The habitat and dietary preferences of Dark-bellied Brent Geese and Wigeon in relation to agricultural management

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Introduction

Eelgrass *Zostera spp*, found on coastal mudflats is the traditional food of the wildfowl Wigeon *Anas penelope* and Dark-bellied Brent Goose *Branta b. bernicla* (Ranwell & Downing 1959). During the 1930s, however, *Zostera* was attacked by a 'wasting' disease associated with, if not caused by, the mycetezoan *Labyrinthula spp* and the species went into rapid decline over the whole of its Atlantic and Pacific range (Ogilvie & Matthews 1969).

Glegg (1943) reported a decline in Wigeon during the 1930s, but concluded that this was not caused by a decrease in Zostera and that Wigeon were adaptable enough to survive the decline of their main food plant. Numbers of Wigeon in Britain have not changed markedly during recent years, but there has been some redistribution, chiefly involving the colonization of inland sites. A change in feeding habitat has been associated with this movement, mainly to managed grasslands and sometimes to arable land (Owen & Williams 1976).

Atkinson-Willes & Matthews (1960) demonstrated that the Dark-bellied Brent Goose declined to some 25% of its pre-1930s level, and Ogilvie & Matthews (1969) attributed this to the reduction in *Zostera* noting, in addition, that the species still had not increased to its former abundance by 1969.

From 1973–1974, large numbers of Brent Geese were noted 'field feeding' on agricultural land. This adaption by the geese opened up potentially unlimited food supplies for them at a time when it seemed as though resources of *Zostera sp* and *Enteromorpha sp* were being fully exploited (Ogilvie & St Joseph 1976).

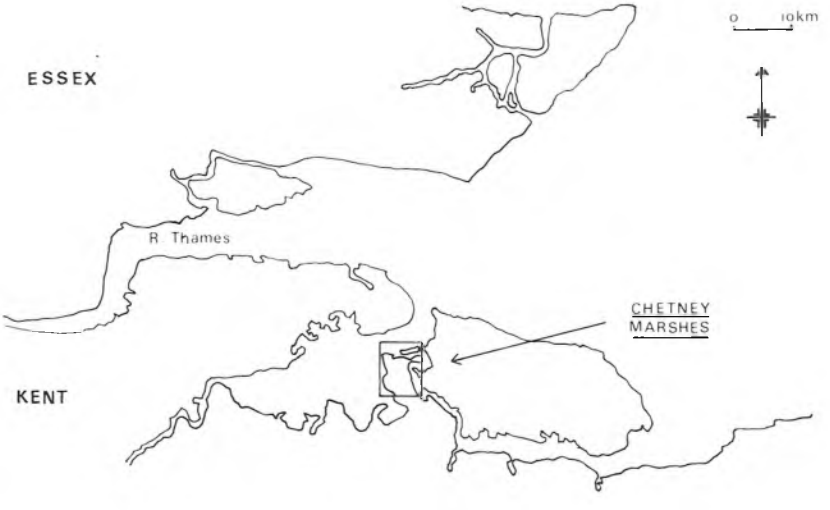
This paper attempts to relate the habitat and dietary preferences of the Dark-bellied Brent Goose and Wigeon to agricultural management at Chetney Marshes, a peninsula of some 525 ha about 5 km due north of Sittingbourne, Kent (Figure 1).

Methods

The study area (Figure 2) was visited up to three times per week between the last week of November 1978 and the first week of May 1979. During each visit Dark-bellied Brent and Wigeon were counted and their distribution noted.

Droppings were collected whenever the species producing them could be identified. Only fresh droppings from settled flocks were taken. The faeces were analysed using a modification of the technique

Figure 1. Map showing study area.



