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TAXONOMY OF SOUTHERN ILLINOIS MEADOWLARKS

Key words: (*Sturnella magna* and *argutula*), meadowlark, Illinois, taxonomy.)

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ABSTRACT

Discriminant function analysis (DFA) of 358 meadowlark specimens, collected in southern Illinois between 1960 and 1967, determined that the population consisted of eastern meadowlarks (*Sturnella magna magna*), southern meadowlarks (*S.m. argutula*), and intermediate forms. A total of 16 scores and measurements, subsequently reduced to nine, were utilized, and resulted in separation of 88 male and 87 female *argutula* specimens from *magna* specimens. Sixty male specimens and eight female specimens reflected discriminant scores which positioned them as intermediate forms.

INTRODUCTION

Meadowlarks (genus *Sturnella*), found from Ontario to South America (Bent 1908; Chapman 1900; Saunders 1932; Stone 1897), have been the object of controversy among ornithologists since Audubon (1844) identified the western form, *Sturnella neglecta*, west of the Mississippi river. Our study sought to examine the meadowlark population in southern Illinois with regard to *S.m. magna* and *S.m. argutula*; we anticipated the presence of the southern meadowlark. As a result of interbreed-

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ing of the two forms, production of offspring exhibiting intergrade characteristics was suspected, if *argutula* was indeed present.

S.m. magna is found from eastern Minnesota, southern Ontario, Quebec and New Brunswick, south to central Texas, South Carolina and Missouri, west to Nebraska, central Kansas and the 100th meridian in Oklahoma, and northern Texas (Saunders 1932:67). Beal (1895) described the range of *S. magna* as extending from the eastern United States and ranging as far west as the Great Plains. Chapman (1900:297) listed this form as observed throughout the United States east of the 100th meridian, with the exception of southern Florida. *S.m. argutula* is resident from Louisiana and southeastern Texas east to Florida; northward in the Mississippi Valley to southeastern Indiana. It is also found along the Atlantic Coast as far north as Georgia and perhaps to southern South Carolina (Saunders 1932). Chapman (1900) simply listed the range of the southern meadowlark as southern Florida.

The eastern meadowlark was described as conspicuous and abundant in Illinois by Ridgway (1873:200). Forbes and Gross (1923) listed *magna* as a permanent southern Illinois resident. From March to mid-December the eastern form was reported as common to abundant by Kleen and Bush (1971). Stone (1897) listed the southern meadowlark for southern Illinois and Indiana. Ridgway (1902) described breeding birds from southern Illinois as more closely resembling birds from the southern U.S. than those from New England.

Southern Illinois was recorded as part of the range of *argutula* in the 12th supplement to the A.O.U. checklist (1903). Specimens of the southern race were collected in southern Illinois in 1897 (Cory 1909) and Howell (1910) said it was common in southern Illinois. Saunders (1932) reported the southern form as occurring in southeastern Indiana and southern Illinois.

METHODS

Roseberry and Klimstra (1970) studied the nesting ecology and reproduction of the eastern meadowlark between 1960 and 1967. Their research yielded the 358 specimens utilized in this study, of which 149 were females and 209 were males. Table 1 lists the numbers of male and female specimens collected, by month of the year. The sample composition was rather evenly distributed among breeding and wintering birds.

Taxonomic characterizations utilized in our study were based primarily upon Saunders (1932). The series of scores and measurements employed included the following: (1) FWL (folded wing length), or chord of the wing, measured to the tip of the longest primary; (2) TMT (tarsometatarsal length), measured from the lower edge of the last complete scute to the hollow formed at the tibio-tarso-metatarsal joint; (3) RAT (ratio of leg length to wing length); (4) LOC (length of exposed culmen); (5) TRL (length of tail rectrices), measured from the tip of the longest central tail rectrix to the point of insertion at the skin; (6) HCL (hind claw length), measured from the lower edge of scutellation to the ankle joint. Rohwer (1972) suggested the use of additional taxonomic characteristics as follows: (7) TBN (thickness of the black notch, or vee), measured at the center of the breast; (8) LYL (lore yellow length), the length of yellow feather coloration on the mallar region immediately above the submallar apterium; (9) LYH (lore yellow height), the height of yellow feather coloration in the mallar region above the submallar apterium; (10) R3, the extent of white feather coloration bordering the rachis of the inner vane of tail rec-

trix 3; (11) R4, same as for R3, for tail rectrix 4; (12) R5, same as for R3, for tail rectrix 5; (13) R6, same as for R3, for tail rectrix 6. Character (14), CRS (central rectrix score), was adapted from Rohwer (1972:310), and Szijj (1963:180), and used to code the distribution of black barring in the central tail rectrices of both sexes (Figure 1a). Character (15), YCS (yellow cheek score), was derived from Szijj (1963), and reflected the degree of yellow coloration of the sides of the cheek region with respect to a line extending from the base of the mandibles down the sides of the neck (Figure 1b). Character (16), BFS (back feather score), also adaped from Szijj (1963), was derived from feather marking patterns from the center of the back area (Figure 1c). All measurements reflected standardized methods (Baldwin et al. 1931) and were taken with dial calipers. Measurements 1 through 6 were recorded to the nearest .01 mm., while 7 through 13 were to the nearest .1 mm.

