Sap tree feeding preference by Yellow-bellied Sapsuckers (*Sphyrapicus varius*) based on tree size and species in Cheboygan County, northern lower Michigan

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General Ecology 381
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August 8, 1997

Abstract

To test for preference in choice of sap trees, the area surrounding an active Yellow-bellied Sapsucker (*Sphyrapicus varius*) nest was surveyed using four randomly selected 20 x 20m plots at the University of Michigan Biological Station in Cheboygan County, Michigan (45°33'30.370"N, 84°40'27.516"W; T37N, R3W, Sec. 33). In each plot, all trees ≥ 20 cm diameter at breast height were measured, identified to the species, and classified as either non-feeding trees or sapsucker trees, indicated by several rows of holes in the tree bark. The range of dbh of feeding trees was 42 cm to 161 cm. Diameter at breast height data collected were insufficient for conclusions about effects of tree size on sap tree choice by sapsuckers. Of the 131 trees sampled, eleven were feeding trees for Yellow-bellied Sapsuckers. Eight of the eleven feeding trees were Scotch Pine (*Pinus Sylvestris*), and the other three were a Jack Pine (*P. banksiana*), a Red Pine (*P. resinosa)* , and a Paper Birch (*Betula papyrifera*). A coefficient of concordance test (Kendall and Smith 1939) suggested that Yellow-bellied Sapsuckers do not select feeding tree species based on relative abundance ($W=19.3636$, $df=9$, $X^2_{approx}=3.33$, $p \leq 0.05$). The preference of sapsuckers for certain species of trees may provide information about their related food webs and communities.

Introduction

The Yellow-bellied Sapsucker (*Sphyrapicus varius*) is a species of woodpecker found throughout the Eastern United States (Kaufman 1996). As their name implies, they have the unique ability to use sap as a food source. Yellow-bellied Sapsuckers feed on a variety of insects as well as on the sap of trees (Kaufman 1996). During the nesting season, insects comprise only half the diet, and sap becomes an important source of nutrition. Sap trees used include numerous deciduous and coniferous species, such as birch, maple, pines, firs, and spruces (Winkler et al. 1995).

Yellow-bellied Sapsuckers have been found to be selective in the number of trees they use. They may explore their territories extensively, drilling holes in many trees. Only a few of these become feeding sites, however. Sapsuckers will repeatedly return to two or three trees in a productive site called an "orchard" (Skutch 1985). They will create new orchards when the trees die and are no longer accumulating sap (Tate 1971).

Several studies have demonstrated preferences in selection of feeding trees by other woodpeckers (Williams 1980, Connel 1980). Connel (1980) investigated the foraging habitats used by six woodpecker species. It was found that different woodpecker species preferred different ages of tree stands. For example, Downy Woodpeckers (*Picoides pubescens*) appeared to prefer younger forests than Hairy Woodpeckers (*P. villosus*) . There was also a difference in the tree species selected. Red-headed Woodpeckers and Hairy woodpeckers used more oaks than the other species; Pileated Woodpeckers and Downy woodpeckers used more conifer species.

Tree choice by other species varies not only with species available, but also with the season and locality (Connel 1980, Skutch 1985). Two woodpeckers which usually exploit similar tree species, the Hairy and the Downy Woodpecker, were found to use completely

different habitats. In Colorado, Hairy Woodpeckers used conifers extensively, while Downy Woodpeckers in the same region used the deciduous forests (Connel 1980).

Little has been published, however, on the Yellow-bellied Sapsuckers or on their feeding preference. Sapsuckers have been reported to feed on as many as 250 species of trees (McAtee 1911). Zatkin (1991) manipulated sugar content of sap and investigated preference related to sap flow and sucrose concentration. It was concluded that sapsuckers depend on sap flow, not sucrose content, when choosing sap feeding trees. Another study (Lovrien 1990) investigated the physical parameters which influence sap tree selection. Lovrien (1990) concluded that sap trees were characteristically found in young, deciduous forests with many aspens and birches.

