Field feeding by dabbling ducks around the Ouse Washes, England

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Introduction

Field feeding has long been known amongst waterfowl and has been reviewed in North America by Bossenmaier and Marshall (1958) and in Britain by Kear (1963). Ducks usually feed on waste crops which may be attractive because they are nutritious, large, easily gathered in a short time or because natural foods may be unavailable or present in lower amounts.

Olney (1964) recorded barley *Hordeum vulgare* as the only cereal taken by Mallard in coastal south-east England as does Street (1975) for an inland area in central England. The latter records potatoes as an important food. Olney (1967) records both barley and wheat *Triticum aestivum* being taken by small numbers of Mallard at an inland area in Kent. Olney (1963) records small numbers of Teal taking both barley and wheat grains in Britain and stated that they rarely flight to stubble fields.

Between 1970 and 1975 the Ouse Washes supported average autumn/winter maxima of 35,700 Wigeon *Anas penelope*, 4,900 Mallard *A. platyrhynchos* and Teal *A. crecca*, 2,520 Pintail *A. acuta*, 770 Shoveler *A. clypeata* and 70 Gadwall *A. strepera* (Thomas 1978). For some part of the autumn/winter the fields outside of the Ouse Washes were important feeding areas for large proportions of the populations of these ducks, excepting those of Shoveler and Gadwall. Owen & Cadbury (1975) show that Bewick's Swans *Cygnus columbianus bewickii* too were becoming increasingly dependent on field foods in this period.

Ducks feeding on stubble grains and waste potatoes *Solanum tuberosum* may help farmers in clearing up unwanted crops and may help rid fields of Potato eelworm *Heterodera rostochiensis*. Kear (1963) notes that ducks effect a quicker return of organic matter and minerals to the soil than would otherwise occur.

Most farmers around the Ouse Washes regard the field feeding of ducks as unharmful to their interests. However, in 1972 there were complaints from four farmers that ducks dug up, trampled and overgrazed germinating winter wheat *Triticum aestivum* from January to March which would cause reductions in yield. In one case, a delay in harvesting and extra expenditure was forecast.

Methods

The foods taken by ducks between September and January 1969–73 were determined by gut analysis of birds shot at the Ouse Washes, usually at dawn or dusk, by local wildfowlers.

The fields used by ducks in the last half of the winter were determined by counts carried out along 76 km of roads on 16 days in February and March 1970, and on 18 days between January and March 1972. No detailed counts were carried out in autumn because birds were surprisingly difficult to locate from roads at this time. Several complete days of observations were carried out noting the flighting patterns of ducks to and from the farm fields.

Duck numbers were amassed for the four fields where damage was alleged. At least 30 sites along a diagonal transect were examined in each field and for a control field which no ducks visited (next to a house) with a 0·5 m^2 quadrat gridded into 25 dm^2. In each dm^2 the presence or absence of animal droppings, grazed wheat leaves and trampling was scored. The latter two were assessed as nil, light and heavy. All potato tubers and stems in the quadrats were collected to estimate their availability. All fields were generally scrutinized for signs of digging, grazing and trampling. The wheat yields from each of the four fields and on the remainder of each farm were obtained from farmers at harvest time.

Historical resumé of local agriculture and field feeding

In the undrained fens (pre 1650) there was a little summer grazing and very limited amounts of arable land in the drier parts (Thirsk 1953). Waterfowl must have largely depended on natural foods. In the partly drained fens (1650–1825) pastoral and ar-

able farming became more widespread, the former predominating. Barley and oats *Avena sativa* were grown in the spring if the ground was dry enough. Their stubbles would have been available to Mallard and other waterfowl. Wigeon would have been able to graze pastures into the spring.

Pastoral farming declined and arable increased when the fens were substantially drained (1825–1939). Wheat became a major crop at the expense of oats. Potatoes, first cultivated around 1860 (Heathcote 1876), were extensively grown by 1918 (Kear 1963) and probably became part of the regular feeding cycle of the Mallard in the 1920s. Sugar beat *Beta vulgaris* was first grown in about 1930.