Data were summarized by utilization of discriminant function analysis (DFA) (Fisher 1936); this method was employed by Rohwer (1971, 1972, 1973) and Szijj (1963) on meadowlarks. Reference specimens, obtained from the American Museum of Natural History, consisted of 15 male and 15 female *magna* and an equal number of male and female *argutula*. Male *argutula* reference specimens had been collected in Florida and Texas; females had been collected in Texas, Mexico and Florida. Male *magna* specimens had been collected in New York, Minnesota, Mexico, New Jersey, and Oklahoma; females had been collected in Florida, New Jersey, North Carolina, New York, Connecticut, Maryland and Georgia. The date and location of collection of individual reference birds has been reported (Hamilton 1977).

SPSS (Statistical Package for the Social Sciences) subprogram Discriminant (Nie et al. 1975) was used in reference and research data analysis.

RESULTS

Discriminant function analysis of female and male reference specimens employed 10 and 4 variables, respectively, of the original 16 scores and measurements entered for computation. F levels of the remaining deleted characters proved insufficient for further calculations; hence, these variables were eliminated from further analysis. Means and standard deviations, in addition to discriminant function scores, for individual reference specimens have been reported (Hamilton 1977).

Due to significant numbers of specimens with missing characters the number of variables was reduced without seriously reducing the overall separation of reference birds. The use of only 9 of the original 16 variables yielded almost all of the original statistical separation for the reference males and females (Table 2). Research specimens missing one or more of the "best" nine variables were, therefore, eliminated from further DFA. Although this final analysis resulted in the deletion of 12.58 percent of the original 358 research specimens (20 males and 26 females), the final DFA was believed to be acceptable.

DFA scores were generated for the male and female research specimens in histogram form (Figure 2). Individual DFA scores, and sub-group classifications, resulting from the final DFA of the research birds are in Hamilton (1977).

DISCUSSION

DFA verfied the existence of *S.m. argutula* in southern Illinois. A total of 88 male and 87 female specimens were separated from *magna*, on the basis of the nine scores and measurements utilized. These *argutula* specimens were generally darker in overall coloration, and smaller in total body size than their *magna* counterparts.

Sixty male research specimens reflected DFA scores which positioned them between the *magna* and *argutula* clusters (Figure 2). Of these, 28 were categorized as closest to *magna*, and 32 labeled closest to *argutula*, by DFA. These intermediate specimens were clustered around the midpoints between the sample means. A total of eight female research birds showed DFA scores which placed them in an intermediate position between the *magna* and *argutula* clusters (Figure 2). Of these, six were classified closest to *magna*, and two closest to *argutula*.

The existence of the 68 specimens (21.8 percent of the 312 research specimens utilized in the final analysis) strongly suggested that intergradation was occurring in southern Illinois. These individuals could easily represent first generation intermediates.

The existence of gaps between the clusters of females (Figure 2) tended to imply a low rate of intergrade offspring production. Assuming additive inheritance, these gaps would not be expected to occur if intermediate meadowlarks were common to this area. However, such gaps did not appear in the male data (Figure 2), suggesting a much more substantial rate of intergradation. Perhaps the overall survival rate of fledged intermediate females was significantly less than that of the males. The sex ratio of successfully reared nestlings may have been inclined to favor survival of greater numbers of intermediate males.

In depth examination of the current meadowlark population in southern Illinois might clarify the rate and degree of intergradation. The overall effects relative to population dimensions and percentages of *argutula* and *magna* and intermediate forms could prove revealing.

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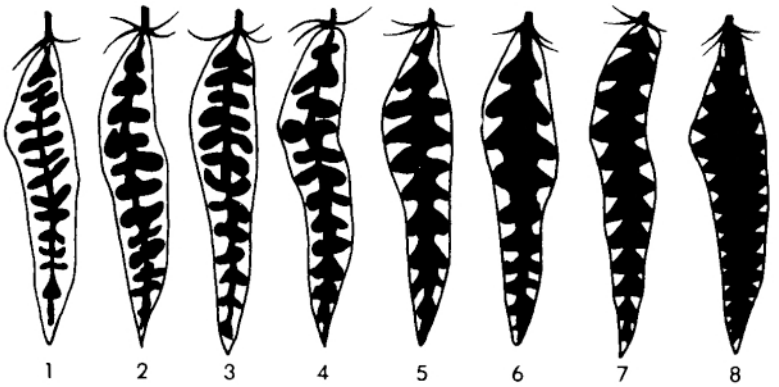

Fig. 1a. Scoring system based on distribution of black barring in the central tail rectrices — CRS.

