooting should be abolished there.

3. The roosts in the IJsselmeer area have good prospects, though there seems to be a gradual increase of the vegetation. As the size of the IJsselmeer seems to play a part, it should be mentioned here that in the near future this size will decrease from some 200,000 ha to about 100,000 ha, which may decrease the wind effect and consequently favour the increase of the vegetation. Our experience of roosts of type E is short, but they may survive for a considerable time.
4. Floods (group F) are considered to be an anachronism in the Netherlands. The present co-operation between the owners of important parts of the roosts of No. 21 and the State nature protection is therefore very welcome. Some purchases of land by the State in area 21 and others in areas 23 and 24 are also very important, though in the latter cases much has still to be done.

Summarising the prospects we might say that serious losses are to be expected in several regions. There will be a general shift from tidal waters to static ones, where both the abolishment of shooting and careful management will be necessary.

III. The feeding grounds

Some species of wild geese are highly specialised in food habits, while others are capable of adapting themselves to various types of human land use. In the case of the latter, the 'natural' habitat selection may be obscured and has to be 'reconstructed' from incidental clues.

On the basis of experiences in the Netherlands (Lebret, 1964) the species might be classified as follows.

Specialists

BRENT GOOSE

Almost entirely a bird of the tidal zone of salt waters, feeding on *Zostera*, *Enteromorpha*, *Ulva* and *Puccinellia*. In one case a group of some 130 birds was feeding in arable country on a grass-seed production field some 300 m. behind the sea wall for several months.

Semi-specialists, with a preference for "natural" habitat but capable of adaptation to agriculture

BARNACLE GOOSE

Timmerman (1962) thinks the specise to be specialising on saltings where brackish and fresh water are in regular contact and where the plant communities of the Agropyro-Rumicion crispi predominates. Philippona (*in litt.*) thinks that the species may also thrive on the same habitats where White-fronted Geese have their main haunts.

GREYLAG GOOSE

In the Netherlands and in north-west Germany (Harrison, 1952) Greylags have a distinct preference for the *Scirpus*-pioneer vegetations of fresh and brackish estuaries. In most localities pasture land is used as a secondary habitat. On both banks of the Hollands Diep estuary there is an increasing preference for arable country, but *Scirpus* fields are still the major food stock here. Only in the province of Friesland and in the State Reserve Boschplaat on the Frisian Isle of Terschelling (Tanis, 1963) are Greylags feeding entirely on grasses. This as well as the situation of the Greylags wintering in the British Isles (Boyd, 1963) suggests that the species might well survive on grasses only.

Non-specialists

WHITE-FRONTED GOOSE

Formerly typical for floods. Recently the majority has moved to areas within flighting distance from coastal roosts. Here they may feed on dry pasture land in great numbers for several months if undisturbed. This suggests that the floods have another significance than food habitat only, their excellence as roosts being of primary importance while they also provide good protection against all types of disturbance.

PINK-FOOTED GOOSE

Since the 'come-back' of the species in the Netherlands in 1956 Pinkfeet have been feeding entirely on pasture land in the southwest of the province of Friesland in a region between the IJsselmeer in the west and a number of lakes in the south and east. In this way this region is well isolated and human disturbance is small. There seems to be no ecological relation with floods. A detailed description of the ecology of the Pink-footed Goose in this area is given by den Daas (*loc. cit.*).

BEAN GOOSE

In the Netherlands this species is to a great extent using arable country, especially on the modern farms with extensive fields, within flighting distance from the estuaries. Pasture land seems to be of secondary importance. The species, therefore, might be classified as the one most adapted to present-day farming.

From its ability to dig out waste potatoes and sugar beets, it may be supposed that the natural food of the species might to some extent consist of tubers of *Scirpus* and other marsh plants. Indeed, some cases of this feeding method are known (Lebret, 1959). Feeding on Cord Grass roots and stems has been mentioned by Maebe and van der Vloet (1956).

Prospects for the future

After the feeding grounds of the various species of wild geese have been briefly described, we have to study the effect of the Delta Project and a number of other hydraulic engineering schemes.

1. Brent Goose

The main feeding grounds of this species are found in the tidal marshes of the Waddenzee, especially near the Isle of Terschelling. Some 3,000 birds may be found here (Tanis, 1963) and fortunately the area will remain untouched. The feeding grounds in the south west of the Netherlands will be lost after the Delta Project has been completed in 1978, as the tide will be eliminated and the waters will become fresh. The number of Brents involved is not likely to exceed 500 birds.