Since 1940, when the fens have been almost completely drained, about 92% of the land around the Ouse Washes has been devoted to arable: 49% of this to cereals, mainly winter wheat and spring barley and 30% to 'roots', chiefly potatoes and sugar beet (Stears 1965). The four-and five-year crop rotations of the previous era have been abandoned and a simplified three-year rotation instituted: year 1, potatoes or sugar beet; 2, winter wheat; 3, winter wheat or barley. The barley acreage has almost doubled between 1950 and 1970 whilst wheat has remained constant; potatoes dropping by about a third, mainly giving way to sugar beet (Table 1).

Local ornithologists first noticed Wigeon, Pintail and Teal field-feeding in the mid-1960s. The cold conditions at these times may have forced the birds out of the Ouse Washes, but these observations also coincide with an increased usage of the Washes (Thomas 1978). Field feeding by Pintail does not appear widespread in Britain although it is well known in North America (Bossenmaier & Marshall 1958). Dementiev (1952) does not mention it in Russia.

Availability of field foods

Germinating winter wheat usually has 4–5 leaves by the end of January. Barley is not sown until spring and germinates after wintering ducks have left. Both cereals are harvested from the end of July and in most years are gathered in by the first week of September. Some 2 to 4 cwt of grains/acre (251–502 kg/ha) remain in the stubbles after harvesting. Most fields are burnt to rid them of excess straw before they are progressively ploughed up, usually by the end of November.

The main potato harvest commences in October and waste tubers then become available. Further tubers are exposed while the fields are being tilled for other crops. The amount of tubers wasted varies considerably, depending on disease and weather at harvest, but at least 10–12 cwt/acre (1255–1506 kg/ha) are left, some of which remain buried below the soil surface.

Foods taken by ducks—September to January

The monthly frequencies of field foods in the guts of 380 Mallard are given in Table 2. Thus, 170 (45%) contained them accounting for 92% of the total food weight. There was a preference for feeding on stubble wheat (September) before barley (October/November) (χ^2 $p < 0{\cdot}001$), in each of the three autumns. The average dry weight of grain per gut was 15 g for wheat (range 0·1–51·5 g) and 22 g for barley (0·1–75 g). The frequency of potatoes in guts increased from October to January, coinciding with their availability after harvest. The average dry weight per gut was 7·8 g (0·1–22·6 g). Germinating winter wheat leaves, about 1 cm long, were taken in small amounts in January. The November record was probably of germinating stubble grains. There was only one record of sugar beet roots being taken by Mallard or any other duck.

Of the 89 Pintail guts, 24 (27%) contained field foods which accounted for 88% of the total food weight. Wheat was found in four guts, barley in ten, potatoes in ten

Table 1. Area (ha) of three crops in Isle of Ely 1950–70.

	1950	1955	1960	1965	1970
Wheat	24,594	23,795	26,454	23,903	23,273
Barley	4,737	6,932	7,914	9,774	11,237
Potatoes	18,418	15,457	15,019	12,801	11,595

Data provided by M.A.F.F. (March Branch)

Table 2. Monthly frequency (and %) of field foods in 380 Mallard guts.

n guts	Sept 92	Oct 56	Nov 73	Dec 75	Jan 84	Totals 380
Wheat (grain)	41(45%)	9(16%)	12(16%)			62(16%)
Barley (grain)	7(8%)	26(46%)	19(26%)			52(14%)
Oats (grain)			2(3%)			2(1%)
Potato (tubers)		4(7%)	12(16%)	14(19%)	29(35%)	59(16%)
S. Beet (roots)					1(1%)	1 –
Wheat (leaves)			1(1%)		14(17%)	15(4%)
No. with field foods	48(52%)	37(66%)	38(52%)	14(19%)	33(39%)	170(45%)

and wheat leaves in two. The seasonality of the foods was similar to that of Mallard. Of samples taken between September and November, 14 out of 23 contained cereal grains and 10 out of 66 samples in December and January contained potatoes. The average amount per gut was 10 g for wheat (range 0·2–21·8 g), 13·7 g for barley (0·2–38·5 g) and 3·7 g for potatoes (0·1–16·4 g). Most of the guts with potatoes contained skins and the digested contents of large tubers, probably broken down by frost. Two birds in January contained three small potatoes which had been swallowed whole: the largest was 3 × 2 cm.

