

# ECOLOGICAL ASPECTS OF AVIAN BILL-SIZE VARIATION

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Ecologists and evolutionists have made various attempts to associate variation in the size of anatomical structures with ecological characteristics of organisms. The attempts have met with varying degrees of success. (e.g., Van Valen 1965, Willson 1969, Soulé and Stewart 1970, Grant 1971, Pulliam 1973, Rothstein 1973). Problems associated with studies of morphological variation have been discussed from several points of view in the above papers and by Van Valen and Grant (1970), Soulé (1971, 1972), Horton (1972) and others. We have attempted an analysis of variation in bill size of bird species known to occur together in the breeding season in east-central Illinois and for which some of the autecology is known. Basically we sought to relate the degree of variation with (1) feeding ecology—specifically foraging strategy, food habits, foraging behavior, and foraging stratum; (2) type of habitat—i.e. grassland, shrub, forest; (3) seasonal movement patterns; (4) body size; (5) the number of sympatric species in a guild of ecologically similar species (Root 1967); and (6) width of habitat niche. In addition, we analyzed the variability in one bill dimension with respect to that in other bill dimensions.

## METHODS

The list of 66 species to be analyzed was obtained from breeding bird censuses (excluding owls) of 24 study areas in Champaign, Vermilion, and Piatt Counties in Illinois (Roth 1967, Karr 1968, Willson 1974). One more species, *Ammodramus henslowi*, was added for analysis of a successional series summarized in Roth (1967). The bills of these species were measured, by MFW, in three dimensions; length from the posterior edge of the nostril to the bill tip and depth and width at the anterior margin of the nostril.

More than 30 specimens were measured for all but four species which were represented by more than 20. In all cases, at least 10 of each sex were measured. The total sample exceeded 2800. Measurement error was not analyzed, but errors were consistently small. We used specimens collected in Illinois when available, but in many cases we had to use specimens from other midwestern states and adjacent parts of Canada. A table of means and standard errors is available from MFW and will be on file with the article in the Josselyn Van Tyne Memorial Library at the University of Michigan. Except for Bobwhite (*Colinus virginianus*), samples were comprised primarily of spring and summer specimens. The problems of using specimens taken over such a broad area and long time span, as represented by museum collections, are obvious but unavoidable; the practical difficulties of capturing and measuring sufficient numbers of birds on our study areas were plainly prohibitive. Few of the specimens used in this study were labeled accurately as to subspecies, according to one of the museum curators, so this taxonomic distinction was ignored.

TABLE 1  
NUMBER OF SPECIES ASSIGNED TO EACH GUILD OR OTHER CATEGORY

Category	N	Category	N
Feeding ecology		Habitat <sup>a</sup>	
Foraging strategy		Grassland	7
Searcher	52	Shrub	28
Pursuer	14	Forest	30
Food habits		Seasonal movement patterns	
Omnivore	23	Summer resident	48
Insectivore	43	Permanent resident	18
Foraging Stratum		Body size	
Bark	5	0-3 g	1
Ground	15	3-6 g	1
Low	22	6-12 g	12
Medium	8	12-24 g	21
High	6	24-48 g	12
Foraging behavior		48-96 g	12
Bark drill	4	96-192 g	5
Bark glean	4	> 192 g	2
Ground glean	15	Guild size	
Foliage glean	34	1 species/guild	36
Sally	9	2 species/guild	18
		3-4 species/guild	12

<sup>a</sup> *Sturnus vulgaris* which nests and feeds in different habitats omitted from this set.

Assignment of the bird species to guilds or other ecological categories (Table 1, Appendix 1) was based on several information sources. In cases in which species could fall into more than one category, we chose the primary one for classification. Category designations and criteria follow Karr (1971) for the most part. References for body weights can be found in Willson (1974). Guild assignments and seasonal movement patterns are based on our own local field experience with most of the species. When questions arose, we supplemented those data with material from Bent (1919-1968), Martin et al. (1951), and other relevant literature. Readers might feel inclined to alter some of these assignments (e.g. Mockingbirds also sally), but because we have tried several different arrangements ourselves, we believe that such alterations will not change the major results of this analysis.

Two measures of the variability in bill dimensions were used in our study: (1) sexual dimorphism in bill size, indexed both by the frequency of occurrence and by the degree of bill size differences (the degree of difference was measured by a ratio of larger : smaller bill size); and (2) continuous variation, indexed by the variance of the logarithms of the measurements (Lewontin 1966), computed for the species sample as a whole and for each sex separately (this index is scaled so that relative variability may be compared for structures of different absolute sizes).

