

A GRAPHIC METHOD OF RECORDING FLIGHT.

BY EARL L. POOLE.

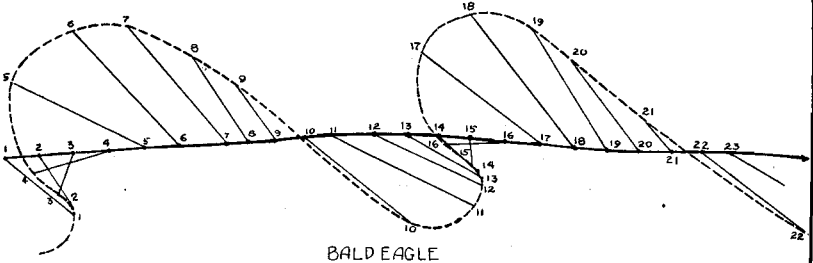
WITHIN the past few years, the increasing general interest in bird study has brought about a great advance in the technique of field ornithology. The more recent popular works are finally getting down to descriptions of birds as they *appear in life*, and stressing identification characters in a manner much more satisfactory to field observers of limited experience than formerly was the case.

One important identification character, however, which has received very little attention at the hands of our writers of popular guides, is flight. Beyond such unsatisfactory remarks as "flight undulating," or "flight direct," the inexperienced student has very little upon which to base comparisons of flight characteristics. Practically every field naturalist can distinguish at a considerable distance the flight of a large number of our native birds, and it is highly probable that the simple system of flight notation herein presented has occurred to many. But as I have never seen such a method published, it may prove a suggestion worthy of further investigation.

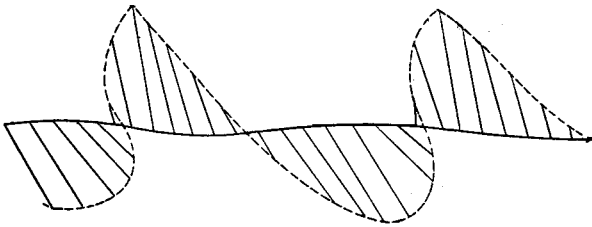
While the flight of the larger birds is quite easy to record, the smaller species are so quick in their movements that it is often exceedingly difficult to determine just exactly what they do.

As a basis for these studies the writer has made a number of graphs based on Muybridge's monumental work on 'Animal Locomotion,' showing the relative position of the wing tips (tips of the longest primaries), and the approximate center of body weight. The synchronous positions of these two points is indicated in the first four graphs by connecting lines. In the other diagrams a solid line represents the path of the center of body weight, while the dotted line indicates the path of the tips of the primaries as they would appear when viewed from the side.

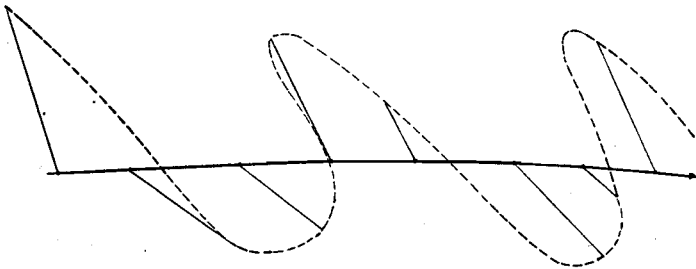
It may seem rather surprising that the wings actually move backward not only in relation to the bird itself, but through space as well, during the up-stroke; while the down-stroke is forward



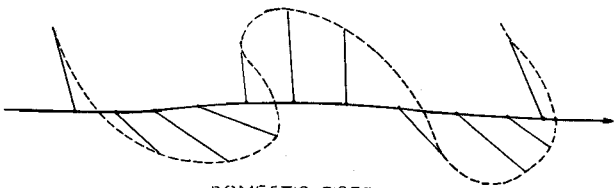
BALD EAGLE



TURKEY VULTURE



OSPREY



DOMESTIC PIGEON

and downward. During the latter the greatest speed of motion is attained. It will readily be seen that a bird flying rapidly through space with rapid wing-strokes will give a similar graph as a bird moving slowly, with wing-beats correspondingly slow. The only difference evident in the diagram will be that the up-stroke is inclined backward at a sharper angle, while the down-stroke is more convex, as seen in the study of the Domestic Pigeon. It is obviously impossible to attempt to show all the different types of flight diagrams that present interesting variations—indeed the flight of a single species varies considerably under different conditions. For instance, the diagram representing the flight of a Blue Jay in passing from one tree to another a few yards distant (fig. 14) is quite different from that of a bird of the same species during a longer flight (fig. 13). A Meadowlark may vary its flight-line by gliding with the wings *above* the body-line instead of *below*, and so on. The great majority of species, however, show a considerable uniformity in their reactions to the same situation.