Cereal grains were the only field foods recorded in 27 (10%) of 279 Teal guts. Barley was found in 18 guts and wheat in 9 and together they formed 50% of the total food weight. Of the 34 September samples, 13 contained grains as did 12 of the 33 October and 2 of the 54 November samples.

Stubble grains were recorded before mid-November in 12 (5%) of the 238 Wigeon guts accounting for 56% of the total food weight. Barley was present in all 12 and wheat in two of these samples. Field foods rank behind many of the foods consumed by Wigeon on the Washes (Owen & Thomas 1979).

Some guts (13 Mallard, 1 Pintail and 11 Teal) containing cereal grains were discarded because they were judged to have been gathered from ponds baited with 'tail' wheat or barley. Such meals were characterized by a low number of cereal grains (1–30) and large amounts of arable weed seeds such as black bind weed *Polygonum convolvulus*, persicaria *P. Persicaria*, fat hen *Chenopodium album*, goosegrass *Galium aparine* and large-flowered hempnettle *Galeopsis speciosa*. Grains consumed from stubbles were characterized by the large number present in the guts, their dryness, and, in 18 Mallard, 5 Pintail and 18 Teal guts, charring as a result of stubble burning.

The proportion of field foods by dry weight are all greater than their frequencies of occurrence. This is because of their high dry weight, and the ease and rapidity with which they are ingested. Feeding on grass and other seeds is less intensive and takes longer and these foods were usually found to have been ingested in smaller amounts.

Numbers of ducks and fields visited January–March

Figure 1 gives the location of flocks noted from the roads. They ranged up to about 5 km from the Washes but 80% were recorded within 2 km. The flock encounters and flock sizes seen in fields are given in Table 3. Fields were usually used for only a

Table 3. Flocks of ducks in fields, Jan–March 1970–72.

	Flock encounters	Av. size	Smallest	Largest
Mallard	147	56	1	1,050
Pintail	53	37	1	300
Wigeon	33	331	1	4,500
Total flock encounters	151	142	1	4,500

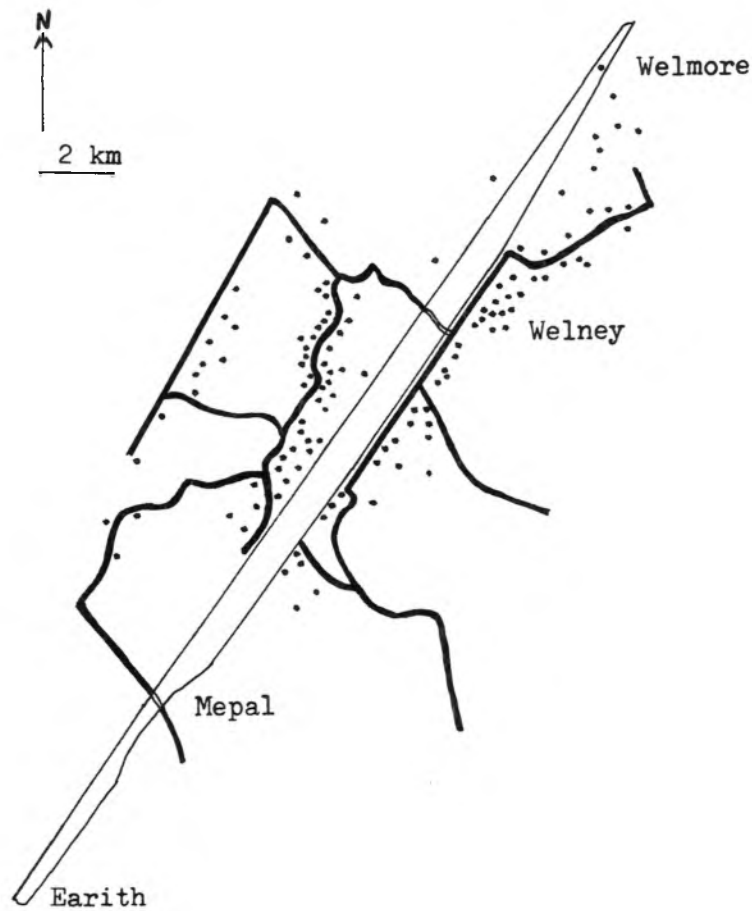

Figure 1. Fields used by ducks in 1970–72 as seen from roads.

part of the winter. Of 64 known to have been used, 69% were used for up to a week, 25% for 1–4 weeks and the rest for up to 6 weeks.

