# The food habits of a hand-reared Mallard population

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## Summary

A STUDY of the food habits of a hand-reared Mallard population was made after they had been released into the wild. This was based on 77 birds obtained during the four shooting seasons of 1958-62 from a 6 acre lake within a private estate near North Frith, Kent. A number of conclusions were reached. a) From a survey of the flora of the immediate vicinity and from stomach analyses it became obvious that a good deal of their diet was made up of naturally occurring plant seeds, even though grain was being fed to them throughout the period of observation. b) Three species, oak *Quercus robur*, bur-reed *Sparganium erectum* and hornbeam *Carpinus betulus* were eaten more frequently and in greater volume than any other food item. c) Yearly differences in feeding habits became apparent, particularly in 1959 when virtually no *Quercus* seeds were produced and in consequence comparatively more grain was eaten. d) There were also obvious differences in feeding habits as the season progressed. Cereal grain formed the principal food item during September, when the main naturally-occurring plant species had not yet ripened seed, and during the latter months of the survey when the bulk of the natural foods had been eaten. During October, November and December *Quercus* formed the main food, with *Sparganium* seeds being taken in each month though proportionally more were eaten during October and November, and *Carpinus* seeds only being eaten from October onwards. This corresponds to their periods of greatest abundance. e) The amount of seed production can be roughly ascertained in September, and then if necessary the amount of grain to be fed can be increased or decreased. It is suggested that the three main plant species, which are the same for similar areas throughout the country, can be actively encouraged and managed.


## Introduction

There is virtually no information available on the food habits of artificially-reared Mallard *Anas p. platyrhynchos* after they have been released. Yet the ultimate success of rearing schemes depends to a large extent on the ability of these birds to adapt themselves to finding and feeding on natural foods.

This survey, based on a sample of artificially-reared Mallard which were released into the wild, shows that a considerable proportion of their diet was obtained from the immediate vicinity, even though grain was still being fed to them.

## Methods and materials

The birds were all obtained from a 6 acre lake within a private estate in North Frith, Kent. From ringing returns this appears to be mainly a sedentary population—at least for the period of sampling, which was confined to the shooting-season months from 1st September to 31st January, and covered the four years of 1958-62. The lake, which has a thick organic mud over clay bottom, has an average depth of three-and-a-half feet (about 1.07 metres) and is divided by a narrow pathway into one large area of 5½ acres and a small pond of ½ acre. The vegetation is typical of a damp oak/hornbeam (*Quercus robur/Carpinus betulus*) wood on a clay soil, with a fairly rich shrub layer dominated by hazel *Corylus avellana* and a rich field layer. The main plant constituents are shown in Table 1, though this must not be accepted as a complete list. The tree layer is dominated by oak, with a smaller number of hornbeam, birch *Betula pubescens* and alder *Alnus glutinosa* trees. The shrub layer has in places a nearly pure stand of hazel, with a number of other species varying in frequency. The field layer has a wide variety of species the frequency of which varies considerably from area to area within the wood. In places bramble *Rubus fruticosus* agg. is dominant, and in other areas stinging nettle *Urtica dioica* and creeping buttercup *Ranunculus repens* with

**Table 1**

Plant species occurring at North Frith, Kent

| | | | | | |
|---|---|---|---|---|---|
| Tree layer: | *Quercus robur* | d | Shrub layer: | *Corylus avellana* | d |
| | *Carpinus betulus* | 1a | | *Crataegus monogyna* | f |
| | *Betula pubescens* | o | | *Prunus spinosa* | o |
| | *Alnus glutinosa* | o | | *Sambucus nigra* | o |
| | *Ilex aquifolium* | r | | *Viburnum opulus* | o |
| | | | | *Salix* spp. | o |
| | | | | *Frangula alnus* | r |
| | | | | *Thelycrania sanguinea* | r |
| | | | | *Rosa canina* | r |

