The daily pattern of display in a wild population of Eider Duck

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Introduction

In most birds display is clearly related to the succession of day and night. Many song birds which are active by day begin their singing at dawn. During the morning singing gradually tapers off, reaching a low level in the early afternoon. Often there is then a resurgence of song towards dusk, but it is less vigourous than that of dawn.

Dawn and dusk display is not confined to the song birds however. Dawn crowing is typical of many game birds including the domestic Cockerel *Gallus domesticus* and the Red Grouse *Lagopus scoticus*. Lekking of Black Grouse *Lyrurus tetrix* and Sage Grouse *Centrocerus urophasianus* reaches a climax at dawn and a secondary peak of activity often occurs at dusk.

Eider Duck *Somateria m. mollissima* in captivity under non-tidal conditions are not equally active throughout the hours of daylight. Their rhythm of activity is similar to that of most *Anas* species, where after a burst of dawn display, the day is divided into many short periods of activity separated by intervals of rest.

In the wild, Eider Duck are usually to be found in situations subject to the influence of tidal change. The aim of the present work was to describe the daily pattern of display activity in such a situation.

Methods

Observations were made on the Eider population of the Ythan estuary, Aberdeenshire, between August 1966 and January 1967.

Eiders on the Ythan move down river with the ebb tide, stopping to feed at the mussel beds as they become exposed (Figure 1). Most of the birds reach the river mouth area by low water, leaving about two hours later and moving up river on the flood tide. During the period of high water they roost in the areas shown.

In order to quantify the frequency of male display throughout the day, the incidence of several movements used by male birds in pair formation ceremonies was recorded. The movements involved were coo-ing movements 1, 2 and 3, ritualised bathing, wing flapping and neck-stretch (after McKinney 1961).

The displays were counted in groups of twenty males, for periods of ten minutes. Each ten-minute period was separated by an interval of five minutes. The mean frequency of display within any ten-minute period was then expressed as displays per bird per minute.

The observations were made from nautical twilight to nautical twilight on two days per week.

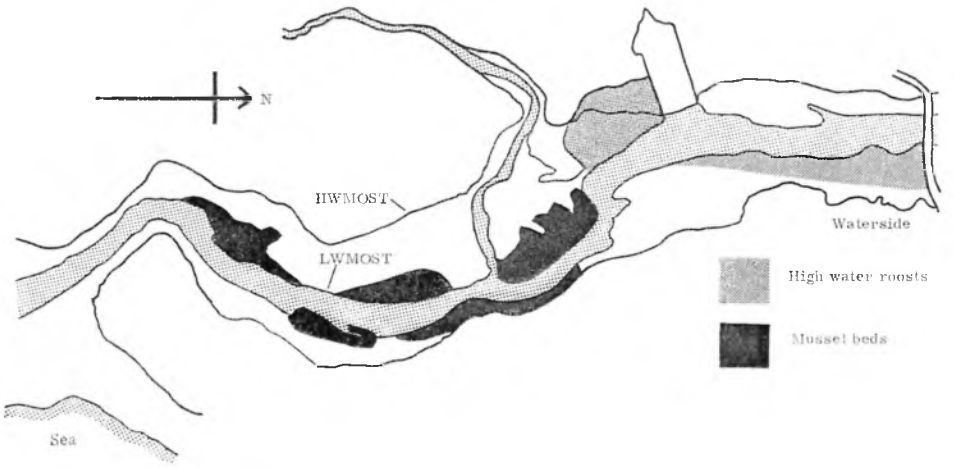

Figure 1. Map of the Ythan estuary, showing the position of the mussel beds and the areas used for roosting by Eider Duck.

Results

On any day display began just before sunrise and finished shortly after sunset (for example Figures 2 and 3). However, the frequency of display was not constant throughout the day. Generally, each day, the mean frequency on the flood tide was greater than the corresponding mean on the ebb tide (Table I). The overall mean display frequency on the flood tide, using the data from every day of observation, was significantly greater than the ebb tide mean ($t=7.7$; $p<0.001$).

Reference to Figures 2 and 3 clearly shows that the peaks of display frequency, associated with the flood and ebb tides, are separated by periods of behavioural quiescence, corresponding to low water, when the birds are feeding, and to high water, when they are roosting.

In addition to the tidal rhythm of display frequency, there is evidence of a second, diurnal, rhythm. A large peak of display is associated with sunrise, and a smaller one with sunset.

This complex of superimposed rhythms of display is analysed more fully in Table II. Each day of observation has been divided into three parts; two two-hour periods, one for an hour before and after sunrise, the other before and after sunset, and the intervening 'day' period. The tidal cycle on each day has been divided in a similar manner, but this time into four

Table I. Mean frequencies of display on flood and ebb tides.