Of 46 fields used by ducks in 1972, 30 contained germinating winter wheat which had followed a potato crop of the previous year. This stage of the rotation provides two food sources: potatoes, which are eaten by Mallard and Pintail, and winter wheat leaves, eaten mostly by Wigeon.

The species composition of 151 flock encounters is shown in Figure 2. Mallard were in 147 (97%) and 84 (56%) were exclusively Mallard. Only two pure flocks of Pintail and two of Wigeon were seen. Otherwise they were in mixed flocks with Mallard. Winner (1959) points out that there is a similar relation between Mallard and Black Ducks *Anas rubripes* in North America.

Feeding methods

Mallard were seen to pick individual grains, but not whole ears of grain. Parts of a few ears of wheat and barley were found in gut contents.

Small potatoes up to about 3 cm across were swallowed whole by Mallard and Pintail after manipulating them in their bills. Both species bit off pieces of larger potato. Kear (1963) showed that the size of the nail on the upper mandible enables Mallard to bite off pieces up to 18 mm. Frosted potatoes may be easier to ingest because they are held firmly in the ground and so easier to bite, and softened contents may be easier to ingest. Later in the winter, Mallard and Pintail ate bits of potato skin with little attached to them. Both species ate potatoes with some difficulty and drank at any nearby small pools (e.g.

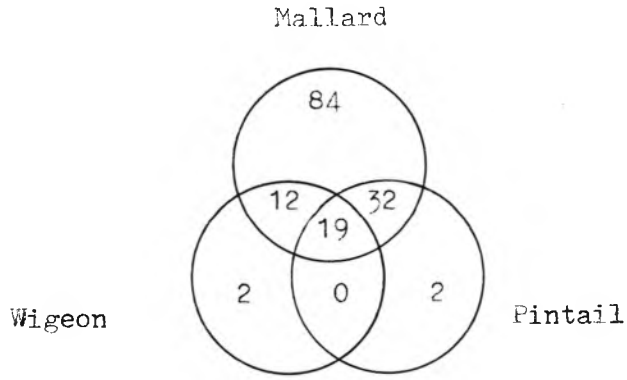

Figure 2. Species composition of 151 flock encounters.

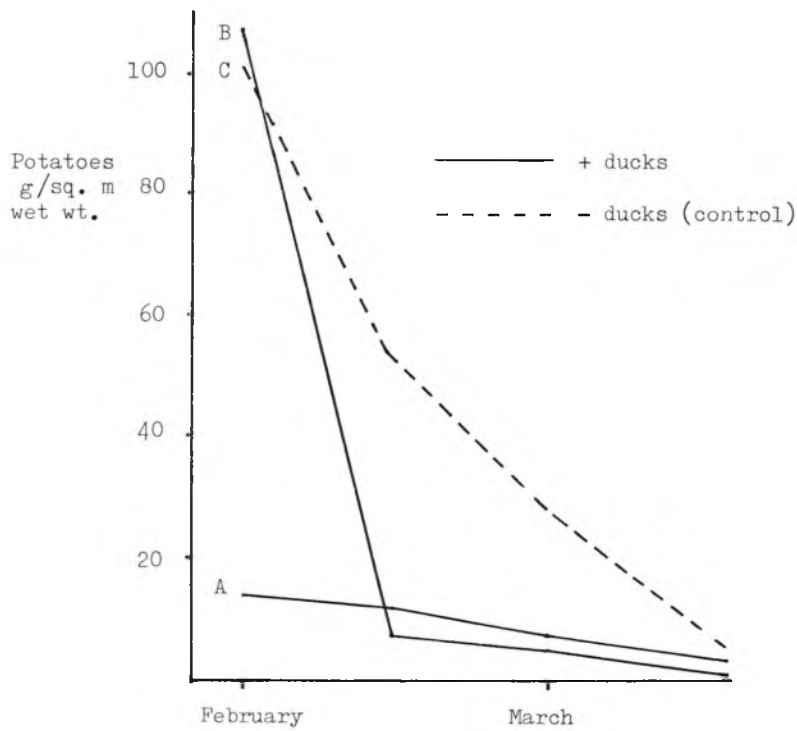

Figure 3. Rate of potato disappearance in 3 fields.

in tractor wheel marks) soon afterwards. The first action of ducks returning to the Washes having fed in cereal fields was also to drink for lengthy periods.

