THE FORM AND DURATION OF THE DISPLAY ACTIONS
OF THE GOLDENEYE (BUCEPHALA CLANGULA)

by

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(With 5 plates)

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Many observers agree that the behavior of animals is in part made up of stereotyped movements. The displays of birds are frequently cited as outstanding examples, and many students of bird behavior have been able to dissect observed activities into stereotyped, component actions. It therefore seems surprising that a search of the literature fails to disclose any quantitative information concerning the variation in the stereotyped movements. This gap in our knowledge is no doubt due to the difficulty of obtaining objective records of specific examples of behavior. Field notes can tell us the general shape of the motions, and what movements are seen, but they cannot provide completely objective recordings of the rigidity or flexibility of the movements.

Motion pictures, however, provide a method of recording display actions objectively. With his method it is possible to study many fine details in the movements of the same bird at different times, to contrast the movements of different individuals within a species, and to compare the movements of different species. In addition, each action can be viewed in slow motion many times and its duration accurately measured. It is the purpose of this study to describe a method by which these displays can be objectively studied, and to use the pictures for a better basis of description.

The present study 3) was planned to compare the displays of the Goldeneye (Bucephala clangula) with those of the Bufflehead (Bucephala albeola) by the use of motion pictures. It was hoped that this study would shed some

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3) Begun as a Senior's research project at Harvard University.
light on the taxonomic relations between the two species as the studies of Lorenz (1941) have done for the Anatinae. It was found, however, that the displays are so dissimilar that separate treatment is desirable.

The displays of the Goldeneye were first described in detail by Townsend (1910) and Brewster (1911). The work of Millais (1913), Boase (1924) and others was summarized by Bent (1925). Munro's (1939) work in Canada, Gunn (1939) in England and Bernhardt (1940) in Germany together with Sawyer's (1928) rather complete work on Barrow's Goldeneye (Bucephala islandica) are important recent contributions.

METHODS

The description of the actions is based on 530 feet of 16 mm black and white motion picture film 1). This was taken on negative film at 24 frames per second with an Arriflex-16 camera equipped with either a 300 or 400 mm telephoto lens. The analysis of the movements was made from an edge-numbered print with a Bell and Howell “Filmotion Viewer”. The prints on the accompanying plates were made directly from the negative film. The duration of each movement was measured by counting the number of frames, since the actions were photographed at a constant rate of 24 frames per second. This gives an accuracy of about plus or minus 0.02 of a second; in the descriptions the standard deviations are given to the nearest hundredth of a second for the sake of convenience.

Except where otherwise noted, this study was carried out on ducks wintering on salt water. Our field notes and observations of ducks wintering on fresh water show that there the display may be quite different. It must be remembered that this study is restricted to a small segment of the Goldeneyes' winter range, and the results found will perhaps not apply elsewhere. The reports of others (Alford, 1921; Gunn, 1939; Boase, 1924) indicate that the displays may be quite different in other parts of the world.

Filming was begun in early February and continued until the end of April during the spring of 1956 and for a week during the latter part of March, 1957. This was done from the end of a sewerpipe jutting out into Newburyport Harbor at the mouth of the Merrimac River at Newburyport, Massachusetts. Ducks came very close to this spot to feed in the eddies below the pipe. Since these birds were comparatively accustomed to people on shore, the presence of the photographer seemed to have little effect on their behavior.

1) Copies of which are available from the authors.