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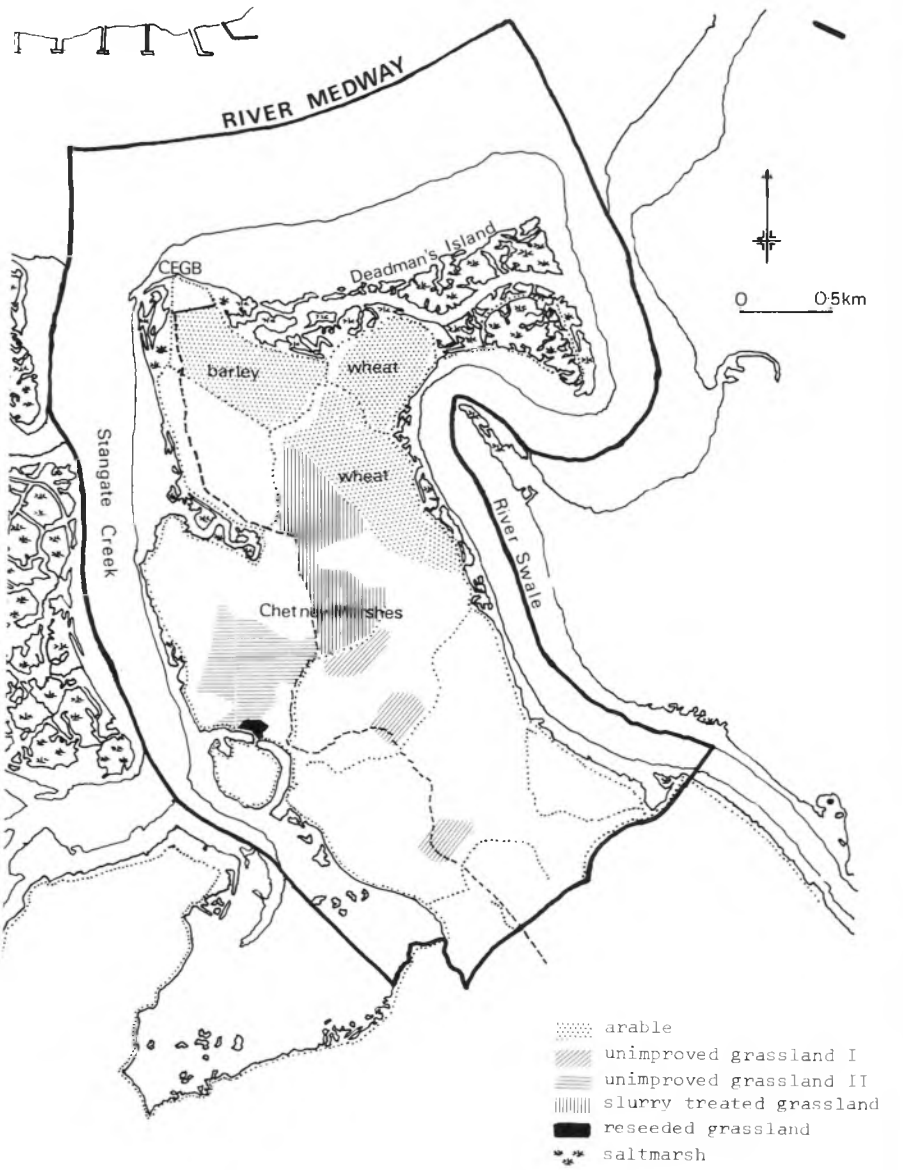

Figure 2. Map showing the habitat and sward types of Chetney Marshes, Kent. Bold line = bird count area, dashed line = metalled road, and dotted line = sea and counter walls.

outlined by Owen (1975a). Each sample was well mixed with formalin and two sub-samples prepared from each, grass fragments being spread on to a glass slide such that they covered as much of the area as possible without overlapping. The species of most grass fragments could then be determined by the characteristics of their epidermal cells, and a 'point' quadrat method used to sample the slide. A transect was taken at random across the slide and each fragment that was 'hit' by the cross-wires of the microscope was identified, to a total of fifty. If fragments overlapped, only the upper-most was recorded. Fragments of *Lolium perenne* and *Cynosurus cristatus* and those of *Holcus lanatus* and *Hordeum secalinum* were very difficult

to distinguish so the results for these two groups have been combined. It is thought that this method provided a reasonable estimate of faecal composition.