Statistical procedures included the use of t-tests for differences between means of males and females, Mann-Whitney U-tests for differences in continuous variation and degree of

dimorphism between ecological categories and G-tests with Yates correction (Sokal and Rohlf 1969) for differences in frequency of dimorphism. In all cases the 5% level of significance was used.

#### SEXUAL DIMORPHISM IN BILL DIMENSIONS AS RELATED TO ECOLOGICAL FACTORS

##### Feeding ecology

*Occurrence of dimorphism.*—We found no significant differences among categories of foraging strategy or food habits. For foraging stratum, bark users were more often dimorphic (80%) in bill length than low- or high-foliage users (18% in each), and in bill depth than high-foliage users (12%). For foraging behavior, bark-drillers were more often dimorphic (100%) in bill length and depth than ground gleaners (31% in both dimensions), foliage gleaners (25% in both dimensions) and salliers (length—0%, depth—22%). Twenty-four other comparisons were not significant.

*Degree of dimorphism.*—Data can be averaged in two ways, over all species and over just the dimorphic species. Considering all species, no significant differences were found among foraging strategies, food habits, or foraging stratum. For foraging behavior, bark-drillers were more dimorphic than foliage gleaners (length and depth) and salliers (length, and probably depth:  $p < .055$ ). Twenty-seven pair-wise comparisons were not significant. When only dimorphic species were considered, none of the 30 comparisons was significant.

##### Habitat

*Frequency of dimorphism.*—Grassland species (86%) are more often dimorphic in at least one bill dimension than are shrub (50%) or forest (38%) species, but the difference is not statistically significant, largely as a result of the small number of typically grassland species. Shrub species are significantly more often dimorphic than forest species. If icterids are omitted, grassland species are significantly more often dimorphic than forest species.

Considering each dimension separately: for length, grassland species (71%) are more frequently dimorphic than either shrub (18%) or forest (26%) species; for depth (79%, 29%, 29%) the differences are not significant statistically; for width, shrub species (32%) are dimorphic more often than forest species (19%), but grassland species, while very frequently dimorphic (43%), are not significantly more so than forest or shrub species. Any trends that might be suggested here disappear if icterids are omitted from the analysis.

*Degree of dimorphism.*—Considering all species in each habitat type, or considering only the dimorphic species, the degree of dimorphism is similar in all habitat types.

### Seasonal movement patterns

It can be argued that permanent residents are more likely to be variable than are migrant species. Conceivably, the migrants (summer residents) can select habitats or micro-habitats in their winter and summer ranges that are more similar for foraging than can year-round residents in a single area. Or, conversely, migration may involve changes in food habits or foraging behavior (see Karr 1971, for examples) and increased morphological variation.

*Frequency of dimorphism.*—Frequency of dimorphism in length and width are not significantly different, but permanent residents are more frequently dimorphic in bill depth than are summer residents.

*Degree of dimorphism.*—Considering all species, permanent residents are more dimorphic than summer residents for bill length and depth. For dimorphic species only, no bill character showed significant differences.

### Body weight

*Frequency of dimorphism.*—No significant differences were found among the size classes for bill length. Large species (> 192 g) were more frequently dimorphic for bill depth than 12–24 g birds. For bill width large species (> 192 g) were more frequently dimorphic than 6–12, 12–24, and 48–96 g species.

*Degree of dimorphism.*—Of those size classes with more than one species the 96–192 g and > 192 g species were significantly more dimorphic for bill length than 6–12, 12–24, 24–48 g species. Nine other pair-wise comparisons were not significant. For bill depth, birds larger than 192 g were more dimorphic than 6–12, 12–24, and 48–96 g species. Twelve other pair-wise comparisons were not significant. For bill width, 48–96, 96–192, and > 192 g species were more dimorphic than 12–24 g species and > 192 g species were more dimorphic than 6–12 g species. Eleven other pair-wise comparisons were not significant.

For dimorphic species only, there were no significant differences in degree of dimorphism. The small number of species in each category often made significance at the .05 level impossible.

### Size of guild

As the number of potential competitors, as defined by similar ecologies, increases among ecologically sympatric species, reduced morphological variation might be expected (Willson 1969, Rothstein 1973). To test this suggestion we constructed a three-dimensional contingency table in which food habits, foraging behavior and foraging stratum were the three dimensions used to compare guilds. We then compared sets of guilds with one, two, or more than

two members. No significant differences in dimorphism were found between "crowded" and "uncrowded" guilds.