2. Barnacle Goose

This species will lose practically all its present feeding grounds within the next 5–10 years. Its main haunt, the Bantpolder, harbours some 15,000 birds, but it will be partly drained in 1965 or 1966. There is a possibility that a new feeding area may be created in the Lauwerszee after this has been closed, in 1967, by sowing special pastures for the species and by managing them as a sanctuary. There will, however, remain a gap of some 4–5 years between the loss of the Bantpolder and the possible effect of a sowing programme. In these years the species might temporarily fall back on the nearby Anjumer Kolken. It would be advisable that all goose shooting should be temporarily forbidden there, as in this region the Barnacles, though fully protected by law, are mixed with Whitefronts and other geese and hence are liable to the disturbance caused by Whitefront shooting. The Barnacle feeding areas in the southwest of the Netherlands (Dirklandse Sas and St. Anthoniegorzen) will be lost due to the Delta Project, which will be finished in this sector in 1969. Some 3,500–7,500 birds may now be feeding here (Timmerman, 1962). These birds may find a new haunt on the Kwade Hoek State Reserve. Moreover on the Hompelvoet State Reserve, now a sandbank in the Brouwershavense Gat estuary, goose pastures may be created after this estuary has been closed in about 1970. Here again a sowing programme would not be effective until some 4 years after the closing of the estuary.

3. Greylag Goose

This species will also be highly affected by the results of the Delta Project. It will lose all the tidal marshes with a pioneer-vegetation of *Scirpus*. This type of habitat will disappear practically altogether in the Netherlands after 1968. Some 10,000 Greylags used to feed here. In the two IJsselmeerpolders still to be drained there may be a temporary revival of comparable pioneer vegetation, but each of them will last only some 5–8 years, unless a special reserve is created. This should be managed by extensive grazing during summer and slightly flooding it in September–March.

If the Greylag Goose proves capable of holding its own on pasture land – and there are several indications that it may do so – it will be of the utmost importance that sufficient grazing opportunities are created and maintained in nature reserves. There are good prospects on the Bosplaat State Reserve, where the numbers of Greylags are gradually building up and will have reached 1,000 birds. Rabbit shooting has been abolished during the presence of the wild geese in this reserve (Tanis, personal communication). The Kwade Hoek and the Hompelvoet Reserves mentioned in reference to the Barnacle will be of positive value for the Greylag Goose as well. The maximum numbers of the species occur in October–November, when cattle are still in the fields, and March–April, when the grass is starting into growth, while the other species have their maximum in December–March. Hence the Greylags may be in conflict with agricultural interests. In October other human outdoor activities may be still in full swing at or near their haunts. The birds may thus be more affected by human disturbance and hence more dependent upon nature reserves than are other species. Consequently they may have to feed in greater concentrations and the carrying capacity of these Greylag reserves will need special attention.

4. White-fronted Goose

The feeding grounds of the White-fronted Goose will not be seriously affected by the Delta Project, but drainage and reallotment schemes further inland will do so. Partial compensation may result from a sowing programme which was started on the Middelplaten State Reserve in May 1964. This reserve has been created in the former tidal zone of the Zandkreek, the first estuary closed as part of the Delta Project. It is the first case where such a sowing programme has been brought into practice. On 4th January 1965 some 600 geese (Bean, White-fronts and Barnacles) arrived, the numbers rapidly building up to well over 2000. On 13th January the flocks departed, after all the food had been

consumed. Taking into account that the turf was still in its initial state of development, the result seems encouraging.

We have found that drainage and reallotment schemes are affecting the wild geese especially by causing an increase of disturbance. Hence a possibility of compensation for loss of feeding grounds may be found by the reduction of disturbance elsewhere. This has proved to be successful in the case of the private reserve of Count Lippens and others between the village of Damme and Bruges (Belgium), where all goose shooting has been stopped since 1959 and wild geese, especially Whitefronts, have increased from a few hundreds to several thousands. The creation of this reserve came just in time to cope with the permanent loss of an important goose feeding area in the near vicinity in the Netherlands (Suetens, 1961)

5. Pink-footed Goose

The prospects for the Pink-footed Goose area in Friesland have been discussed in detail by Den Daas (1963). His recommendations are the following: (a) total stop of shooting at and near the roost on the Idsegaster Poel (roost No. 28); (b) a feeding area of some 5 sq. km. within 3–10 km. of the roost should be managed in the present state; (c) in case jetcraft activities may be increased, flying under 750 m. should be prohibited.

6. Bean Goose

The prospects for the Bean Goose are relatively good. Large-sized arable fields cover wide areas within flighting distance from the present roosts. The only unfavourable aspect is a strong tendency among farmers in the regions visited by the Beans to switch from the usual crops to orchards and the acreage of the latter is rapidly increasing. As far as can be foreseen these developments are not likely to become a menace for the species.

Generally speaking the non-specialists (Whitefront, Pinkfoot and Bean) and probably also the Greylag and perhaps even the Barnacle, could be helped greatly by reducing the disturbance caused by indiscriminate shooting. In this way a considerable degree of tameness might develop in these species and this might increase the number of areas accessible for them. The readiness of a number of wild fowlers to co-operate gives good prospects for the future.

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