A habitat survey was made of the study area during November, prior to the start of the wildfowl counts. In addition, the swards which had been grazed by Dark-bellied Brent and Wigeon were sampled during May and June. A number of ungrazed, control areas were also sampled. A 25 cm^2 quadrat was dropped at random ten times in each sample area and the percentage cover of all plant species within the quadrat was estimated.

Results

Habitat types

Within the sea-wall, two main habitats were identifiable—arable land and grassland (Figure 2).

There were three arable fields. In the early 1950s, dredgings were pumped onto the field at the north-western end of the peninsula, to raise ground level above that of the water-table. It was converted to arable in 1972, although no tile drainage was installed. Because of this and the silty, structureless nature of the sediment, drainage was poor. The area was planted with winter barley, shoots of which first emerged during December. Rain-water collected in shallow depressions during the early winter; later on, snow-melt and, in January, the topping of the sea-wall by spring tides, caused the area of flooding to become more extensive.

The other two arable fields at the north and east of the peninsula were tile drained during 1978 and planted with winter wheat. The crop first emerged in early February and no surface water collected.

The remainder of the area was brackish-freshwater grazing marsh being utilized by store cattle, a suckling beef herd and sheep. Three main grassland types were identified within this second habitat:

i. Unimproved grassland: Two sub-types were identified. The variation was probably due to past management practices.

(a) Sub-type I: *Agrostis stolonifera, Alopecurus geniculatus* and *Poa trivialis* were dominant. The sward was very tussocky with many dead grass inflorescences and a layer of leaf debris. In contrast to the types below the grasses appeared coarse and yellowed. This area was only lightly grazed by cattle.

(b) Sub-type II: Dominated by *Lolium perenne, Poa trivalis* and the herb *Trifolium repens*. This area had been grazed by cattle more heavily than the above, resulting in a short sward with few tussocks. Again, except beside fleets, the grass appeared dry and yellow.

ii. Slurry-treated grassland: The grass composition of this area was similar to that of the unimproved grassland II, *Lolium perenne* being dominant, with *Holcus lanatus, Poa pratensis* and *P. trivalis* well represented. Sewage slurry spraying started in October 1978 and although it is doubtful that its use had affected sward composition, it helped to produce grass that appeared green and lush throughout the winter. The sewage slurry was supplied by tanker and pumped into a holding lagoon. It was then sprayed on to the grassland, using a tractor and slurry spreader. The sward was fairly short due to the high cattle grazing intensity. Within this area, two sub areas could be identified—one in the south, which was dissected by a number of wide, shallow 'fleets' of flood-water and the second in the north, which was better drained and dry apart from a single steep sided ditch.

iii. Re-seeded grassland: A small area of the eastern peninsula had been re-seeded and had an abundance of *Lolium perenne* and *L. multifolium*. The sward was short and green although sparse.

The habitat composition of the peninsula was, therefore, 91 ha arable of which 36 ha (6·9%) was winter barley and 55 ha (10·5%) was winter wheat. Of the 434 ha of grassland, 27 ha (5·1%) had been treated with sewage slurry, about 2 ha (0·4%) had been re-seeded and the remaining 405 ha (77·1%) was unimproved.

Disturbance

On weekdays the road was in regular use by construction traffic passing to and from an electricity sub-station that was being built at the north-western corner of the peninsula. Farm vehicles used the road at irregular intervals every day. Public access was limited to a single footpath, passing along the southern third of the west and east sea-walls and traversing the marsh along a counter-wall. Members of the public, however, only visited the peninsula infrequently. Wildfowling was limited to up to eight guns along the south-western

third of the sea-wall and, on Saturdays only, up to six guns over the remainder of the study area. No wildfowling took place between 26 January and 7 February when a statutory ban was imposed nor between 14 February and the end of the season on 20 February when a voluntary ban was in force.

Brent Goose flocks soon became accustomed to passing traffic, frequently feeding to within 10 m of the road. They fed close to banks and they often allowed human approach to as close as 50 m before taking to the air.