#### Width of habitat niche

McNaughton and Wolf (1970) and Rothstein (1973) have explored in detail the suggestion that more abundant species have broader niches, or that species with broader niches are likely to be more abundant.

Our measure of width of habitat niche should be taken as a first approximation until more precise measures are available. We determined the percent vegetation cover (PCVC) in each of the three strata for all study areas as in Karr (1968) and Willson (1974), and summed over all strata. The study areas were then ranked from low to high PCVC, and the distribution and abundance of each bird species plotted on this gradient. Habitat-niche width was then indexed in two ways: by the range of PCVC occupied (five categories), and by the area under the abundance curve (large, medium and small "niche size").

*Frequency of dimorphism.*—Not one of 30 possible comparisons was significant.

*Degree of dimorphism.*—For dimorphic species alone, no significant differences appeared. For all species, only one comparison was significant.

Thus, there seems to be no relationship between width of habitat niche and bill-size variation.

#### CONTINUOUS VARIATION IN BILL DIMENSIONS AS RELATED TO ECOLOGICAL FACTORS

No consistent patterns in the amount of variability appeared in the comparisons of foraging strategy, food habits, foraging stratum, foraging behavior, habitat set, seasonal movement pattern, guild "crowding," or width of habitat niche. Occasional differences of statistical significance appeared, but the biological significance of these is obscure.

For body weight, over 29% of the tests were significant, more than expected at random. In general, larger size classes (48–192 g) are relatively more variable than smaller classes (6–48 g), but there are a number of exceptions, and furthermore there is no evidence of any correlation of size increment with variance.

Our series of habitats mimics a successional series in structure, and showed no trends of increasing or decreasing continuous variation. We also used an actual successional series, composed of over 20 years of breeding bird censuses on a "forest-edge" study area (Roth 1967). During this time the area changed from open pastureland with scattered trees and shrubs to a dense late shrub-forest habitat. Mean continuous variation by species and weighted by species

abundances showed no successional trend. Such an analysis could be a test of the hypothesis that niches become narrower as succession proceeds (Odum 1969). If so, the hypothesis is not supported by our results. However, the test requires the assumption that variation of bill size reflects niche width. That assumption may be inaccurate.

#### RELATIONSHIPS AMONG BILL DIMENSIONS

No one bill dimension tended to be more variable or to vary more often than any other.

The variance of each bill dimension was regressed on all others, but no significant product-moment correlations were evident in any of the 6 comparisons, even when the few species with unusually high variances were excluded. This indicates that selection on variability, if any, operates independently on the three bill dimensions.

#### DISCUSSION

Nearly 1000 tests of statistical significance were made during the course of this study in an effort to determine the ecological circumstances likely to be associated with variability in bill size. Of those, about 9.5% were significant at the 5% level, more than would be expected by chance alone ( $\chi^2 = 13.43$ ,  $p < .001$ ). The only ecological classification that gave more significant tests than would be expected by chance alone was continuous variation by size ( $\chi^2 = 28.6$ ,  $p < 0.001$ ). The irregular pattern of significant results suggests a spurious cause. Conceivably, measuring error might be relatively large on small species rendering tests of variation among the size classes ineffective (Sokal and Rohlf 1969:15). Similarly, t-tests and measurement of dimorphism may be affected by this problem. If statistical significance is ignored and only the direction of the differences is considered, no significant trends emerge.

The results presented here differ notably from those of Rothstein (1973). He found a positive correlation of morphological variability and abundance in a carefully selected example, and argued that wide niches may be expected to support larger populations than narrow niches. However, this argument is not necessarily true. One can imagine a species with a very broad niche (on some particular dimension) which is held at low population densities because resources have been reduced by interspecific overlap and competition. The concept of diffuse competition (MacArthur 1972:29) describes such a situation. We found no relationship between bill-size variation and abundance or width of habitat niche. It is possible that sampling problems or our choice of niche dimension (i.e. habitat) obscured the true relationship, but it seems more likely that the basic assumption of a relationship between abundance

and niche width needs to be refined. In particular, population density, intraspecific competition, and resulting dispersion patterns seem likely to be important.

Tests of niche width with respect to geographical (rather than ecological) sympatry have no necessary validity (Soulé 1972), although habitat restriction in areas of geographic overlap *may* be associated with restricted morphological variance. A more powerful test of the possible effects of present competitors would employ coexisting species. Insofar as this was possible with our samples, no such effect could be shown.

