

## Grit in waterfowl at the Ouse Washes, England

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### Introduction

Waterfowl need grit to help digest some of the fibrous and hard foods they eat. Grit can either be ingested deliberately or swallowed along with the food. The condition and functioning of the gizzard is also influenced by grit. Brooke (1957) showed that the gizzards of Light Sussex cockerel chicks *Gallus domesticus* which had been fed grit were up to 50% heavier than those of birds denied grit. The muscles of the gizzards containing grit were thicker, tougher and free from erosion. Without grit the gizzard tends to retain fibrous material which can cause a partial or complete impaction thus affecting the rate of food passage. The present study looked at the grit of birds which were wintering in an area where the substrata is predominantly peat and which is probably deficient in grit.

### Materials and methods

Grit was examined from the gizzards of 596 water birds shot by wildfowling at the Ouse Washes in East Anglia between September and January, mostly in the winters 1971–1972 and 1972–1973. The contents of each gizzard, having been stored in 5–10% formaldehyde, was washed in a petri dish and the grit separated from organic material by sifting. After drying, batches of five grit samples (10 in the case of Teal *Anas crecca*) were passed through a series of sieves and the grit separated into five fractions: over 5 mm, 2–5 mm, 1–2 mm, 0.5–1 mm, and less

than 0.5 mm. Each size class was weighed. The few particles of grit which regularly occur in a proventriculus were included with the appropriate gizzard sample. Gravel samples were collected to a depth of 3 cm from two local gravel pits. Four sub-samples, each of about 20 g, were sieved and the resultant size classes also dried and weighed.

### Weight of grit

Table 1 shows the average weights of grit in the gizzards of 12 species of waterfowl. There was no significant difference in the grit weights in male and female Pintail *Anas acuta*, Shoveler *Anas clypeata* and Teal. The grit of 58 male Mallard *Anas platyrhynchos* average 4.26 g and 48 females 3.32 g ( $p < 0.01$ ). Male Wigeon *Anas penelope* contained 4.28 g of grit and females 4.07 g ( $p < 0.01$ ). The average grit weights remained constant from month to month for all species except possibly for Shoveler. Grit weights from the September–November samples of this species were less than 1.5 g but the December–January samples were between 2.0 and 3.6 g. The early winter samples probably belonged to young birds bred that year at the Ouse Washes and the late winter samples from recently arrived immigrants.

The weight of grit in nine Mallard gizzards which contained ingested lead pellets averaged 3.76 g (2.12–5.59 g) and was similar to the grit weights of all Mallard gizzards.

Table 1. Weight of grit (g) in gizzards.

Species	N	Average wt. $\pm$ SE	Range
Mute Swan <i>Cygnus olor</i>	7	69.8 $\pm$ 17.2	32.8–153.0
Bewick's Swan <i>Cygnus columbianus bewickii</i>	18	24.6 $\pm$ 3.1	8.3–69.5
Pintail <i>Anas acuta</i>	34	2.5 $\pm$ 1.3	0.4–5.2
Teal <i>Anas crecca</i>	112	0.9 $\pm$ 0.4	0.2–2.2
Mallard <i>Anas platyrhynchos</i>	113	3.8 $\pm$ 2.2	0.1–19.9
Gadwall <i>Anas strepera</i>	15	3.9 $\pm$ 0.8	2.5–4.8
Wigeon <i>Anas penelope</i>	224	4.5 $\pm$ 0.1	0.5–13.1
Shoveler <i>Anas clypeata</i>	44	1.6 $\pm$ 0.9	0.2–3.6
Pochard <i>Aythya ferina</i>	9	2.9 $\pm$ 1.5	2.4–5.1
Tufted Duck <i>Aythya fuligula</i>	13	1.7 $\pm$ 1.9	0.1–5.6
Moorhen <i>Gallinula chloropus</i>	25	3.3 $\pm$ 1.4	0.3–5.8
Coot <i>Fulica atra</i>	7	10.5 $\pm$ 2.6	7.6–14.4

Swans after Owen & Cadbury (1975)

### Size of grit

We found that the size classes of grit for the different species agreed closely for the corresponding species in North America (Anderson 1959). In Gadwall *Anas strepera* and Wigeon virtually all the grit was less than 1 mm and mostly less than 0.5 mm. Most of the grit of the swans *Cygnus* spp., Coot *Fulica atra*, Moorhen *Gallinula chloropus*, and Teal was fairly equally divided between the 0.5–1 mm and 1–2 mm size classes. About a half of the grit of Pochard *Aythya ferina*, Mallard, Pintail and Shoveler was between 1–2 mm. The most common size for the grit of Tufted Duck *Aythya fuligula* was over 5 mm and the distribution of grit within the size classes was fairly similar to that of samples from local gravel pits. No other species showed this close affinity.