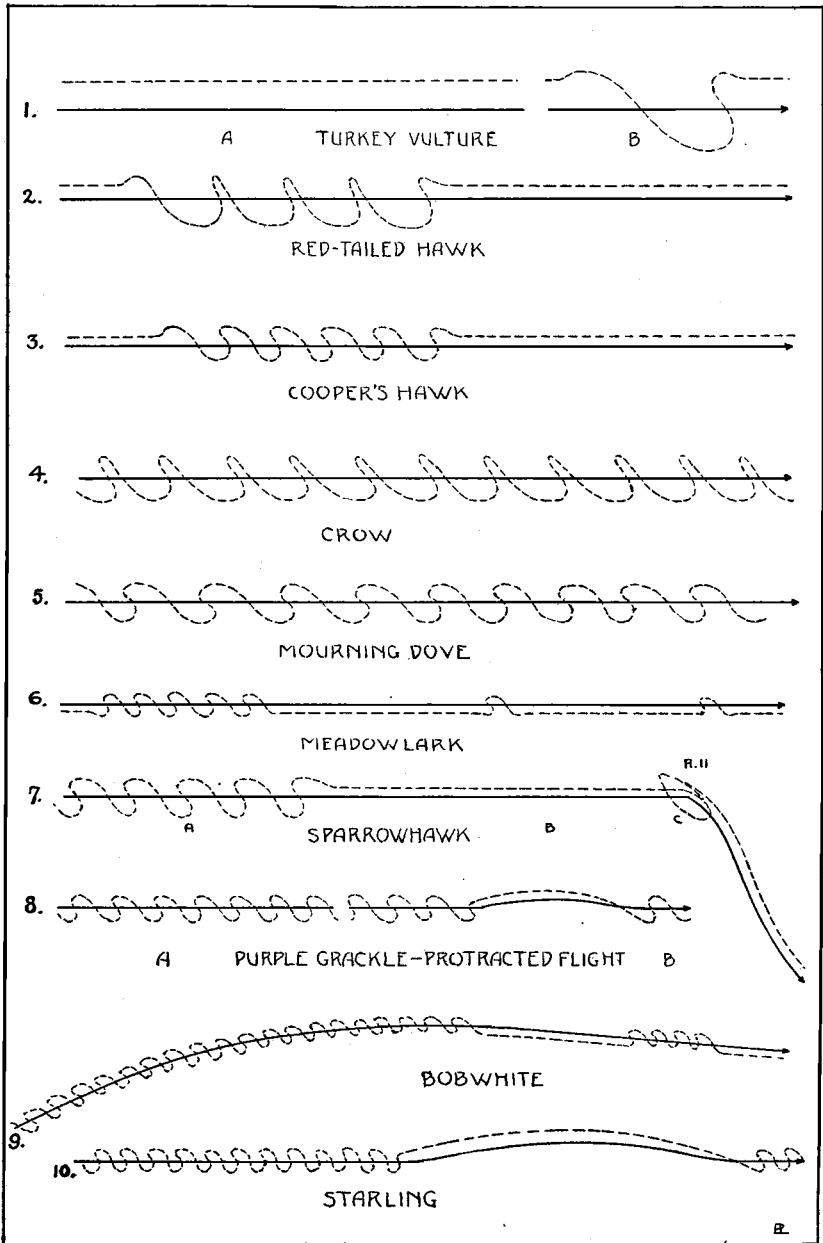
These diagrams are only impressions, and are based entirely on what the bird appears to do. I have no doubt that a motion picture taken with a measured screen as a background would show some surprisingly different results.

"A" at the left of fig. 1, shows probably the simplest type of flight, a Turkey Vulture soaring with its wings raised somewhat above the body-line. Occasionally a single flap, as at "B," may break the line, or a series of several of these flaps.

The second figure, that of the commoner type of flight of the Red-tailed Hawk, shows a series of strokes alternating with the glide. The other Buteos and the Eagles usually give a somewhat similar line, as well as the Brown Pelican and Black Vulture. The third figure on the plate is the line of the Cooper's Hawk, similar to the last, but with the wing-beats showing the curves of a more rapid stroke. The line of the Sharp-shin is almost identical, but on a smaller scale.

The Crow is a good example of uniform, direct flight. Many species would show similar lines: such as the Herons, Ducks, Geese, Pileated Woodpecker and a number of others.

Figure five is typical of the Mourning Dove, but many of the Sandpipers, and Plovers, the smaller Ducks; and at times the



Sparrow Hawks, are similar. The sharp backward inclination of the upstroke and the more rounded downstroke are again similar to figure three.

Figure six shows a typical flight of the Meadowlark, with the wings held below the body level during the act of gliding. I have frequently seen them held above, however, and even both ways during the same flight.

In figure seven a Sparrow Hawk entered the diagram flapping (A), soared a short distance (B), examining the ground below. At "C" it hovered for several strokes (indicated by the R. 11) and then dropped to the ground.

The flight of the Purple Grackle may be either as shown in figure eight "A," direct and uniform as to stroke, or broken at intervals by a hurried bound, as shown in "B." The line of the Starling (fig. 10) bears a strong resemblance, but with a longer bound, while that of the Cowbird is similar, but approaches the undulating type.

Figure nine is a Bobwhite flushing from one cover and then gliding to another. The Grouse and Woodcock would give a similar, but more irregular line, due to the interference of the undergrowth.

