

**Report submitted to the
City of Boulder Open Space Department**

The Foraging Ecology of the Western Wood-Pewee

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April 1996

**FORAGING ECOLOGY AND BEHAVIOR OF THE WESTERN
WOOD-PEEWEE, *CONTOPUS SORDIDULUS***

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INTRODUCTION

Several studies on insectivorous birds have attempted to relate their foraging ecology to such factors as prey availability (Busby and Sealy 1979, Bibby 1981, Moeed and Fitzgerald 1982, Quinney and Ankney 1985, Raley and Anderson 1990), habitat structure (Rotenberry 1980, Robinson and Holmes 1982, 1984), or optimality theory (Davies 1977a, 1977b; Goss-Custard 1970).

Of particular interest in such studies has been the relatively behaviorally diverse family of New World flycatchers, the Tyrannidae (Traylor 1977). Although not solely limited to sally-hovering as a means of prey capture, many of the species of Tyrannidae rely solely on such behaviors. Several workers have examined the foraging ecology of various species of tyrannid flycatchers (Davies 1977a, 1977b; Beaver and Baldwin 1975; Eckhardt 1977; Frakes 1978; Fitzpatrick 1980, 1981; Sherry 1984; Verbeek 1975). Furthermore, some of these workers have included the Western Wood-Pewee, *Contopus sordidulus*, in their studies (Beavers and Baldwin 1975, Eckhardt 1979, Frakes 1978, Verbeek 1975). The primary objectives of the our study were to examine in the foraging behavior of the Western Wood-Pewee and to further the understanding of its foraging ecology.

The Western Wood-Pewee is primarily an insectivorous species (Beal 1912) whose range extends throughout much of western North America (Frakes 1978).

Generally, the wood-pewee is an open cup nester found in open deciduous and pine forests (Gabrielson and Jewelt 1940, Grinnel and Miller 1944, Frakes 1978, Chace and Cruz 1996).

STUDY AREAS AND METHODS

This study was conducted from May 29 to August 15, 1995. Care was taken to make observations at all times during daylight hours in order to gain insight into the foraging behavior of pewees throughout the day.

Study site. Field work was conducted at Mt. Sanitas, which is located on the western outskirts of Boulder, Colorado. Rising to approximately 2200 m in the foothills of the Rocky Mountains, Mt. Sanitas is predominantly forested with ponderosa pine (*Pinus ponderosa*). The forest cover ranges from relatively dense, in which the canopy is closed, to open fields approximately 50 m².

Methods. Detailed observations of foraging birds were made by observing as many pewees as possible within the study area. We surveyed the study area in a reasonably systematic manner: each day in the field, we zig-zagged around the mountain in order to cover the entire study area. Furthermore, we made our observations at a distance greater than 10 meters to ensure that we did not disturb or influence the bird's behavior. Due to the relatively small number of resident birds, individuals were often followed for as long as possible, in many instances, up to 10 minutes. This allowed us to record several sequential observations of the individual's foraging behavior. For each foraging individual, we recorded a number of observations as follows.

Height of perch.--The height of the perching bird in the tree was visually estimated to the nearest meter. We often checked our approximated heights by actually measuring the perch height of a perched wood-pewee and found our observations to be quite accurate.

Foraging attempts and successes .-- A foraging attempt was recorded when an individual pewees left its perch and attempted to catch an insect. When an individual left its perch and did not seem to pursue any insect, or no insects were visible, the observation was not recorded as an attempt. Foraging attempts were scored as successful when an individual captured an insect.

Foraging methods.-- Only two types of foraging methods were witnessed during our study: hawking and sally-gleaning. We define hawking as "the capture of a flying insect" and sally-gleaning as "the flying to and capture of an insect on a substrate."

Return to perch.-- When attempting to capture an insect, the wood-pewee has a choice of either returning to its perch or going to a new one. We scored a foraging attempt as a "return to perch" when an individual returned to the perch site, within 15 cm, from where it just left.

Distance to and Identification of Prey.-- Distance to prey was categorized as either less than or greater than 10m and was estimated in much the same way as perch height. Based on field observations, we were able to identify some prey items to order. Insects that were either too small or too far away were recorded as "unknown."

Flight pattern.-- Flight pattern was determined as either ascending, descending, or horizontal with regard to the perch position of the foraging pewee.

RESULTS

Height of perch.--The mean perch height for foraging Western wood peewees we observed was 7.7 +/- 3.1m.

Foraging attempts and successes.--We made a total of 97 foraging observations, of which 56 were determined as successes, giving a success rate of 57.7%.