### Type of grit

Most of the grit examined was silica (quartz). In the case of Gadwall, Wigeon and swans it was mainly composed of small translucent crystals. The larger particles taken by the other water birds were mainly orange or brown together with pieces of flint, typically brown and white. These grits are of the types found at local gravel pits. Small amounts of black lava particles were also found. Gudmundsson (1972) points out that as Icelandic lava is unique its presence in migrants could be used to discriminate between birds originating from Iceland, and Scandinavia and Greenland. Such precise analysis was not possible in the present case.

Waste lead shot is also ingested and serves as grit, 9% of the Mallard and 10% of the Pintail examined from the Ouse Washes contained ingested lead pellets which upon digestion cause lead poisoning (Thomas 1975). Hard seeds, for example, of pondweeds *Potamogeton* spp. and sea club rush, *Scirpus maritimus* and hard pieces of mollusc shell may also be retained in the gizzard and serve as grit in those species feeding mainly on vegetation. The use of such 'food items' has not been considered in this account.

### Discussion

The autumn and winter diets of water birds may be a critical factor in the size of grit they select. Gadwall, Wigeon and Coot feed mainly on leaf and stem material and all ingest grit of a small size. Owen & Cadbury (1975) describe similar foods and grits being taken by Mute Swans *Cygnus olor* and

Bewick's Swans *Cygnus columbianus bewickii*. Numerous small pieces of grit may puncture the cells of plants more efficiently than fewer pieces of large grit. Mallard and Pintail predominantly eat fruits and seeds between 1 and 5 mm which reflects the commonest size classes of grit taken. Teal generally, although not always, select seeds between 1–2 mm (Olney 1963; Tamisier 1974), which again reflects the commonest size of grit taken. Pochard and Moorhen have grit enabling them to deal with leaves, stems and grains. Shoveler feed mainly on small invertebrates and contain grit mostly between 1–2 mm. Tufted Ducks frequently take molluscs (Olney 1963) and may need the larger pieces of grit, over 5 mm to help crush the shells, particularly of tough-shelled species such as zebra mussel *Dreissena polymorpha* and swan mussel *Anodonta cygnaea*.

Anderson (1959) has shown that some grits can remain in the gizzards of Mallard for 7½ weeks but retention could be longer in other cases. Kraupp (1924) showed that hens denied grit for one year retained a sufficient amount properly to grind their food. Lead pellets being relatively soft may only remain in the gizzard for 2–3 weeks (Bellrose 1959). Of the 54 lead pellets found in the gizzards of the Ouse Washes ducks 34 (63%) had obviously been digested or eroded. Brown (1904) showed that when poultry are allowed free access to grit the amount ingested and voided varied with individual birds and diet. Up to 6 g a day were voided. But when no grit was available little was passed out. Zaitschek (1904) concluded that there is something in the anatomical structure of the gizzard which aids in the retention of grit. The range of grit weights (Table 1) is wide for most of our specimens but all individuals contained some grit.

The Ouse Washes soil is predominantly peat with little available grit. Some fine silt is brought by the annual winter floods and by water periodically admitted from the New Bedford River. This collects in the 140 km (87 miles) of functional ditches within the Washes. These are cleaned out, typically every five years, and the spoil left on the ditch sides. Occasionally some larger pieces of flint are seen. A small amount of gravel is present alongside the 4 km of roads that traverse the Washes. Mallard, Pintail and Teal visit the surrounding arable farms from July to November to feed on stubble grains and the first two species from November to March to eat waste potato tubers. Wigeon visit the fields from December to March to

Table 2. Grit weights (g) of Wigeon at Bridgwater Bay (BB), Somerset, and at the Ouse Washes (OW), Cambs.

