Goldeneye feeding close to sewer outfalls in winter

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The importance of sewer outfalls in influencing the distribution of flocks of Goldeneye *Bucephala clangula* wintering off the east coast of Scotland has been described by Milne and Campbell (1973) and by Pounder (1976). Flocks concentrate at sites with either a high degree of sewage pollution (Seafield) or at outfalls with waste from food factories (Peterhead), breweries (Leith) or distilleries (Invergordon). The main site at Leith in the Firth of Forth holds at least 35% of the east coast population in winter and has both a high degree of sewage pollution and brewery waste in the effluent.

This paper describes an investigation of the factors attracting a small flock of Goldeneye in Aberdeenshire.

The study area was the northern part of Peterhead bay (Figure 1). In the north-east, there are two discharges, one of domestic effluent and the other containing a mixture of vegetable fragments, such as carrot and onion, from an adjacent food factory. While such fragments were widely dispersed over much of the northern part of the bay, there were no visible signs of pollution by domestic sewage.

A flock of up to 100 Goldeneye had been regularly recorded in the bay from 1958 (data from the Wildfowl Trust) with peaks in excess of 200 in some seasons. During 1971–1972 and 1972–1973 a flock varying in size between 40 and 80 birds was regularly seen, with maximum counts of 100 and 112 respectively in each winter. Numbers were rather variable since the bay was used primarily as a daytime feeding area for birds which flighted in at dawn and out before dusk. The night-time roosting areas of these birds were not located but were thought to be on the sea north of Peterhead.

Feeding behaviour

During six day-long watches the activity of the birds was recorded from fixed observation points. The total number of birds present in the bay was regularly checked throughout each watch. Systematic scans were made of the area every five minutes and birds were classed as 'non-feeding' if they showed no feeding behaviour, such as diving, within a time period of 30 seconds. (This time interval was the maximum pause time

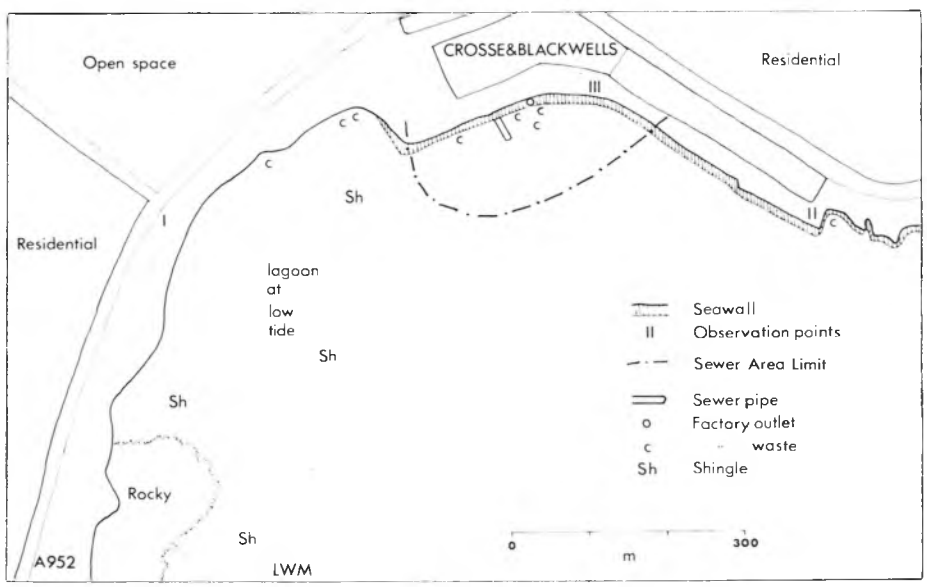

Figure 1. Peterhead Bay study area.

recorded between series of five or more consecutive dives made by actively feeding birds.) The total number of feeding birds, including those under water, was obtained by subtracting the non-feeding total from the total number in the bay. To allow for differences in total numbers both during and between watches, the number of birds feeding in each scan was expressed as 'bird feeding-minutes' (number recorded as feeding × scan duration in minutes). Since scans were effectively continuous, bird-feeding-minutes were summed and expressed as a percentage of 'total-bird-minutes' (number present × duration of interval in minutes) for set time intervals (15 minutes). The greatest variation in feeding intensity (the percentage of total-bird-minutes recorded as feeding in each interval) in any watch was from 20·8% to 95·3% and the same watch also had the lowest overall mean value (53·3%). In contrast, the watch with the smallest range (36·8%–89·9%) had the highest overall mean value (61·4%). The results of all six watches combined are shown in Figure 2. Feeding intensity varied irregularly throughout the day, with no marked diurnal pattern. Variations both during and between watches could only be partly explained in terms of obvious factors such as disturbance.