Okoniewski (1988) concluded that sapsuckers are selective in northern Michigan, with Paper Birch being the most commonly used sap tree. She also suggested that further studies should compare the size of feeding trees with others in the plot. She concluded that conifers were used more than she had expected, but she had not recorded them to the species. One would predict, however, that some species of trees must provide better nourishment, and would therefore be preferred over others.

The current study attempted to offer further support for the idea of selectivity for feeding trees by Yellow-bellied Sapsuckers. All trees within each plot were classified to the species, and their diameter at breast height was recorded. These data were compared between the total trees present and those which were chosen as feeding trees by the sapsuckers. Because certain trees should have different levels of nutrition (Kramer & Kozlowski 1979), we hypothesized that we would find non-random, preferential feeding on only a few of the available species of trees.

Methods

This study was conducted July 31, 1997, at the University of Michigan Biological Station in Cheboygan County, MI (45°33'30.370"N, 84°40'27.516"W; T37N, R3W, Sec. 33). The area sampled was a mixed deciduous woodlot dominated by Paper Birch and Red Maple, with interspersed conifer and aspen species. An active Yellow-bellied Sapsucker nest located within the woodlot served as the intersection of two transect lines (N-S, E-W), along which 40-20 x 20m plots were placed. The nest was used as a center of feeding because of the suggestion of Skutch (1985) that feeding "orchards" are established near the nesting site. Along each of the four compass directions, we randomly selected one point as the center of a plot, for a total sample area of 4-20 x 20m plots. Plot #1 was 60m North of the nest,; plot #2 was 100m East; plot #3 was 100m South; plot #4 was 120m West of the nest.

All trees in the plot were identified to the species and their diameter at breast height recorded. Yellow-bellied Sapsucker activity was defined as several rows of holes in trees at which sap had collected. All trees were identified as either sapsucker trees or non-feeding trees. In order to show a tree species preference or lack of preference, we ranked our data for frequency of tree species occurrence in a non-parametric test known as coefficient of concordance (Ostle & Malone 1988).This test allowed us to compare two different sets of ranked data based on a Kendall coefficient, W, and a chi-squared approximation value to test for equivalence of ranking.

Results

The dbh range for feeding trees was 42 cm to 161 cm. Scotch Pine (*Pinus sylvestris*), the only tree species found with more than one feeding tree, had a large range of dbh as well (43 cm-161 cm). Analysis of the dbh data was limited by small sample size.

Only 11 of the 131 trees sampled showed evidence of sapsucker feeding (Table 1). Eight of these eleven tree were Scotch Pines (*Pinus sylvestris*), one was a Jack Pine (*Pinus banksiana*), one was a Red Pine (*Pinus resinosa*), and one a Paper Birch (*Betula papyrifera)* (Figure 1).

These data showed a significant Kendall coefficient suggesting a preference in Yellow-bellied Sapsucker selection of sap trees independent of tree species abundance (W= 19.3636, df=9, X^2_{approx}=3.33, $p \leq 0.05$).

Discussion

The wide range of dbh data in our results suggests that sapsuckers do not show a tree size preference for feeding trees. Nelson (1991) found similar results when studying sapsucker preference in Paper Birch; no significant difference was found between the dbh of active and inactive birch trees. Other studies, however, have contradicted the results of Nelson's study. Edinger and Schik (unpubl.) found that sapsuckers preferred birch trees with a dbh between 21 cm and 30 cm. Okoniewski (1988) and Lovrien (1990) both found that larger trees were preferred by sapsuckers as feeding trees. When we censused the feeding trees, current bird activity was not monitored to confirm that they were active trees. Previous studies have warned against making conclusions about size preference without confirming trees are actively used by birds; the trees may have grown since they were used (Lovrien 1990, Nelson 1991). Given these caveats and sample size limitations, any conclusions about sap tree size preference would be inaccurate at this point.