Only a few associations of ecological characters with bill size variability were found. (1) Species that feed from bark, especially bark drillers, are more frequently dimorphic than other species in bill length and depth. Sexual differences in morphology (e.g. Selander 1965) and in behavior (e.g. Willson 1970, 1971; Reller 1972) are well-known for woodpeckers. (2) Permanent residents are more frequently dimorphic in bill depth than summer residents, and more dimorphic in length and depth when all species are considered. When only dimorphic species are tested, the degree of dimorphism is not significantly different. The 10 species of permanent residents which are dimorphic include three bark-drillers, and four other species that are bark-users at least in winter. Only one bark-user among the permanent residents is not dimorphic. (3) Frequency and degree of dimorphism may be higher in large-bodied species than in small ones. All of these associations may be a function of a restricted resource base, either as a limited substrate in the case of bark feeders (see also Orians and Willson 1964), perhaps especially in winter, or as a limited food supply for large birds (e.g. Schoener 1965, 1968).

Our failure to find other notable correlations of autecology with morphological variation is discouraging but perhaps instructive (see also Soulé 1972).

Certain difficulties of measurement and of sampling may contribute to the problems of the study. The use of an arbitrary reference point, such as the nostril, for measurements might well obscure real differences because the location of the nostril itself is probably responsive to selection pressures. However, most studies of morphological variation with reference to niche size would encounter this problem, although the difficulties are reduced by studying restricted taxonomic units. In addition, construction of our samples from museum collections meant that in almost all cases it was essential to pool specimens from different times and places; thus, if ecotypic (Pulliam 1973) or temporal differences (Fretwell 1972) occur for any species, our values are inaccurate. The severity of this problem is untested.

There are, of course, a variety of sometimes conflicting selective pressures affecting the evolution of bill size. A very clear case is provided by the Icteridae in which some species probably are sexually dimorphic due, in part,

to sexual selection (Selander 1965). Furthermore, a consideration of morphology, even with behavioral categorizations, can easily neglect real and important behavioral differences in exploiting resources.

It is likely that bird species may carry with them phylogenetic constraints (Karr and James, in press) such that members of certain taxa may be locked into certain patterns of variation; studies of more restricted taxa would alleviate this problem. We did note, however, that separate consideration of passerines and nonpasserines did not significantly improve our results and that intra-specific variability was not a function of the number of ecologically sympatric congeners.

Problems of sampling and of compound selective pressures may preclude much success of a generalized venture such as ours. We have not attempted to test the "morphological variation model" so much as to use it; if the model is validated, it seems likely that its utility will be found primarily in situations where the biological variables, especially population structure, can be better defined.

#### SUMMARY

Consistent, significant associations of morphological variation in avian bill dimensions, measured by continuous variation and by sexual dimorphism, and autecological characteristics were few. Species with a limited resource base may be more frequently sexually dimorphic in bill size, and the frequency of dimorphism may change with habitat structure. Problems of this approach are discussed.

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## APPENDIX I. SPECIES USED IN THE COMPARISONS, OCCURRENCE OF SEXUAL DIMORPHISM (+) AND CATEGORICAL ASSIGNMENTS.

Species	Sexual Dimorphism <sup>a</sup>			Habitat <sup>b</sup>	Food Habits <sup>c</sup>	Foraging			Body Wt. Class (g)
	L	D	W			Strat-egy <sup>d</sup>	Strat-um <sup>e</sup>	Behav-ior <sup>f</sup>	
Bobwhite ( <i>Colinus virginianus</i> )	-	-	-	S	O	S	G	G	96-192
Ring-necked Pheasant ( <i>Phasianus colchicus</i> )	+	+	+	G	O	S	G	G	> 192
American Woodcock ( <i>Philohela minor</i> )	+	+	-	S	O	S	G	G	> 192
Mourning Dove ( <i>Zenaida macroura</i> )	-	-	-	S	O	S	G	G	96-192
Yellow-billed Cuckoo ( <i>Coccyzus americanus</i> )	-	-	-	S	I	S	M	G	48-96
Whip-poor-will ( <i>Caprimulgus vociferus</i> )	-	-	-	S	I	P	H	S	48-96
Ruby-throated Hummingbird ( <i>Archilochus colubris</i> )	+	-	-	F	O	S	M	G	< 3
Red-bellied Woodpecker ( <i>Centurus carolinus</i> )	+	+	+	F	I	P	B	D	48-96
Red-headed Woodpecker ( <i>Melanerpes erythrocephalus</i> )	+	+	+	F	I	P	B	D	48-96
Common Flicker ( <i>Colaptes auratus</i> )	-	+	-	F	I	P	G	G	96-192
Hairy Woodpecker ( <i>Dendrocopos villosus</i> )	+	+	+	F	I	P	B	D	48-96
Downy Woodpecker ( <i>Dendrocopos pubescens</i> )	+	+	-	F	I	P	B	D	24-48
Eastern Kingbird ( <i>Tyrannus tyrannus</i> )	-	-	-	S	I	P	H	S	24-48
Great Crested Flycatcher ( <i>Myiarchus crinitus</i> )	-	-	-	F	I	P	H	S	24-48
Eastern Phoebe ( <i>Sayornis phoebe</i> )	-	+	+	S	I	P	L	S	12-24
Willow Flycatcher ( <i>Empidonax traillii</i> )	-	-	-	S	I	P	H	S	12-24
Acadian Flycatcher ( <i>Empidonax virescens</i> )	-	-	-	F	I	P	L	S	12-24
Eastern Wood Pewee ( <i>Contopus virens</i> )	-	-	-	F	I	P	M	S	12-24