Figure 3 gives the amount of potatoes present in three fields in February and March. Field A had already been visited by Mallard and Pintail since mid-January. The other two fields nearby, hitherto not visited by ducks, contained about 7 times the amount of potatoes. Field B was subsequently used by ducks and the available potatoes soon fell to the value of field A. The control field (C), which was next to a farmhouse, remained unused by ducks and the amount of available potatoes declined more gradually, as the tubers rotted or were eaten by other animals.

Short winter wheat leaves formed the main field food of Wigeon from December

onwards. Typically, they fed in compact groups and did not walk far in a field. Mallard and Pintail would walk over large areas of field, probably in search of potatoes. They occasionally plucked wheat leaves but never as consistently as Wigeon. Wigeon were never seen to eat potatoes.

Figure 4 gives the degree to which wheat was grazed in the same three fields as in Figure 3. The trends were the same in all the fields and there was no measurable difference between grazing in fields used or unused by ducks. Hares *Lepus capensis* and Woodpigeons *Columba palumbus* were probably responsible for much of the grazing. All Wigeon, Woodpigeon and Hare droppings examined were green (composed of wheat leaves) whilst Mallard, Pintail and Pheasant *Phasianus colchicus* droppings were brown (potatoes). Wheat that stood in pools was probably grazed solely by ducks. Rat *Rattus norvegious* grazing was evident in the corners of one field. It was surprising that Mallard did not feed more on freshly discarded sugar beet tops. These may be too tough for them to bite, although Bewick's Swans are able to do so (Owen & Cadbury 1975).

Flighting patterns

The daily flighting of Mallard and Pintail to and from the fields were normally concentrated into two periods, early in the morning and late in the afternoon. The normal pattern seen at the Washes is shown in Figure 5a for a sunny February day with a slight frost (minimum grass temperature −2°C) the previous night. The Washes were about a half flooded. Birds started leaving for the fields before first light and most had left before full daylight. Flights returning from the fields had commenced before daybreak with most ducks returning within an hour of daybreak.

The afternoon flights to the fields usually commenced about three hours before dark with most birds having departed from the Washes about an hour before dusk. Birds returned from the fields over a three-hour period with the largest numbers returning at or just after dusk. Some returned up to an hour, and on moonlight nights, up to two hours after dark. Birds were never known to stay in fields all night.

At times when the Washes were fully (and in most parts deeply) flooded, or when there were heavy night frosts or under conditions of freezing snow, the flight patterns changed. Figure 5b gives the pattern during a day of freezing snow showers and after a fairly hard night's frost (minimum grass temperature −4°C). This was nine days after Figure 5a, from the same area and with similar Mallard and Pintail populations of about 6800 and 1300 respectively at the Washes. The pattern