The abundance data from the present study (tree species and those species used by sapsuckers) were analyzed with the coefficient of concordance. The significant Kendall coefficient based on the relative abundance of tree species and their use by birds suggests that sapsuckers do not select species of feeding trees based on availability. This implies that the selection of sap trees by Yellow-bellied Sapsuckers is not random. There is an obvious preference for Scotch Pine. This contradicts a few of the past studies which found sapsuckers to prefer Paper Birch (Kilham 1964, Tate 1971, Okoniewski 1988, Lovrien 1990, Edinger and Schik unpubl.).

It is not unheard of, however, for the sapsuckers to show strong preference for trees other than birch. Williams (1980) found that hickories (*Carya ovata*) were the tree of choice in Illinois during spring migration. In two other studies, sapsuckers returning to northern Michigan in spring and summer were found to initially feed on conifers and switch to elms, maples, and oaks as they broke dormancy (Kilham 1964, Tate 1971).

There are most likely a range of tree species which provide a more favorable food source for Yellow-bellied Sapsuckers. The selection of sap feeding trees would be based on the characteristics of the available species, as well as the traits of individual trees. Our data lend support for the idea that although sapsuckers are capable of using a wide range of tree species for sap feeding, they are selective. The ability of sapsuckers to exploit a wide range of food sources may be responsible for their wide geographic distribution throughout the eastern United States (Kaufman 1996).

There are several possible reasons for the finding in this study. The Scotch Pines in our study may have been used as an early spring food source. The cold temperatures during the previous winter and spring may have prolonged the dormancy of other tree species, leading to more extensive use of the pines for sap. The Scotch Pines are also a non-native species which may not have been present in the other northern Michigan studies. It may be that Scotch Pines provide more nutrition for sapsuckers; given the choice between their usual Paper Birch and the Scotch Pines in an open area the sapsuckers choose the pine trees.

Another possible factor in the selection of suitable trees may be spatial. Connel (1980) mentioned the preference by some species, such as the Flickers, for park-like open areas. In our study, we noted that the trees which were used by sapsuckers were all in exposed areas such as roadsides or the lakefront. The eight Scotch Pines that were used as feeding trees were in very close vicinity to each other, and the Red Pine and Jack Pine were near the water. These trees provide an open understory for foraging (Connel 1980). It may also be that these trees have greater access to limited resources such as space and light, and provide higher quality sap in some way for the sapsuckers (Kramer & Kozlowski 1979).

There are, however, too many factors affecting the feeding behavior of these birds to narrow them down to any one category or species preference. Birds may be influenced by types of bark, height of trees, seasonal changes, and chemical compounds in the trees. Yellow-bellied Sapsuckers' choice of sap trees may be influenced by any combination of

these factors. Because of this variability, the information collected about the habits of these birds should be taken in perspective. The preference demonstrated in this study was during a narrow window of time, in a specific locale, with presumably one pair of sapsuckers.

The information collected in studies such as this, however, give general information about use of resources such as sap trees that is required for the conservation of habitats and avifaunas. Such information may be crucial to the survival of the Yellow-bellied Sapsucker and its role in its associated community and food web. Questions of foraging behavior are important for developing an understanding of the ecology of terrestrial birds. The breeding season foraging (investigated in the present study) is not the only important consideration. Demonstration of possible preferences should be investigated over time, space, and under varying biotic and abiotic conditions. I agree with Recher (1990) that manipulative studies, and long-term studies in the future should include documentation of individual differences in order to understand the true relationships between birds populations, communities, and their associated trophic webs.

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Acknowledgments

Inspiration for this project was provided by Dr. Francie Cuthbert. Indispensable editing and support were supplied by Dr. Claudia Jolls and Eric Hellquist. Commitment to a difficult project was given by my partners, Lia Florey and Jessica Strok. All of the above contributions were greatly appreciated.

Table 1. Observed tree species in sampled plots: number used by Yellow-bellied Sapsuckers (YBS) vs. total abundance.