Field layer (including number of different 'habitats' — pathways, wet and drier areas, banks, etc.):

| | | | |
|---|---|---|---|
| *Rubus fruticosus* agg. | 1d | *Cirsium palustre* | |
| *Filipendula ulmaria* | | *Galium aparine* | |
| *Ranunculus repens* | | *Juncus effusus* | |
| *Deschampsia cespitosa* | | *Juncus bufonius* | |
| *Urtica dioica* | | *Juncus inflexus* | |
| *Ajuga reptans* | | *Polygonum convolvulus* | |
| *Carex sylvatica* | | *Polygonum persicaria* | |
| *Carex pendula* | | *Scrophularia aquatica* | |

| | | | |
|---|---|---|---|
| Lake: | *Sparganium erectum* | 1d | |
| | *Polygonum amphibium* | 1d | |
| | *Elodea canadensis* | | (Key to symbols: d=dominant; a=abundant; f=frequent; o=occasional; r=rare; l=locally.) |
| | *Callitriche* sp. | | |
| | *Potamogeton* sp. | | |

meadowsweet *Filipendula ulmaria* and tufted hair-grass *Deschampsia cespitosa.* The vegetation of the lake is sparse, though in places there are good growths of common bur-reed *Sparganium erectum* and amphibious bistort *Polygonum amphibium.* The submergent vegetation is mainly starwort *Callitriche* sp. and Canadian pondweed *Elodea canadensis,* with some pondweed *Potamogeton* sp. The nomenclature of all seeding plants follows that of Dandy (1958).

The viscera were extracted from the birds, preserved in formo-saline and despatched to the Trust where they were analysed for food content. The method of analysis has been previously described in full (Olney 1961, 1962).

There was no apparent difference in feeding habits between males and females or between first-year and older birds.

## Results

The frequency with which food items were found during the four years of sampling is shown in Table 2. The volume and volume percentage of the main food items are shown in Table 3.

The seeds of *S. erectum* were taken more frequently than any other species, though the number taken and their total volume was never large. The smallness in volume is probably due to the small quantity available as most of the *Sparganium* is confined to the smaller pond and covers an area of less than a quarter of an acre. The highest number of seeds found in any one gizzard was 250, from a bird shot in October. The fact that *Sparganium* seeds are eaten by Mallard does not appear to have been noted for this country before, though they are known to form an important part of the diet of wildfowl in America (Martin & Uhler 1939, Stroudt 1944, Yocom 1951, Anderson 1959) and in Russia (Dementiev & Gladkov 1952, Dolbik 1959). It has been stated by a number of authors (Guppy 1894, Cook 1962) that the seeds of this species can be dispersed by wildfowl both internally and externally, yet of the 39 birds examined and found to have fed on *Sparganium* seeds, not one had

**Table 2**

Food items taken expressed as percentage of total frequency

| | 1958-59 | 1959-60 | 1960-61 | 1961-62 | 1958-62 |
|---|---|---|---|---|---|
| No. of possible occurrences .. .. | 15 | 16 | 19 | 27 | 77 |
| Seeds: | | | | | |
| Bur - reed (*Sparganium erectum*) .. .. | 60.0 | 37.5 | 52.6 | 51.9 | 50.6 |
| Oak (*Quercus robur*) | 60.0 | — | 31.6 | 25.9 | 28.6 |
| Hornbeam (*Carpinus betulus*) .. .. | 46.7 | 18.8 | 52.6 | 3.7 | 27.3 |
| Barley (*Hordeum* sp.) | 6.7 | 25.0 | 15.8 | 33.3 | 22.1 |
| Bramble (*Rubus fruticosus* agg.) .. .. | 26.7 | 18.8 | 10.5 | 14.8 | 16.9 |
| Alder (*Alnus glutinosa*) | 6.7 | 18.8 | 26.3 | 7.4 | 14.3 |
| Wheat (*Triticum* sp.) | 6.7 | — | 10.5 | 18.5 | 10.4 |
| Rose (*Rosa canina*) .. | 26.7 | 6.3 | 5.3 | 3.7 | 9.1 |
| Hawthorn (*Crataegus monogyna*) .. .. | 26.7 | — | — | 7.4 | 7.8 |