In contrast, Wigeon were usually feeding well away from the road and banks. Only at weekends, when traffic on the road was at a minimum, did they feed on the south slurry-treated grassland or winter barley.

Habitat preferences

Both Brent Geese and Wigeon showed their traditional preferences for tidal habitats (Table 1). After 28 December 1978, weather conditions deteriorated, particularly on the Continent and a 'hard' weather influx of Wigeon was noted. Conditons became milder during the second half of January, before deteriorating again in mid-February, resulting in a further influx of Wigeon.

Both species began to feed within the sea-wall after the onset of colder weather. Wigeon fed within the sea-wall during the hours of day-light, flighting out to roost on Stangate Creek at night. Generally, they were feeding on the unimproved grassland and the re-seeded grassland (38·6 days/ha), adjacent to shallow fleets. On several occasions at weekends, however, Wigeon were feeding on southern areas of the slurry-treated grassland (518·4 days/ha) and, less frequently, on winter barley (31·9 days/ha), again adjacent to shallow areas of flood-water.

In contrast, Brent Geese were noted both feeding and roosting within the sea-wall and no flighting movements were observed. They showed a clear preference for feeding on all areas of the slurry-treated grassland (68·8 days/ha) and on winter barley (50·9 days/ha). No Brent were feeding on the fields of winter wheat and unimproved grassland.

During the 'field feeding' Brent Geese were joined by up to 127 European Whitefronts *Anser a. albifrons*, two Pink-footed Geese *Anser brachyrhynchus* and a Bean Goose *Anser fabalis*. The pattern of usage of the peninsula by these species was similar to that of the Brent and a single mixed flock was frequently observed.

Faecal and sward composition

The details of the collection of droppings are given in Table 2. Table 3 provides a

Table 1. Abundance and distribution of Brent Goose and Wigeon at Chetney Marshes, 1978–1979. Table excludes counts of birds in flight.

	Nov	December		January			February		March		April			Bird*	
	30	3	17	3	14	28	11	25	11	25	8	18	29	Days	%
BRENT GOOSE															
Unimproved grassland I & II	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0
Slurry treated grassland	—	—	—	—	13	21	5	63	26	6	—	—	—	1,856	16·6
Arable	—	—	—	—	—	7	100	25	—	—	—	—	—	1,834	15·4
Marine	13	5	125	40	141	69	32	55	39	20	74	—	—	8,238	69·0
Total	13	5	125	40	154	97	137	142	65	26	74	0	0	11,928	
WIGEON															
Unimproved grassland I & II	4	—	—	56	300	42	28	645	54	17	14	2	—	15,722	16·5
Slurry treated grassland	—	—	—	—	—	9	228	755	6	—	2	—	—	13,996	14·7
Arable	—	—	—	—	—	—	—	22	40	20	—	—	—	1,148	1·2
Marine	50	41	295	1,345	585	540	481	115	1,151	84	—	—	—	64,332	67·6
Total	54	41	295	1,401	885	591	737	1,537	1,251	121	16	2	0	95,198	

* 'Bird Days' are calculated by multiplying the average of two successive counts by the number of days between them and totalling the result.

comparison of the results of the sward and faecal analyses.

i. Brent Goose: Whilst feeding on the slurry-treated grassland, they showed a preference for feeding on *Cynosurus cristatus/Lolium perenne*, species equally well represented in the sward. *Holcus lanatus/Hordeum secalinum* were much less favoured although relatively abundant in the sward. *Agrostis stolonifera* and *Festuca rubra*, however, were well favoured. No herbaceous species were found in the diet, a marked contrast to the Barnacle Goose *Branta leucopsis* that derives much of its

Table 2. Dates of collection of droppings.

	Date	Site	Number collected	Flock size
BRENT GOOSE	14 Jan 79	North 'slurry treated' grassland	25	13 *
	28 Jan 79		50	21 *
	28 Jan 79	South 'slurry treated' grassland	50	21 *
	11 Mar 79		50	26 *
WIGEON	7 Feb 79	Unimproved grassland I	50	c140
	11 Feb 79	South 'slurry treated' grassland	50	c150

* Indicates that the samples were combined for the purposes of the analysis.