Species	Latin Name	#YBS	Total #
Scotch Pine	*Pinus sylvestris*	8	9
Jack Pine	*Pinus banksiana*	1	2
Red Pine	*Pinus resinosa*	1	16
Paper Birch	*Betula papyrifera*	1	23
White Pine	*Pinus strobus*	0	11
Red Maple	*Acer rubrum*	0	42
American Beech	*Fagus grandifolia*	0	6
Trembling Aspen	*Populus tremuloides*	0	5
Bigtoothed Aspen	*Populus grandidentata*	0	10
Red Oak	*Quercus rubra*	0	7

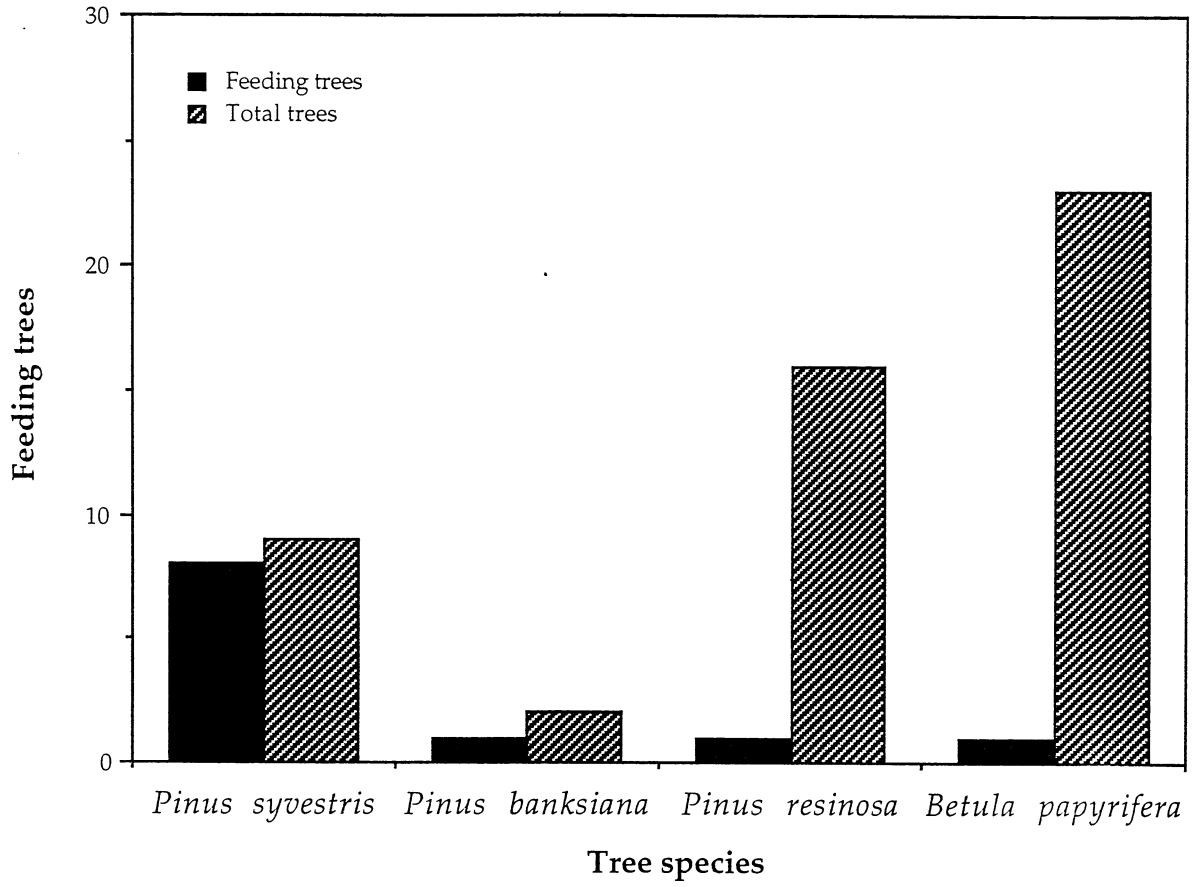

Figure 1. Frequency of feeding trees (n = 11) versus total trees for species with sapwells (n = 50)