Other species with number of occurrences:

Plant material:

Seeds: Birch (*Betula pubescens*) 7. Creeping buttercup (*Ranunculus repens*) 4. Goosegrass (*Galium aparine*) 4. Pondweed (*Potamogeton* sp.) 3. Dock (*Rumex crispus*) 2. Sedge (*Carex* sp.) 1. Vetch (*Vicia* sp.) 1. Marsh bedstraw (*Galium palustre*) 1. Clover (*Trifolium repens*) 1. Redleg (*Polygonum persicaria*) 1. Bugle (*Ajuga reptans*) 1. Amphibious bistort (*Polygonum amphibium*) 1.

Vegetative material: Amphibious bistort (*Polygonum amphibium*) root-stock 3. Grass 2. Pondweed (*Potamogeton* sp.) tubers 1. Starwort (*Callitriche* sp.) leaf and stem 1.

Animal material: Midge-fly larvae (Chironomidae) 2. Alder-fly larvae (*Sialis lutaria*) 1. Horse-fly larvae (Tabanidae) 1. Earthworm (Lumbricidae) 1. Waterlice (*Asellus* sp.) 1.

whole seeds below the gizzard and only the very smallest pieces were found within the rectum. Preliminary tests with hand-reared Mallard produced no evidence that these seeds are normally passed through the alimentary canal.

*Sparganium* seeds were taken in each of the four seasons and within each month, though proportionally more were found in those birds shot in October and November (Table 4 and Figure 1). This corresponds to the time when most of the seeds have ripened and fallen.

The seeds of *Quercus robur* formed the main bulk of the food taken and were found in 29 per cent of the 77 birds examined. The total absence of acorns in the 1959-60 season (Tables 2 and 3) is a reflection of the almost complete failure of the acorn crop in the study area during 1959. That oak is exceptionally erratic in its seed production is well known (Jones 1959) and years of nearly complete failure are frequent. In this wood in years of heavy crop there were trees which though of seed bearing age produced no fruit and, conversely, in years of no crop by the majority of trees a few produced seeds. In years of general seed production it was obvious that Mallard were taking acorns in greater volume than any other food, even in apparent preference to the wheat or barley which was being regularly fed to them. A number of birds were shot which were so distended by the number of acorns they had eaten that the whole neck was swollen to almost twice its size. In November 1958, for example, a bird had over 28 acorns within the oesophagus alone.

**Table 3**

Main food items taken

| | 1958-59 | | 1959-60 | | 1960-61 | | 1961-62 | | 1958-62 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Volume in ml. | % of total vol. | Volume in ml. | % of total vol. | Volume in ml. | % of total vol. | Volume in ml. | % of total vol. | Volume in ml. | total vol. % of |
| Seeds: | | | | | | | | | | |
| *Quercus robur* | 54.90 | 80.4 | — | — | 81.00 | 81.0 | 89.20 | 49.8 | 225.10 | 59.9 |
| *Triticum* sp. | 2.20 | 3.2 | — | — | 1.80 | 1.8 | 57.80 | 32.2 | 61.80 | 16.4 |
| *Hordeum* sp. | 0.50 | 0.7 | 24.00 | 84.9 | 8.40 | 8.4 | 27.80 | 15.5 | 60.70 | 16.2 |
| *Sparganium erectum* | 2.40 | 3.5 | 1.45 | 5.1 | 5.05 | 5.1 | 3.70 | 2.0 | 12.60 | 3.4 |
| *Carpinus betulus* | 2.70 | 4.0 | 0.40 | 1.4 | 2.40 | 2.4 | 0.05 | — | 5.55 | 1.5 |
| *Alnus glutinosa* | 0.05 | 0.1 | 0.40 | 1.4 | 0.40 | 0.4 | 0.15 | 0.1 | 1.00 | 0.3 |
| *Rosa canina* | 0.90 | 1.3 | trace | — | 0.40 | 0.4 | trace | — | 1.30 | 0.3 |
| *Rubus fruticous* agg. | 0.10 | 0.2 | 0.10 | 0.4 | 0.10 | 0.1 | 0.10 | 0.1 | 0.40 | 0.1 |
| *Crataegus monogyna* | 0.40 | 0.6 | — | — | — | — | 0.10 | 0.1 | 0.50 | 0.1 |
| Total plant material | 66.85 | 97.9 | 28.05 | 99.3 | 99.9 | 99.9 | 179.20 | 100.0 | 374.0 | 99.5 |
| Total animal material | 1.45 | 2.1 | 0.20 | 0.7 | trace | 0.1 | 0.05 | — | 1.7 | 0.5 |