Table 3. Comparison between sward and faecal analyses. A dash indicates absence; a plus sign that the species was recorded only in small quantities.

	BRENT GOOSE				WIGEON			
	N. slurry treated grassland		S. slurry treated grassland		S. slurry treated grassland		Unimproved grassland type I	
	Faeces	Sward	Faeces	Sward	Faeces	Sward	Faeces	Sward
	% Frequency				% Frequency			
GRASSES								
Agrostis stolonifera	16·5	4·25	16·25	2·0	17·0	2·0	8·0	24·5
Agrostis tenuis	—	—	—	0·75	—	0·75	—	—
Agropyron repens	2·0	—	6·0	—	6·0	—	1·0	—
Alopecurus genic.	10·0	0·50	3·5	—	5·0	—	6·0	12·5
Arrhenatherum elatius	—	0·50	—	—	—	—	—	—
Cynosurus sp/Lolium sp	36·5	32·25	30·5	32·0	33·0	32·0	59·0	15·0
Dactylis glomerata	—	8·75	—	5·25	—	5·25	—	8·5
Festuca rubra	9·0	2·25	12·5	1·5	4·0	1·5	1·0	1·0
Holcus lanatus/Hordeum sec	12·5	33·00	11·5	21·0	24·0	21·0	6·0	26·0
Phleum pratense	2·5	—	8·5	—	7·0	—	8·0	2·5
Poa pratensis	6·5	10·00	5·5	19·25	1·0	19·25	3·0	10·0
Poa trivialis	2·0	—	3·0	8·25	—	8·25	—	+
HERBS								
Achillea millifolium	—	—	—	3·0	—	3·0	—	—
Cerastium sp	—	0·25	—	+	—	+	—	—
Cirsium vulgare	—	+	—	—	—	—	—	+
Lotus corniculatus	—	—	—	0·25	—	0·25	—	—
Plantago lanceolata	—	+	—	+	—	+	—	—
Ranunculus repens	—	+	—	—	—	—	2·0	+
Rumex acetosella	—	—	—	+	—	+	—	—
Taraxacum sp	—	+	—	+	—	+	—	—
Trifolium repens	—	4·50	—	1·25	—	1·25	—	+
Unidentified sp	—	+	—	—	—	—	—	—
MOSSES	—	0·75	—	0·5	—	0·5	—	—
BARE GROUND	—	3·00	—	4·75	—	4·75	—	—
UNIDENTIFIED	2·5	—	2·5	—	3·0	—	3·0	—

food requirements from clover *Trifolium spp* stolons (Owen & Kerbes 1971).
ii. Wigeon: When feeding on the slurry-treated grassland, they also showed a preference for feeding on *Cynosurus cristatus/Lolium perenne* and in contrast to the Brent, *Holcus lanatus/Hordeum secalinum. Agrostis stolonifera, Agyropyron repens, Alopecurus geniculatus* and *Phleum pratensis* also seemed to be favoured. *Poa pratensis, P. trivalis* and *Dactylis glomerata* were selected against, although relatively abundant in the sward.

While grazing on the unimproved grassland I, an even more noticeable preference was shown for *Cynosurus cristatus/Lolium perenne*; grasses relatively poorly represented in the sward. Species such as *Agrostis stolonifera* and *Holcus lanatus/Hordeum secalinum* were disfavoured.

Wigeon were also noted feeding on the unimproved grassland II and the re-seeded grassland, but no droppings were collected from these areas for analysis.

Discussion

The increase in the numbers of Brent Geese feeding on agricultural land has inevitably caused some discontent amongst farmers, a number of whom feel that the goose should be removed from the protected list to allow shooting (Ogilvie & St Joseph 1976; Anon 1980). So far this demand has been averted, but if geese are to be kept from feeding on arable crops, it is essential that grassland areas are managed in such a way as to provide a suitable and preferably more attractive alternative.

Although both Brent Geese and Wigeon only began to feed within the sea-wall after the onset of colder weather, it is not clear whether this was a response to the colder conditions or to a shortage of estuarine foods.