<sup>a</sup> L = length, D = depth, W = width of bill. <sup>b</sup> G = grassland, S = shrublands, F = forest.  
<sup>c</sup> O = omnivore, I = insectivore. <sup>d</sup> S = searcher, P = pursuer. <sup>e</sup> G = ground, B = bark, L, M, H = low, medium and high foliage. <sup>f</sup> G = glean, S = sally, D = drill.

APPENDIX I—Continued									
Species	Sexual Dimorphism <sup>a</sup>			Habitat <sup>b</sup>	Food Habits <sup>c</sup>	Foraging			Body Wt. Class (g)
	L	D	W			Strat-egy <sup>d</sup>	Strat-um <sup>e</sup>	Behav-ior <sup>f</sup>	
Horned Lark ( <i>Eremophila alpestris</i> )	+	-	-	G	O	S	G	G	24-48
Blue Jay ( <i>Cyanocitta cristata</i> )	-	-	-	F	O	S	L	G	48-96
Tufted Titmouse ( <i>Parus bicolor</i> )	-	-	+	F	I	S	M	G	12-24
Carolina Chickadee ( <i>Parus carolinensis</i> )	+	+	-	F	I	S	M	G	6-12
Black-capped Chickadee ( <i>Parus atricapillus</i> )	-	+	-	F	I	S	M	G	6-12
White-breasted Nuthatch ( <i>Sitta carolinensis</i> )	-	-	-	F	I	S	B	G	12-24
House Wren ( <i>Troglodytes aedon</i> )	-	-	-	F	I	S	L	G	6-12
Carolina Wren ( <i>Thryothorus ludovicianus</i> )	+	+	-	F	I	S	L	G	12-24
Mockingbird ( <i>Mimus polyglottos</i> )	-	-	-	S	O	S	G	G	48-96
Gray Catbird ( <i>Dumetella carolinensis</i> )	-	-	-	S	I	S	L	G	24-48
Brown Thrasher ( <i>Toxostoma rufum</i> )	-	-	-	S	O	S	G	G	48-96
American Robin ( <i>Turdus migratorius</i> )	-	-	-	S	O	S	G	G	48-96
Wood Thrush ( <i>Hylocichla mustelina</i> )	-	-	-	F	O	S	G	G	48-96
Eastern Bluebird ( <i>Sialia sialis</i> )	-	+	+	S	O	P	L	G	24-48
Blue-gray Gnatcatcher ( <i>Poliophtila caerulea</i> )	-	-	-	F	I	S	H	G	3-6
Starling ( <i>Sturnus vulgaris</i> )	-	-	-	F	O	S	G	G	48-96
White-eyed Vireo ( <i>Vireo griseus</i> )	+	-	+	S	I	S	L	G	12-24
Bell's Vireo ( <i>Vireo bellii</i> )	-	-	+	S	I	S	L	G	6-12
Yellow-throated Vireo ( <i>Vireo flavifrons</i> )	+	+	+	F	I	S	H	G	12-24
Red-eyed Vireo ( <i>Vireo olivaceus</i> )	-	-	-	F	I	S	H	G	12-24

