

THE INSECTIVOROUS BIRD AS AN ADAPTIVE STRATEGY

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Birds and insects are virtually unique among extant forms, sharing only with bats the ability to fly. Having this characteristic in common, it is not surprising that these groups have developed intricate and fundamental ecological interrelationships. Perhaps best known, and to be discussed here, is the preying of birds upon insects.

As a group, insectivorous birds display a wide variety of feeding specializations, from hunting upon the wing (swifts, swallows) to excavating deeply in wood (woodpeckers). Roughly 60% of the approximately 8600 species recognized by Mayr & Amadon (50) are partly or largely insectivorous (percentage estimated from 90). Most are relatively small, and some attain high densities (data from breeding-bird and winter bird censuses in *Audubon Field Notes*). In spite of their small size, their total biomass may make up a high percentage of the avian contribution. Since this diversity and abundance occurs in spite of the severe restrictions imposed by food chain energetics (42, 84), it points out even more clearly the importance of the bird-insect relationship.

At least within the macroscopic realm insect diversity on a world-wide scale is unprecedented (49), and in well-studied terrestrial communities the numbers of insect species may reach equally impressive figures (cf. 11). Despite their small size their overall energetic contribution may be substantial (reviewed in 13). Relative to other major taxonomic groups the number of life forms of insects is also impressive (83), and where metamorphosis occurs, it compounds effective diversity. Given their abundance of general life forms and productivity, insects not surprisingly support many predatory species. Flying predators should enjoy a distinct advantage in capturing flying insects and ones in otherwise practically inaccessible locations (tips of vegetation, etc.). This may well represent a partial basis for the high abundance and diversity of birds.

In this paper I consider insectivorous birds as "adaptive strategies," that is, as adaptations or sets of adaptations to the spatial and temporal patterning of the environment. Adaptive strategies cut across community barriers and are in theory distinct from special adaptations to particular environmental regimes. For example, will a population become polymorphic or re-