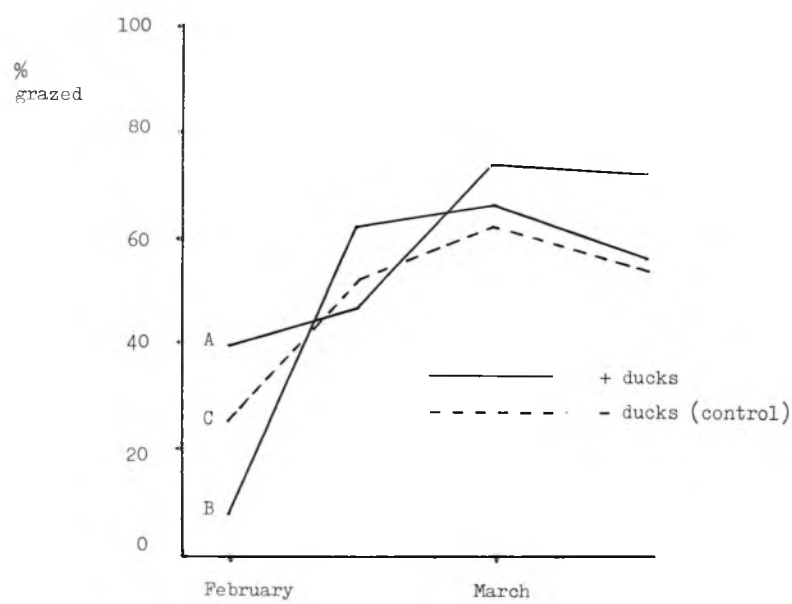

Figure 4. Percentage of samples (300 dm^2 on each date) with grazed wheat in 3 fields.

was similar to that seen during extensive flooding.

The numbers of birds flighting out in the morning were possibly up to six times higher and in the evening three times higher under these adverse conditions. Birds left later mostly some 1½–2 hours after daybreak, but did not return in the normal way. Up to 50 birds per hour continued to leave or arrive back at the Washes for 2 hours either side of noon. The main afternoon flights to the fields commenced up to 2 hours sooner than normal and birds returned earlier than normal.