No watches showed any evidence of a tidal response; the combined data for all six, in hourly blocks relative to the time of high tide, demonstrate the absence of any tidal pattern, with feeding intensity fluctuating between 34% and 69% (Figure 3).

Observations from point III (Figure 1) of birds feeding near the sewers, showed that carrot and other vegetable remains were being regularly taken and brought to the surface. Direct observation was more difficult elsewhere but two birds were seen to take crabs from the shingle area (Figure 1).

Distribution pattern

The positions of groups of birds or individuals in the bay were recorded and expressed as being within or without the sewer area (Figure 1). Presence within the sewer area, expressed as a percentage of total-bird-minutes in 30 minute intervals, is shown in Figures 4 and 5 in relation to time of day and general tidal state respectively. While no tidal element was evident, there was a distinct daily routine, presence being much higher early or late in the day. A marked diurnal pattern (Figure 4) and absence of tidal effect (Figure 5) is evident.

Reactions to disturbance

The birds were obviously sensitive to sudden loud noises. On eleven occasions when such occurred (for example, blasting or ship sirens) they immediately took flight and left the bay. On six days no birds had returned after two hours and less than 10% of the original flock returned on the remaining five,

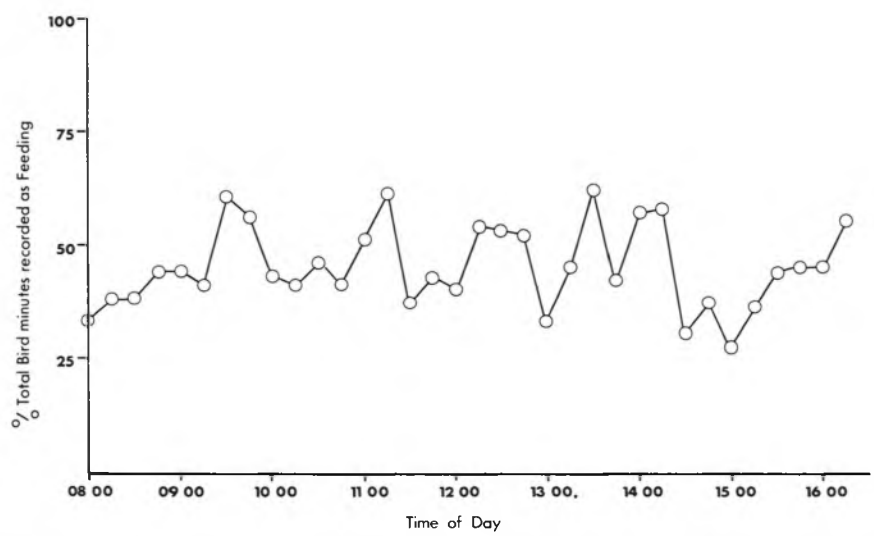

Figure 2. Pattern of feeding intensity of Goldeneye in relation to time of day; results of six watches combined.

although these usually did so within ten minutes of the incident.

While large vessels anchored in the bay had no effect, smaller boats approaching the flock caused the birds to take flight, normally to the southern part of the bay, from whence they gradually returned once the boat departed.

Regular disturbance to birds in the sewer was caused by passers-by on the sea-wall. When approaching from the east people were visible some distance from the flock,