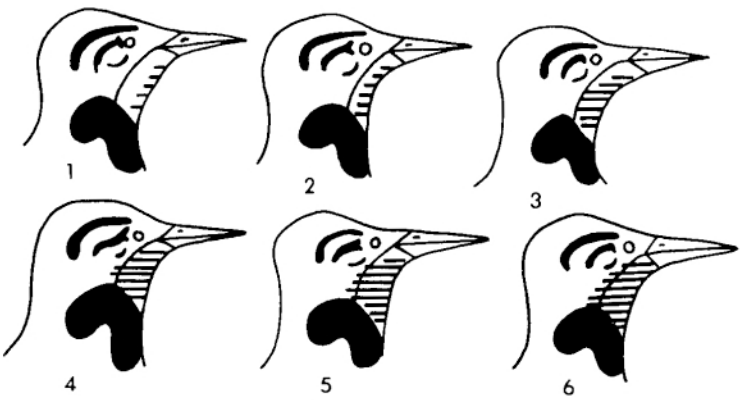

Fig. 1b. Scoring system based on yellow neck color — YCS.

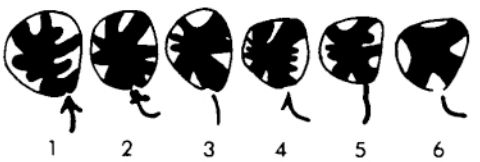

Fig. 1c. Scoring system based on the pattern of markings on feathers from the center of the back — BFS.

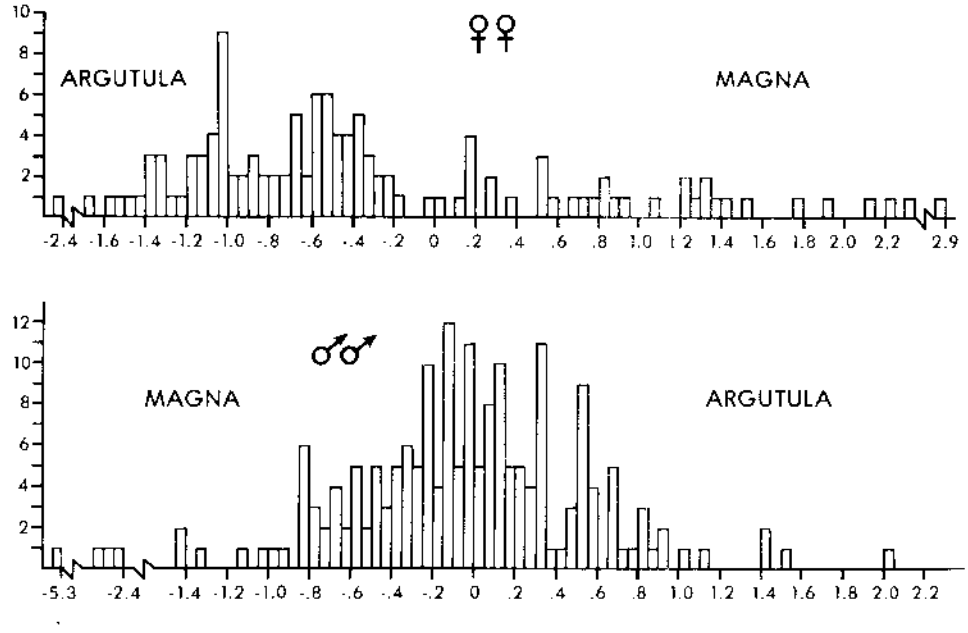

Fig. 2. Discriminant function analysis (DFA) scores for female and male research specimens.

Table 1. Specimens utilized in study

Month	Numbers collected	
	Male	Female
January	25	5
February	25	4
March	17	12
April	13	15
May	14	15
June	13	17
July	10	19
August	15	16
September	12	20
October	18	14
November	27	3
December	20	9
TOTALS:	209	149

Table 2. Statistical results of discriminant analysis of reference meadowlark specimens

Sex	level of analysis	canonical correlation	Wilks' lamda	chi-square	degrees of freedom
Female					
	Initial	0.966	0.0674	62.031	10
	Final	0.928	0.1396	49.232	6
Male					
	Initial	0.951	0.0960	60.936	4
	Final	0.951	0.0960	60.936	4