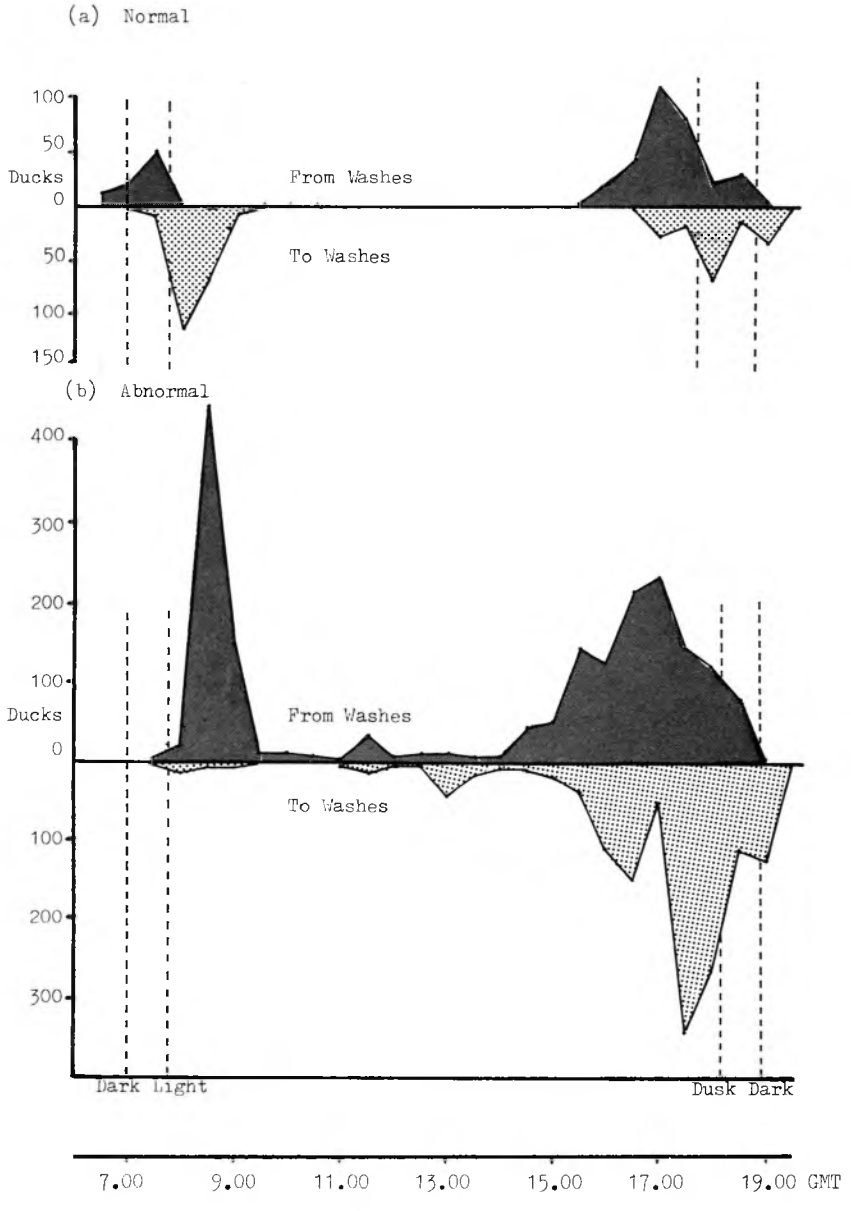

Figure 5. Flighting patterns of Mallard and Pintail.
(a) Normal, (b) Abnormal.

Table 4. Details of 4 fields where duck damage was alleged: Jan–Feb 1972. M = Mallard, P = Pintail, W = Wigeon.

Fields	Area (ha)	Distance from Washes (km)	Approx usage (duck days/ha)	Duck activities dig	tramp	graze	Farmers' action	Wheat yield (cwt/acre) on field	rest of farm
1. Wheat following Potatoes	33	4·9	49-mainly M.P.	–	–	29% light	Shooting after 4 days—ducks did not return	42	19–51
2. Wheat following Potatoes	3·2	0·8	2500-mainly W.	–	+	87% heavy	Shooting after 4 days—ducks did not return	46	45–50
3. Wheat following Potatoes	40	4·4	250-mainly M.P.	–	+	73% light	Shooting after 28 days—ducks did not return	48–51	48–51
4. Wheat following Sugar Beet	8	3·2	62-mainly M.P.	–	–	none evident	None	30	30–39

In Figure 5b, more ducks (c. 1,100) were seen returning from, than flew out (c. 900) to the fields in the afternoon. Some may have spent all day in the fields. On this day up to 1,240 Mallard and 320 Pintail were seen on six fields at various times from 10.00 hours to 18.00 hours.

On foggy mornings flights to the fields were delayed until full daylight. Sometimes, quite inexplicably, there would be no morning flight at all but followed by a normal afternoon one.

Wigeon parties flying to fields usually did so in late morning or early afternoon with no obvious timing. They seemed more affected by the degree of flooding on the Washes, as this submerged their grass food.

Alleged duck damage to crops

Table 4 gives some details from the fields where duck damage was alleged. 'Field 3' was made up of three smaller units. The fields where ducks were seen were attractive because they:

1. were isolated and relatively undisturbed. They were at least 1 km from human habitation.
2. were large, or part of a series of small fields separated only by ditches, thus having good vistas.
3. contained sought-after foods.
4. held water in tractor wheel marks or in badly drained areas.

Duck trampling was apparent in two of the four fields involving areas of 2 sq m and 30 sq m near pools.

The heavily trampled areas were devoid of any visible wheat leaves and stems and there was only a half the amount of potatoes and skins available (7·9 g/sq m) as in the rest of the field.

Most of the grazing recorded in fields 1 and 3 (Table 4) was light, usually 1–3 leaves grazed with a dm^2. However, grazing in field 2 which had been visited by Wigeon, was heavy, plants had been grazed down uniformly from about 7 cm to about 3 cm over about a half of the field.

Ducks were not observed to dig up grains and no evidence of such practices was found during field searches. Pheasant digging and scratching was noted in three of the four fields and Hare digging in one field.

Three of the four farmers dispersed the ducks by shooting over the fields on one occasion only. A farmer of another field displaced several thousand Wigeon which had been grazing a field for 3–4 days by tying coloured plastic sacks onto posts.

As seen in Table 4, the yields of the duck-used fields were satisfactory and in keeping with yields from the remainder of each farm. The heavy grazing on field 2 did not mean a reduced yield or a delay in the time of harvest. The heavily trampled areas in field 3 contained shorter stemmed wheat in the spring but by harvest time it resembled the rest of the field. Allegations of duck damage to crops were thus largely unfounded, in the cases investigated. Trampling, although not widespread and serious on this occasion, could be more so if duck usage was heavier, and occurred in wetter conditions or after March (when most wintering wildfowl have left). This would tend to promote weed growth, cap the soil and may inhibit germination, as has been noticed in some other cases of wildfowl damage (Owen & Thomas 1975).