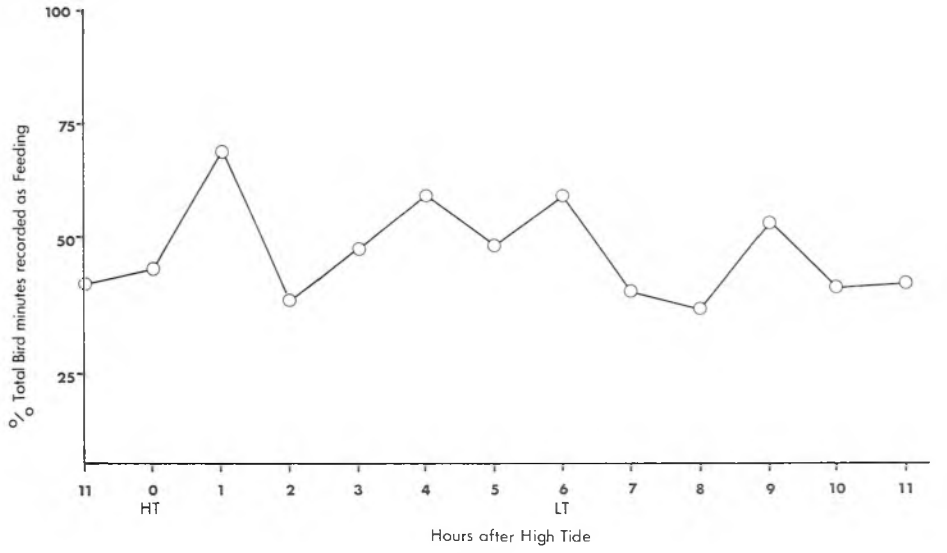

Figure 3. Pattern of feeding intensity of Goldeneye in relation to state of tide; results of six watches combined.

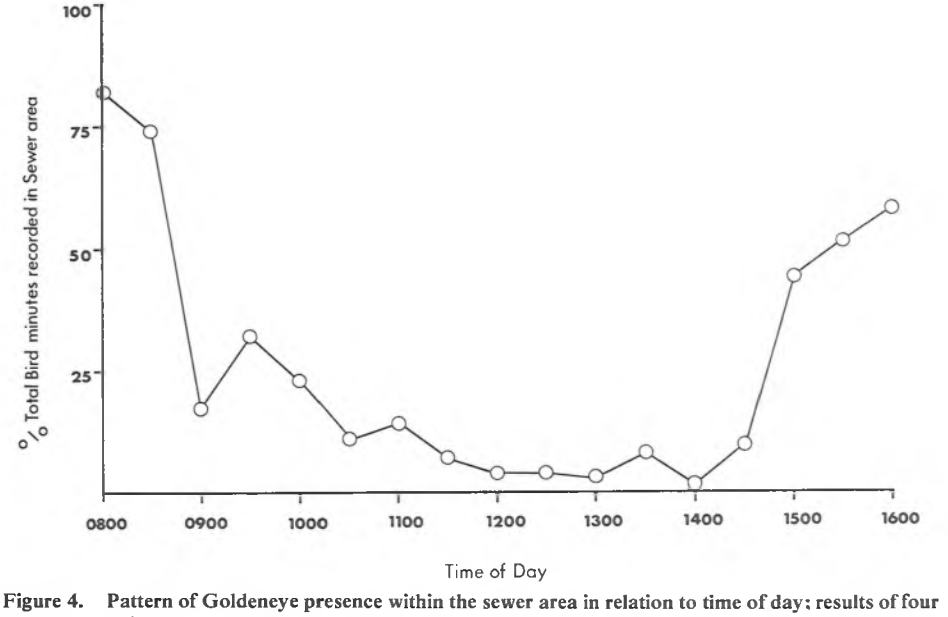

Figure 4. Pattern of Goldeneye presence within the sewer area in relation to time of day; results of four watches combined.

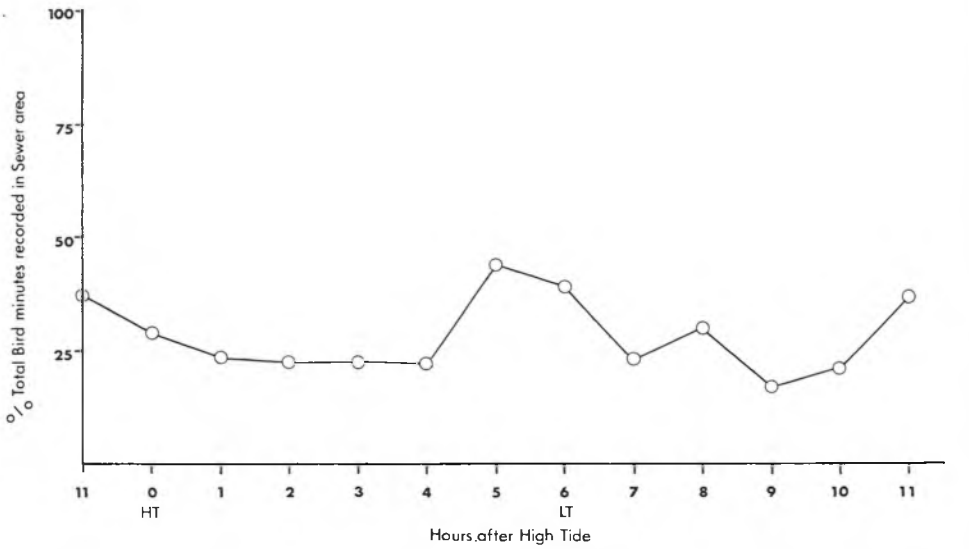

Figure 5. Pattern of Goldeneye presence within the sewer area in relation to state of tide; results of four watches combined.