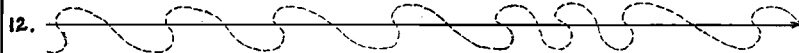
Figure 11, representing the usual flight of the Chimney Swift, is somewhat similar to figure 3, but the intervals of both gliding and flapping are longer; while in figure 12, the typical flight of the Kingfisher consists of several (3-5) slow, powerful beats, alternating with two or three shorter beats.

In figure 13 the usual protracted flight of the Blue Jay, consisting of a regular series of beats, interrupted at intervals by a very brief glide is shown as a contrast to the series of swoops (fig. 14) that are usual during a short flight, especially from a higher to a lower position. Many birds use this same method of covering a short distance. It is quite general, for instance, with the Phoebe.

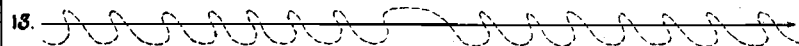
The weak, slightly undulating flight of the House Wren in traversing a short distance between two patches of shrubbery is indicated in figure 15. Many other small species give a similar line under the same conditions. That of the Song Sparrow (fig. 16B) is sometimes altered to a series of glides or swoops (16A) especially when going from a high perch to a lower one.



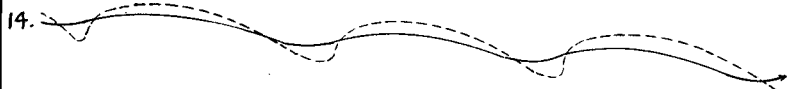
CHIMNEY SWIFT



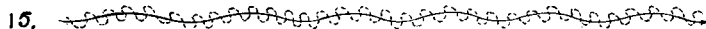
KINGFISHER



BLUE JAY - PROTRACTED FLIGHT



BLUE JAY - SHORT FLIGHT



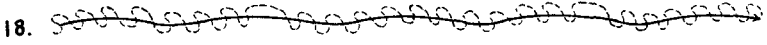
HOUSE WREN - SHORT FLIGHT



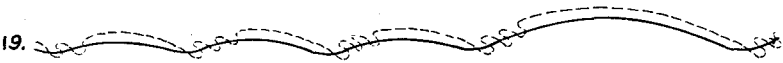
A SONG SPARROW - SHORT FLIGHT B



BARN SWALLOW



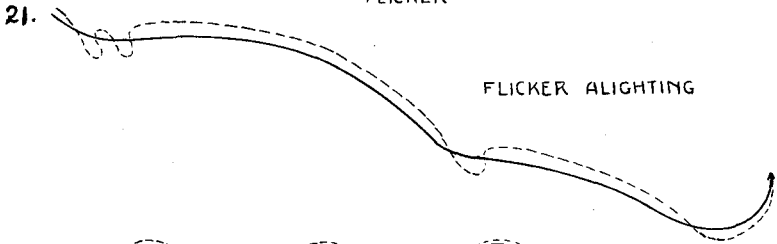
ROBIN



BLUE BIRD



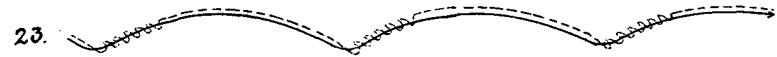
FLICKER



FLICKER ALIGHTING



MYRTLE WARBLER



FIELD SPARROW



GOLDFINCH



NIGHTHAWK

Figure 17 shows a typical bit of the flight of the Barn Swallow, when the graceful sweeps of the wing are interrupted by a short upward swoop at a passing insect.

In figure 18 the protracted flight of a Robin is shown to be somewhat like that of the Blue Jay in that the regular wing beats are occasionally interrupted by an omitted stroke. The slight undulations, however, are characteristic.

Figure 19 represents the flight of a Bluebird over a distance of a hundred yards. A series of short bounds with fixed wings, brought up by two or three rapid beats, and an occasional longer undulation, are typical of the longer flights of this species.

In figure 20 we have one of the strongly undulating types, that of the Flicker. It is also typical of the other Woodpeckers, varying only according to size. The Pileated Woodpecker is the single exception in this locality. While descending, or preparatory to alighting, the Flicker usually indulges in a series of long bounds, interrupted by an occasional "braking" motion of the wings until just before the perch is reached, when a strong upward swoop is taken with partly extended wings (fig. 21).

Another quite dissimilar type of undulating flight is illustrated by the diagram of a short flight of the Myrtle Warbler, in which the undulations are sharper, as if due to weaker flight. A few exceedingly rapid beats turn the bird on an upward course, which rapidly curves into a dive, and is again halted by a series of beats. Most of the Warblers fly in a similar fashion (fig. 22).

A Field Sparrow, during a high flight, gave the line shown in figure 23, in which the downward dive was interrupted by an abrupt change of direction. During short, low flights the line would be similar to figure 16.

While I have sometimes seen Goldfinches come quite close to fig. 23 the usual flight is more evenly undulating, as in figure 24.

An interesting and typical diagram of the flight of the Night-hawk is shown in figure 25. A few leisurely beats, accompanied by an undulating motion of the whole body, are followed by a series of rapid beats, resulting in a rapid rise in elevation when the former method is resumed.

Reading Public Museum, Reading, Pa.