Males	BB 6.52 (N = 42)	OW 4.82 (N = 126)	t = 4.65 P < 0.001
Females	BB 5.39 (N = 38)	OW 4.07 (N = 98)	t = 4.34 P < 0.001

feed on the leaves of winter planted cereals. Grit may be picked up at such feeding sites especially where the peat has wasted, revealing silts or flints.

There are two gravel pit complexes within 3 km of the Washes and relatively small numbers of waterfowl are seen on them when the Washes are flooded. When the Washes are not flooded these pits hold larger numbers, particularly of Tufted Duck, Pochard and Coot. It is very probable that these pits are an important source of grit for the birds wintering at the Ouse Washes.

The wintering Wigeon population, which exceeds 25,000 for three months each winter, seems most faithful to the Ouse Washes and may thus be deprived of grit. The male Wigeon from Bridgwater Bay, Somerset (Owen 1973), contained 35% more grit than those from the Ouse Washes and similarly, females contained 32% more (Table 2). It is not known if these lower grit weights are affecting the efficiency of digestion in the Wigeon at the Ouse Washes but it is likely that grit retained for a long period becomes polished and less efficient at puncturing leaves. The R.S.P.B. and the Wildfowl Trust have put grit near their permanent lagoons and swans and ducks (especially Wigeon) use these piles regularly to obtain grit. Piles of gravel

could also be provided at intervals on higher ground so as to be available under flooded conditions. The gravel should be 'as dug' to include a range of sizes and should be taken from unshot pits so as to eliminate the possibility of waste pellets causing lead poisoning.

#### Acknowledgements

We are very grateful to the Ouse Washes wildfowlers for allowing their ducks to be eviscerated and to Dr C. J. Cadbury for useful criticism of the manuscript.

#### Summary

Grit was examined from the gizzards of 596 wintering waterbirds shot at the Ouse Washes, England. All contained some grit but the range of weight was high for most species. The amount of grit is to some extent related to gizzard size, ranging from an average of 0.9 g in Teal *Anas crecca* to 4.5 g in Wigeon and 69.8 g in Mute Swans *Cygnus olor*. Only in Tufted Duck did the size distribution of grit resemble that from local gravel pits. Most of the grit was silica (quartz). The Ouse Washes soil is predominantly peat and may be deficient in grit. Wigeon here contain about two-thirds the amount of those wintering at Bridgwater Bay, Somerset. It is suggested that deposition at the Ouse Washes of grit from unshot gravel pits should be increased.

#### References

- Anderson, H. G. 1959. Food habits of migratory ducks in Illinois. *Bull. Ill. St. Nat. Hist. Surv.* 27: 289-344.
- Bellrose, F. C. 1959. Lead poisoning as a mortality factor in waterfowl populations. *Illinois Nat. Hist. Surv. Bull.* 27, Art. 3 288 pp.
- Brooke, H. T. 1957. Insoluble grit cuts feeding costs. *Modern Poultry Keeping*, 16th May 1957: 5-7.
- Brown, E. W. 1904. Digestion experiments with poultry. *U.S. Dept. Agr. Bur. Animal Industry Bull.* 56.
- Gudmundsson, F. 1972. Grit as an indicator of the overseas origin of certain birds occurring in Iceland. *Ibis* 114: 582.
- Kraupp, B. F. 1924. The digestive organs of the fowl. *Vet. Med.* 19: 522-3.
- Olney, P. J. S. 1963. The food and feeding habits of Teal. *Proc. Zool. Soc. Lond.* 140: 169-210.
- Olney, P. J. S. 1963. The food and feeding habits of the Tufted Duck. *Ibis* 105: 55-62.
- Owen, M. 1973. The winter feeding ecology of Wigeon at Bridgwater Bay, Somerset. *Ibis* 115: 227-43.
- Owen, M. & Cadbury, C. J. 1975. The ecology and mortality of swans at the Ouse Washes, England. *Wildfowl* 26: 31-42.
- Tamisier, A. 1974. Etho-ecological studies of Teal wintering in the Camargue. *Wildfowl* 25: 123-33.
- Thomas, G. J. 1975. Ingested lead pellets in waterfowl at the Ouse Washes, England, 1968-1973. *Wildfowl* 26: 43-8.
- Zaitschek, A. 1904. Zur physiologie des muskelmagens der Körner-fressenden vögel pflüger's arch. f. *Physiol.* 104: 608-11.

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