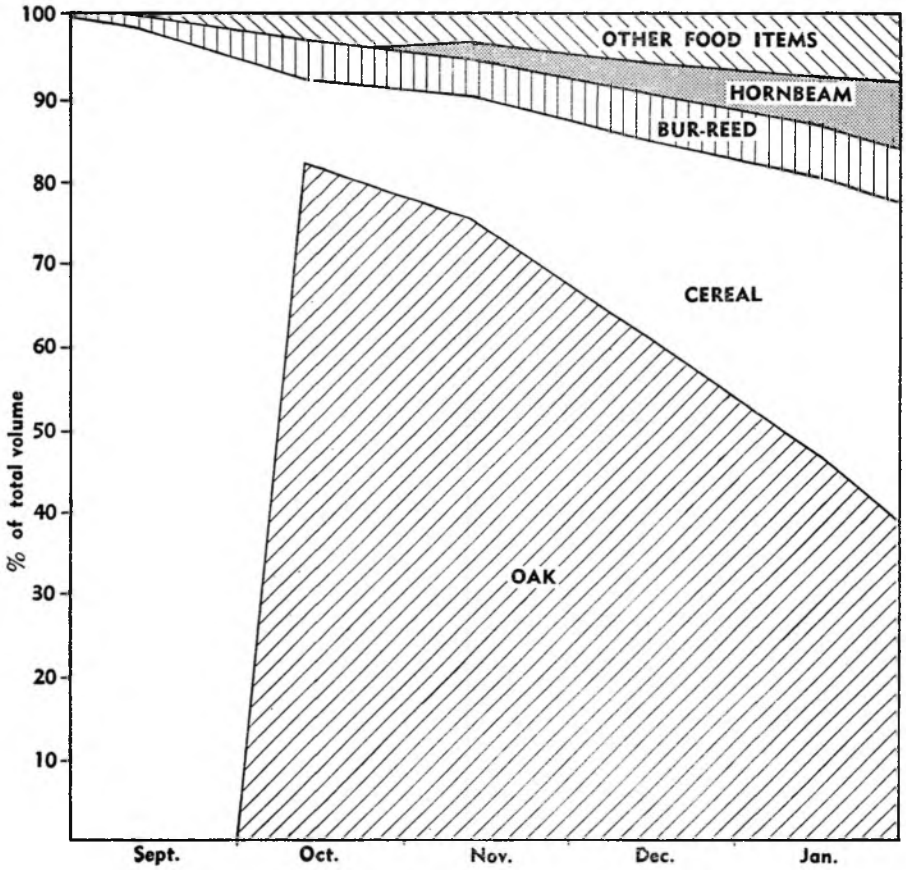


**Figure 1.** Main food items eaten per month expressed as percentage of monthly total volume

Acorns begin to fall in late September and early October and it was during October and November when the greatest number would be available that most of the acorns were eaten (Table 4 and Figure 1). That acorns are an excellent food for Mallard has been noted by a number of authors including Millais (1902), Coward (1910), Berry (1939) and Witherby *et al.* (1939).

During October and November relatively less cereal (*Hordeum* and *Triticum*) was eaten, even though it was still being fed to the birds and had formed the main constituent of their diet prior to their release. There appeared to be a definite preference for the seeds of *Sparganium* and *Quercus* and it was only in periods when these were less available, either because they had not yet ripened and been shed (September) or because the bulk of the supply had been eaten (December, January) that the birds took grain. In October and November, 1959, when few acorns were produced, comparatively more cereal was eaten than in the same months of the other years.