Foraging methods.--Of the 97 foraging attempts we witnessed, 95 were classified as aerial hawks and 2 were classified as aerial gleaners ($P < .001$)

Return to Perch.-- Without considering the success or failure of the foraging attempt, pewees showed no significant tendency to either select a new perch site or return to the original perch. However, of the 56 successful foraging attempts, the bird returned to the original perch 41 times ($P < .05$).

Distance to and identification of Prey item.-- There was no correlation between distance to the prey and success rate nor was there between distance to and prey selected.

Flight pattern.-- There was no significant difference between the flight pattern the foraging pewees used in attempting to capture a passing insect. However, pewees did show a marginally significant ($P < .10$) tendency to favor either a descending or horizontal mode of attack rather than an ascending mode of attack.

DISCUSSION

Many of our results are congruent with previous studies done by such workers as Verbeek (1975), Beavers and Baldwin (1975), Eckhardt (1979), and Frakes (1978). But, in contrast with those researchers, our results indicate several interesting behaviors and tactics utilized by pewees heretofore undescribed or analyzed in the literature.

Mean height of perch.--The mean perch height of pewees in the Mt. Sanitas study area was 7.7 ± 3.3 m. This location in the tree allows the foraging bird a wide variety and number of directional opportunities to aerial hawk at passing insects, yet is slightly lower than the average height of most Ponderosa trees on Mt. Sanitas. As we indicate later in the paper, this tendency could be due to more insects being found near the ground rather than high in the canopy.

Foraging attempts and successes Pewees in our study exhibited an overall success rate of 57.7%, a number that at first glance might seem rather high for an insectivorous forager. But, Davies (1977b) found a success rate of 63.8% for the Spotted flycatcher (*Muscicapa striata*) hawking for Diptera. Pewees apparently evolved

behavioral mechanisms or morphological adaptations that allow it feed rather efficiently.

Foraging methods.--In all other studies of the mode of attack (Verbeek 1975, Eckhardt 1980, and Frakes 1978) of Western Wood-Pewees, aerial hawking was found to be the case in well over 90% of the observations, and in one case, 100% (Verbeek 1975). We observed 2 sally-gleans and 95 aerial hawks in our study, giving a total percentage of 97.9% aerial hawking attempts. Along those lines, since pewees relies so heavily on aerial hawking, it prefers to perch on the outer branches of the trees.

Return to Perch.--Leck (1971) showed that length of flight and tendency to return to the same perch are related in the Eastern Kingbird (Tyrannus tyrannus). However, Verbeek (1975) indicates that there is no correlation between flight distance, perch height, flight direction and tendency to return to perch in pewees in California. Similarly, we observed no correlation between those factors.

Moreover, we were interested in the possible relationship between successful foraging attempts and the tendency to return to the same perch. By feeding on insects that appear randomly and are a common occurrence, Pewees in no way create a 'resource depression' that Charnov (1976) refers to. The argument goes that if an individual is having a fair amount of successful foraging attempts from a specific location, then why should it have to change locations, assuming that the resource is not rapidly depleted. In fact, we found such in tendency in pewees. Pewees showed a significant correlation between successful aerial hawks and a propensity to return to the same location ($P < .05$). Of the 56 successful attempts we observed, on 41 of those, the successful bird returned to the same perch site.

Distance to and identification of Prey.--We relied upon our ability to identify insect prey as they were being taken by the foraging Western Wood-Pewees. Pewees exhibited no preferences or apparent discrimination between the available insect prey on Mt. Sanitas.

Furthermore, the foraging Peewees showed no desire to fly farther out from the perch for a particular prey organisms or group of organisms. It appears that peewees in Ponderosa pine forests in Colorado, relatively entomologically simple communities, take what they can get when they can get it, regardless of size or classification.

Flight pattern.--In aerial hawking for a prospective prey item, the Western Wood-Peewee generally leaves its perch in a horizontal or descending pattern rather than an ascending pattern. Two possible reasons for this might be that it is too energetically costly to fly upward and chase an often times very maneuverable insect, and/or the majority of available insect prey is found either horizontal to or below the mean perch height of 7.7m.

Related to the tendency to not fly upward from the perch is the fact that the peewee has less success in upward flights, as compared to horizontal or descending flights. The extremely low success of ascending flights might again be attributed to the energetic costs involved in pursuing an insect from below. Since a bird flying upward is often times slower in pursuit, a prospective prey insect will have more time to respond and more than likely escape. On the other hand, horizontal and descending flights counter the argument in that they will allow the Western Wood Peewee to attack in a quicker, more successful manner.

Acknowledgments

We wish to thank the Clint Miller and the City of Boulder Open Space Department for allowing us to conduct our studies in the Mount Sanitas area.

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