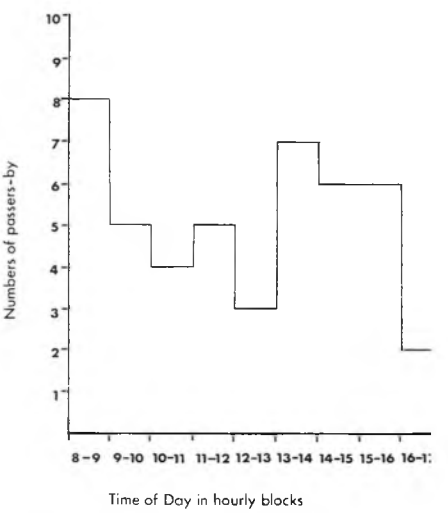

Figure 6. Frequency of passers-by close to the sewer area throughout the day during four watches.

which merely swam further offshore. However, from the west passers-by tended to come into view suddenly, close to the sewer, and the birds usually took flight.

The occurrence of passers-by was highest between 08.00 and 09.00 and from 13.00–16.00 (Figure 6). These peaks of human activity coincided with the periods when Goldeneye presence was highest and the diurnal distribution pattern of the birds was not therefore a response to disturbance.

The time taken for the first bird to return to the sewer area following disturbance was recorded on 28 occasions (Table 1), and was significantly longer during the middle of the day.

Discussion

Daytime feeding by Goldeneye and their tendency to gather to roost by night in areas separate from the feeding grounds have been described by several workers (Breckenridge 1953; Linsell 1969) and Pounder (1976) has

Table 1. Time taken by Goldeneye to return to the sewer area after disturbance.

Time of day	Number of disturbances observed	Mean time to return (mins)	Range
08.00–11.00	10	5·1	2–9
11.00–14.00	10	11·7	3–22
14.00–17.00	8	4·3	3–7

recorded tide-dependent movements between adjacent sewer outfalls in the Tay. While Nilsson (1970) recorded no diurnal or tidal patterns in day-time feeding intensity, he found that, in some areas of Sweden, it increased with decreasing temperature. This, coupled with generally higher female feeding intensities, led him to suggest that some birds were having difficulty in obtaining sufficient food during the cold and short mid-winter day. He recorded overall feeding intensities of 80–95% with mean daily temperature below 0°C. In this study, mean temperatures during the watches were considerably higher and feeding intensities correspondingly lower (50–60%).

However, while there was no evidence in this study that Goldeneye were having any difficulty in obtaining sufficient food, it does seem that the attraction to sewers was, at least partly, related to the short day.

The absence of the flock from the bay on some days indicated that there were alternative feeding grounds. Similarly, for over 75% of the day when present in the bay, they were feeding over the shingle areas, presumably on invertebrate items such as crabs. The dawn and dusk localization of feeding close to the sewer outlets, despite the increased likelihood of disturbance, can be considered to be a means of rapidly filling the gut, prior to or following the roosting period. The abundance of vegetable fragments would enable increased intake without increased intensity or effort. Such feeding would be opportunistic rather than obligatory in mild winter conditions, but may be expected to be of greater importance during harsh weather.

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Summary

No diurnal or tidal patterns in feeding intensity of a flock of Goldeneye *Bucephala clangula* were detected. However, the birds concentrate at dawn and dusk close to a food factory sewer outlet where they feed on discharged vegetable waste. It is argued that the birds were exploiting a locally concentrated food source which enabled rapid food intake prior to or following the roost period. Such feeding could be of greater importance in severe weather.

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The Wildfowl Trust's ringing station at Abberton Reservoir, Essex. Above: one of the three sections of the reservoir. Below: Sir Peter Scott and Roy King, the Warden, about to visit one of the permanent duck traps. Since the death, in 1968, of Major-General C. B. Wainwright, the founder, some 20,000 ducks have been ringed. (*Philippa Scott*).