The seeds of hornbeam *Carpinus betulus* occurred in 21 of the 77 birds examined, though the total volume only amounted to 1.5 per cent. They did not occur in any of the birds shot in September or October, but were found in the three months following, with a relatively higher proportion in November. This is to be expected for the seeds are usually retained until later in the year, often remaining on the tree until late November and even until January.

**Table 4**

The frequency of the main food items from 1958-62 expressed as a percentage of the monthly total

| | Sept. | Oct. | Nov. | Dec. | Jan. |
|---|---|---|---|---|---|
| No. of possible occurrences .. .. | 10 | 18 | 18 | 11 | 20 |
| *Quercus robur* .. | — | 61.1 | 33.3 | 18.2 | 15.0 |
| *Sparganium erectum* .. | 60.0 | 66.7 | 66.7 | 36.4 | 25.0 |
| *Hordeum* + *Triticum* | 80.0 | 33.4 | 16.7 | 18.2 | 15.0 |
| *Carpinus betulus* .. | — | — | 50.0 | 27.3 | 45.0 |
| *Rubus fruticosus* agg. | 20.0 | 11.1 | 22.2 | 27.3 | 10.0 |
| *Alnus glutinosa* .. | — | 5.6 | 22.2 | 45.5 | 5.0 |
| *Rosa canina* .. .. | — | 11.1 | 5.6 | 9.1 | 15.0 |
| *Betula pubescens* .. | — | 11.1 | 11.1 | 9.1 | 15.0 |
| *Crataegus monogyna* . | — | 11.1 | 16.7 | 27.3 | — |

Only four other species (*Rubus, Alnus, Rosa* and *Betula*) were found in any number or volume and even then the number of occurrences was too small to reflect any significant differences in yearly or monthly availability.

## Conclusions

The results of this survey, though admittedly based on rather small numbers, reflect well the availability of the main food species—as one species became less abundant, another was taken (Table 4 and Figure 1) and in this area, where there is a large population of birds in a comparatively small area, some form of artificial feeding was necessary. This was particularly so during September, when few of the main food plant species have seeds which have ripened, and during January and February, when the bulk of the natural food had been eaten. From October to January most of the foods eaten were seeds of naturally occurring species from the immediate vicinity. The plants which were utilised were the same species taken by wild Mallard from similar areas throughout the country.

This survey also shows that artificially-reared Mallard, whose diet up to the time of release has been composed mainly of grain, adapted themselves quickly and with apparent efficiency to naturally occurring foods, often taking such foods in preference to grain which was still being fed to them. During the periods when natural foods were most abundant, surplus grain could be found at the feeding places.

One surprising omission from the diet was the seeds of hazel *Corylus avellana*, as this is particularly common in certain parts of the wood. It seems to have been recorded only once as a food of Mallard (Spencer 1960). It was thought that the seeds of *Polygonum amphibium*, which are known from other parts of the country to figure highly in Mallard diets, would have been eaten more frequently. It was however noticed that Coot *Fulica atra* were feeding within the *P. amphibium* areas during and after the period of flowering, and two Coot which were later examined were found to have been feeding on the

stem and leaves of this species. The amount of seed available would probably therefore be very small.

It is obvious that in the area under survey and in similar areas the main natural food species *Quercus, Sparganium* and *Carpinus* could be actively encouraged and managed. Experimental propagation of *Sparganium erectum* has indicated that the most successful method is to use rootstock or young rooted plants taken from similar habitats and transplanted in early spring. It was found that autumn planting was less effective and seeding has so far proved to be unsuccessful. When replanting or altering the environment it should be borne in mind that the optimum conditions for growth and fruit production of this species seem to be bright sunlight, a loose substratum and about 10 cm. of standing water (Cook 1962). It is also essential that the water table should be above the root level, although short periods of lower levels in summer can be tolerated.

A rough guide to the carrying capacity of the area can be made in early September when the amount of seed production of the three main food species can be ascertained.

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