## APPENDIX 1—Continued

Species	Sexual Dimorphism <sup>a</sup>			Habitat <sup>b</sup>	Food Habits <sup>c</sup>	Foraging			Body Wt. Class (g)
	L	D	W			Strat-egy <sup>d</sup>	Strat-um <sup>e</sup>	Behav-ior <sup>f</sup>	
Warbling Vireo ( <i>Vireo gilvus</i> )	-	-	-	F	I	S	H	G	12-24
Prothonotary Warbler ( <i>Protonotaria citrea</i> )	-	-	+	F	I	S	L	G	6-12
Blue-winged Warbler ( <i>Vermivora pinus</i> )	-	-	-	S	I	S	H	G	6-12
Northern Parula ( <i>Parula americana</i> )	-	-	-	F	I	S	H	G	6-12
Yellow Warbler ( <i>Dendroica petechia</i> )	-	-	+	S	I	S	L	G	6-12
Cerulean Warbler ( <i>Dendroica cerulea</i> )	-	-	-	F	I	S	H	G	6-12
Ovenbird ( <i>Seiurus aurocapillus</i> )	-	-	-	F	I	S	H	G	12-24
Yellowthroat ( <i>Geothlypis trichas</i> )	-	+	-	S	I	S	L	G	6-12
Yellow-breasted Chat ( <i>Icteria virens</i> )	-	-	+	S	I	S	L	G	12-24
Kentucky Warbler ( <i>Oporornis formosus</i> )	-	-	-	F	I	S	G	G	12-24
American Redstart ( <i>Setophaga ruticilla</i> )	-	-	-	F	I	P	M	S	12-24
Eastern Meadowlark ( <i>Sturnella magna</i> )	+	+	+	G	O	S	G	G	96-192
Red-winged Blackbird ( <i>Agelaius phoeniceus</i> )	+	+	+	G	O	S	L	G	48-96
Common Grackle ( <i>Quiscalus quiscula</i> )	+	+	+	S	O	S	G	G	96-192
Brown-head Cowbird ( <i>Molothrus ater</i> )	+	+	+	S	O	S	M	G	24-48
Orchard Oriole ( <i>Icterus spurius</i> )	+	+	-	S	I	S	H	G	12-24
Northern Oriole ( <i>Icterus galbula</i> )	-	-	-	F	I	S	H	G	24-48
Scarlet Tanager ( <i>Piranga olivacea</i> )	-	-	-	F	I	S	H	G	24-48
Cardinal ( <i>Cardinalis cardinalis</i> )	-	+	-	S	O	S	L	G	24-48
Rose-breasted Grosbeak ( <i>Pheucticus ludovicianus</i> )	-	-	-	F	O	S	H	G	24-48

## APPENDIX I—Continued

Species	Sexual Dimorphism <sup>a</sup>			Habitat <sup>b</sup>	Food Habits <sup>c</sup>	Foraging			Body Wt. Class (g)
	L	D	W			Strat-egy <sup>d</sup>	Strat-um <sup>e</sup>	Behav-ior <sup>f</sup>	
Indigo Bunting ( <i>Passerina cyanea</i> )	-	-	+	S	O	S	M	G	6-12
American Goldfinch ( <i>Spinus tristis</i> )	-	-	-	S	O	S	L	G	12-24
Dickcissel ( <i>Spiza americana</i> )	+	+	-	G	O	S	L	G	12-24
Rufous-sided Towhee ( <i>Pipilo erythrophthalmus</i> )	-	-	-	S	O	S	G	G	24-48
Grasshopper Sparrow ( <i>Ammodramus savannarum</i> )	-	-	-	G	O	S	L	G	12-24
Henslow's Sparrow ( <i>Ammodramus henslowi</i> )	-	-	-	G	O	S	L	G	12-24
Vesper Sparrow ( <i>Poocetes gramineus</i> )	-	+	-	G	O	S	L	G	12-24
Field Sparrow ( <i>Spizella pusilla</i> )	-	-	-	S	O	S	L	G	6-12
Song Sparrow ( <i>Melospiza melodia</i> )	-	-	-	S	O	S	L	G	12-24

## NEW LIFE MEMBER

Dr. William Yancey Brown has recently become a life member of the Wilson Ornithological Society. Dr. Brown received his Ph.D. from the University of Hawaii in 1973, and he is principally interested in sea bird ecology. His research interests and publications have been concerned primarily with the biology of Sooty Terns and Brown Noddies. He is a member of the AOU, Ecological Society of America, AAAS, and Sigma Xi. At the present Dr. Brown is a student at Harvard Law School.