Brent Geese chose to feed on fertilized, slurry-treated grassland or arable land as opposed to unfertilized, unimproved grassland. The preference of a goose species for feeding on fertilized grassland in preference to unfertilized grassland has also been demonstrated by Owen (1975b) who discovered that White-fronted Geese at Slimbridge used fertilized plots in preference to unfertilized plots and that these preferences were entirely due to the increase in the nutritive value of the grass.

The ability of Brent Geese to become habituated to repetitive sources of disturbance, as was noted on Chetney, has also been shown by Owens (1977), although unexpected disturbances usually put the geese to flight. He also noted that Brent at Leigh Marsh, Essex, fed undisturbed 50 m from passing trains.

In contrast, disturbance appeared to be the major factor controlling the distribution of feeding Wigeon. Although the species showed a distinct preference for feeding on the fertilized slurry-treated grassland, an intolerance of disturbance led them to feed on the less disturbed, but nutritionally poorer unimproved grassland.

Olney (1965) analysing 112 Wigeon guts, from the Chetney area, noted that grass, *Potamogeton* leaves and algae were the most important constituents of the ducks diet, both in terms of frequency of occurrence and volume. Seeds made up to 10% of total volume, but no animal foods were found. Observations around Chetney showed that most Wigeon feed on pasture and in ditches, the remainder using the intertidal zone and saltmarshes. Owen (1973), however, illustrated that Wigeon at Bridgwater Bay, Somerset, selected for *Puccinella maritima* and *Agrostis spp.* in preference to *Festuca rubra.* He concluded that the basis for this food selection by Wigeon was partly explained by the first two species having higher nutritional values than the last. Other factors, such as digestibility and physical characteristics may also play a part. Here too, disturbance was an important factor affecting the availability of feeding habitat and it could mask the birds' food preferences.

This study would suggest that disturbance and the nutritional value of grassland can be identified as the two main factors controlling the distribution and availability of grazing for Dark-bellied Brent and Wigeon.

The application of nitrogenous fertilizers increases both the water and protein content of grass (Harwood, 1975). Wildfowl may be able mechanically to select for grasses with a higher water content, which are coincidentally of a higher nutritional value, in preference to those with a lower water content (Owen, Nugent & Davies 1977). Thus the application of fertilizer increases the overall palatability of grassland and may also improve its value for feeding wildfowl by changing the species composition of the sward towards the finer, more nutritious grass species such as *Lolium perenne* and *Agrostis stolonifera* (Owen 1973).

The use of sewage slurry as fertilizer appears to be particularly attractive since it provided a cheap source of nitrogen and helped to solve a waste-disposal problem. In addition, it did not intrude upon what farmers might regard as 'good' agricultural practice. Careful monitoring, however, is required to ensure that the application of slurry does not result in toxic concentrations of heavy metals such as copper from building up in the soil.

A further secondary factor limited the areas of grassland available to feeding wildfowl. Large areas of the unimproved grassland were very lightly grazed and this resulted in a tussocky rank sward. Both Brent Geese and Wigeon avoided such areas, perhaps due to the unpalatability of the grass and because the presence of tall grass inflorescences and large tussocks restricted movement, thus reducing feeding efficiency.

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Summary

The habitat and dietary preferences of Dark-bellied Brent Geese *Branta b. bernicla* and Wigeon *Anas penelope* on Chetney Marshes, Kent, were established and related to the agricultural management of the peninsula.

Faeces were collected from several areas of Chetney and analysed. The habitats of the area were surveyed and the sward composition of three main grassland types identified. Faecal and sward composition were compared and the grazing preferences for the various habitats established.

The study showed that in the Chetney area, Brent Geese and Wigeon preferred to feed in intertidal habitats. Approximately two-thirds of usage was in marine environments. When feeding on land both Brent Geese and Wigeon showed a preference for fertilized, slurry-treated grassland. The Brent Goose showed a greater tendency for feeding on arable land than did Wigeon. The feeding distribution of Wigeon, however, was modified by their intolerance of disturbance.

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