Discussion

Field foods alongside the Washes are important sources of foods for Mallard, Pintail, Teal and Wigeon. About a half to two-thirds of the autumn Mallard gut samples contained waste cereals as did about a third of the Teal. At times during the winter, probably at least a third of the Ouse Washes' Mallard and Pintail regularly visited old potato fields with a smaller proportion of the Wigeon population joining them to graze on germinating winter wheat.

Among the ducks, Mallard showed the greatest flexibility in exploiting the field foods, probably because most were local birds familiar with the range of feeding opportunities. Ten Mallard guts contained two or more field foods (oats, wheat and/or barley), almost certainly gathered by visiting several fields in one foray.

Mallard, with established feeding areas, probably attract in Pintail and Wigeon. If Mallard started eating old sugar beet roots one would expect Wigeon to follow them into these fields but to feed on the leaves of cereals, which are usually the next crop in the rotation. There does not seem any reason why Teal, Wigeon and Gadwall should not capitalize on potatoes. All walk well on land and they should have no difficulty in searching for them. Apart from one record of four Shoveler feeding at a disused potato clamp, there have been no field feeding records for this species, nor for Gadwall.

The potential of the fens for field feeding ducks was recognized by Matthews (1956) who commented on the ample food supplies that were unexploited because of the lack of large undisturbed wildfowl roosts. The establishment of refuges at the Washes has meant that undisturbed roosts have been set up alongside both the feeding areas of the Washes and surrounding arable fields. This is clearly seen in the autumn when flocks of up to 2,000 Mallard loaf on the well-grazed fields within the refuges. Their droppings at this time are almost entirely composed of cereal grain debris.

The linear shape of the Washes (Figure 1) means that there are about 44,000 ha of fields within 5 km for birds based there. This is about 2·4 times greater than would be available if the Washes were a square of the same area. The ducks do not have to fly to such distances as the 15 km reported for Teal (Tamisier 1972) and Wigeon (Owen 1973) and 20 km for Mallard (Bossenmaier and Marshall 1958).

Assuming that Mallard need about 113 g (10% of body weight) of food per day and that 3 cwt/acre of waste cereal grains are available after harvest and that stubbles are ploughed up at an even rate, there are enough grains to support about 672 duck days/acre (1,660/ha) from the beginning of August to the end of October. Calculations from Figure 3 show that 7·9 cwt/acre (991 kg/ha) of potatoes are available, enough to support 3,203 duck days/acre. Given these figures, about 75 million duck days are sustainable on post-harvested cereal and potato fields in the 44,000 ha. Even if all the Mallard and Pintail are wholly feeding in the fields, only about 1% of the available cereals and potatoes are at present eaten by them. It does seem that the carrying capacity of the area for ducks could be increased if they had more safe roosts from which to operate.

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Summary

Around the Ouse Washes wheat *Triticum aestivum*, barley *Hordeum vulgare*, and potatoes *Solanum tuberosum* are the main field crops. Mallard *Anas platyrhynchos*, Pintail *A. acuta*, Teal *A. crecca* and small numbers of Wigeon *A. penelope* feed on stubble grains in the autumn. In the winter the first two feed on waste potatoes and Wigeon graze on winter wheat leaves. The ducks range freely over fields up to 5 km away, usually two-thirds of the fields being used for only up to a week. The favoured stage of the crop rotation was sprouting winter wheat following an old potato crop.

Mallard and Pintail usually flighted to the fields before it was light and returned to the Washes just after daybreak. Another flight occurred in the late afternoon with birds returning at or just after dusk. Wigeon mostly flighted during the day. The largest number of ducks used the fields when there were adverse feeding conditions on the Washes, especially under high flooding and freezing conditions.

Allegations of duck damage to crops were largely unfounded in the cases investigated. Yields of winter wheat in fields visited by ducks were comparable to the crop in the remainder of the farm. Trampling was confined to small areas around temporary pools. Dispersal of flocks was affected by shooting over fields on single occasions.

Only a small proportion of the available foods were consumed. With more refuges it is almost certain that the carrying capacity of the area would be increased with other species feeding on the fields even if only on a seasonal basis.

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