	Mean displays per bird per minute	
Date	*Flood tide*	*Ebb tide*
10. 9.66	0.30	0.19
22. 9.66	0.20	0.16
27. 9.66	0.53	0.15
30. 9.66	0.56	0.18
5.10.66	0.62	0.53
8.10.66	0.86	0.31
12.10.66	1.46	0.53
15.10.66	1.74	0.91
19.10.66	1.43	0.84
26.10.66	1.42	0.57
29.10.66	1.12	0.47
2.11.66	1.16	0.84
5.11.66	0.71	0.92
9.11.66	1.75	0.80
12.11.66	1.40	0.53
16.11.66	1.54	0.72
19.11.66	1.48	1.33
26.11.66	0.91	0.60
3.12.66	0.77	0.65
13.12.66	1.31	0.36
17.12.66	0.94	0.54
4. 1.67	0.82	0.56
11. 1.67	0.92	0.62
18. 1.67	1.20	0.91
25. 1.67	1.20	0.83
1. 2.67	0.65	0.41
Mean	1.06	0.58
S.D.	0.21	0.09

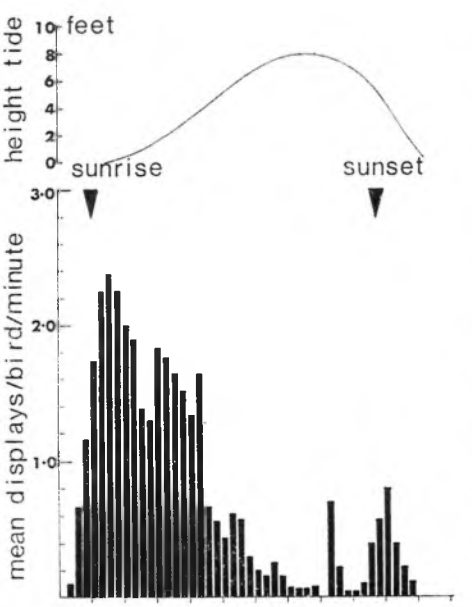

Figure 2. The pattern of frequency of display on 29th October 1966.

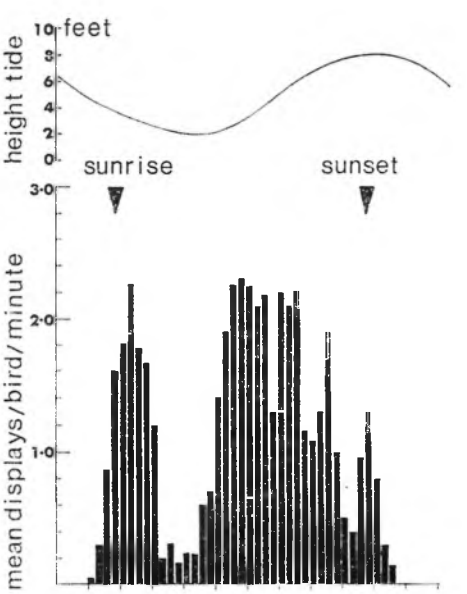

Figure 3. The pattern of frequency of display on 16th November 1966.

Table II. Mean frequencies and standard errors of display, measured in displays per bird per minute, for various combinations of tide and time.

		Flood tide	*High tide*	*Ebb tide*	*Low tide*
Dawn	mean	2.33	0.75	1.25	1.09
	s.e.	±0.15	±0.01	±0.04	±0.04
Day	mean	1.36	0.47	0.54	0.86
	s.e.	±0.08	±0.01	±0.02	±0.06
Dusk	mean	0.67	0.38	0.38	0.34
	s.e.	±0.02	±0.05	±0.08	±0.04

parts; one hour each side of low water, one hour each side of high water and the periods of flood and ebb tide. The mean frequency of display for each of the twelve possible combinations of tide and time has then been computed, using the data from every day of observation.

From this analysis it is clear that there are indeed two distinct rhythms of display involved, each of which can augment the effect of the other. Thus when the peaks of the two rhythms occur together, for example when a flood tide occurs at dawn, the resultant mean frequency of display is greater than the mean produced by one peak acting alone, as when dawn coincides with high water or a flood tide with 'day'.

In short, any combination of tide with dawn results in a greater mean frequency of display than the corresponding combinations with 'day'. In a similar manner a flood tide at any time gives a higher mean than the corresponding combinations of the ebb tide, low, or high water. Finally ebb tide combinations are always higher than their low and high water counterparts.

Every day display frequency drops shortly before sunset (Figures 2 and 3), only to rise to a peak at sunset and falling away after.

Although the peak of activity associated with sunset is discrete, and occurs each day, it is not demonstrated by the above analysis, since in magnitude it is smaller than the peaks in the 'day'.

Discussion

The dawn and dusk peaks of display shown by Eiders in non-tidal situations, are also demonstrated by their wild counterparts. However, the polyphasic periodicity of captive birds is replaced in the wild by a marked tidal rhythm resulting from the feeding behaviour of the birds.

At low water the birds are feeding and bathing, with the result that little display occurs. As they move up river on the flood tide they are comparatively satiated and presumably more free to display. High water is spent in roosting, feather maintenance and probably in digesting the food obtained at low water. As a result there is little display to be observed during this period. On the ebb tide the birds move down river and begin to feed, as mussel beds become exposed. Again there is comparatively little time available for display, consequently the mean frequency of display on the ebb tide is lower than that on the flood tide.

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Summary

The daily pattern of display frequency among the male members of a wild population of Eider Duck *Somateria m. mollissima* is described. The birds exhibit marked diurnal and tidal rhythms. Display is more frequent on the flood than on the ebb tide. The diurnal rhythm is in the form of a peak of display at dawn and one at sunset. The two rhythms interact.

References

McKINNEY, F. 1961. An analysis of the displays of the European Eider *Somateria m. mollissima* L., and the Pacific Eider *S. m. v.-nigra* Bonaparte. *Behaviour Supplement VIII.*

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