STUDIES ON DIET OVERLAP AMONG ICTERIDS, CROWS, AND STARLINGS

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Some of the problems that have been publicized for the past two to three years about blackbirds and Starlings in the southeastern United States are concerned with what these birds eat and the degree to which these granivores compete on their wintering grounds. The assumption by agriculturists has been that these birds cause severe depredations. Futhermore it is presumed by some that food supplies are unlimited and that these birds are simply living off the "fat of the land"; others consider that food is limited and that the birds are "pressured" into direct competition with man's food or food destined for livestock. Sadly, there is little information about either case, and to date media reports have been based upon unsupported allegations.

In order to put the overall problem of these birds[1] feeding in the winter ecosystems into perspective, this paper introduces certain aspects of well-known and widely accepted ecological theory into the assessment of food habits of these birds. Despite unpublished comments made by U.S. Fish and Wildlife Service Animal Depredations Control personnel in the past, we know little about diet of blackbirds and Starlings in terms of broad ecological associations. There indeed is considerable information about what the birds eat, mainly from ad hoc surveys taken from time to time in the latter part of the last century and through this century; but to date no one has attempted to synthesize this information and make predictions about the ecology of these animals. Thus little can be said about these birds in terms of responsible management.

The basic feature to analyze concerns niche relationships in a series of ecological categories that become known as the "resource states" (Colwell and Futuyma, 1971). By selecting carefully resource states which have strong numerical data, one can then determine the basic features of "niche breadth" or "niche overlap." As Colwell and Futuyma (and many others) have pointed out, there are many metrics that can be used; however, one of the most basic concerns food intake in time and space. By collecting information about overall diet, seasonal changes in foods, and locations of foraging, it is possible to compute indices which give a measure of the similarity of dissimilarity of diets and thus obtain some indication as to whether various species "compete" for common items in the diets. Without a careful analysis of "where, what is eaten," no logical statement can be made about the status of these birds in the winter ecosystems (or anywhere else for that matter, J.A. Wiens, pers. comm.). For this paper we then concentrate upon diet throughout the year, but particularly during the winter, as one dimension of the niche metric.

METHODS

Literature reporting diets of Redwinged Blackbirds *(Agelaius phoeniceus),* Common Grackles *(Quiscalus quiscula),* Brown-headed Cowbirds *(Molothrus ater),* Rusty Blackbirds *(Euphagus carolinus),* Brewer's Blackbirds *(E. cyanocephalus),* Yellow-headed Blackbirds *(Xanthocephalus xanthocephalus),* Bobolinks *(Dolichonyx oryzivorous),* Common Crow *(Corvus bzachyrhynchos)*, and the European Starling *(sturnus vulgaris)* from work in widely scattered areas of North America (Beal, 1900), from published reports of conditions in Arkansas (Meanley, 1971), from unpublished data collected during 1967 in Alabama (James E. Keller, Univ. Alabama), from data in an Environmental Impact Statement report from 1974-1975 (Department of Army, 1975), and collections made during the winter of 1975-76 by one of us (MID) constitute the data used in this study. The collections, made simply to obtain an index of current conditions to compare with other reports, were made in roosts at Fort Campbell, KY in December 1975 and Russellville, KY in February 1976. Obtained were: 27 Redwings, 76 Grackles, 4 Cowbirds, and 68 Starlings. Birds were collected in the evening after arrival at the roosts. All data have been grouped by month throughout the year for the overlap analyses.

Items used for the diet comparisons were grouped into four categories: (1) native plant seeds, (2) corn, (3) other agricultural crops seeds, including wheat, oats, and soybeans, and (4) insect material. Grit and unknown items, usually in low abundance, were ignored in proportions by weight and further computations of dietary overlap.

Measures of similarity or niche overlap were computed either by Horn's R_0 index (Horn, 1966) or by equations 1-3 of Colwell and Futuyma (1971) and by a weighted pair-group cluster analysis (Sokal and Sneath, 1963).

RESULTS AND DISCUSSION

Results from Cluster Analyses

The cluster analysis obtained from Horn's R_0 method, using data from the Environmental Impact Statement done for the Department of Army covering food habits at Ft. Campbell, KY and Milan, TN, are presented in Fig. 1. The greatest similarity in diets existed for Cowbirds and Redwinged Blackbirds at about the 90% level. This group then clustered with Starlings at about the 75% level, and finally these clustered with Grackles at about the 38% level.

Slightly different results were obtained for data from Alabama, Kentucky, and Arkansas using the method prescribed by Colwell and Futuyma (1971) (Fig. 2). Diets from the October-March period in Alabama Redwings clustered first with Cowbirds; then Grackles and Starlings clustered; finally these two groups clustered at about the 45% level. For the 1975-76 data from Kentucky, Redwings and Cowbirds were the first to cluster, then Grackles and finally Starlings. The February analysis was slightly different, however, because of extremely small samples sizes; we give little attention to that date, except to simply publish the results for possible future comparison (Fig. 2*).*

For the relatively large sample sizes available from Arkansas, there were further variations in the cluster pattern (Fig. 3). The overall average showed Grackles and Cowbirds clustering first, then joined by Redwings. During the nesting season Redwings and Grackles showed the greatest similarity in diet and were finally joined by Cowbirds. During the fall rice depredation period (Meanley, 1971) Redwings and Cowbirds were most similar, and then the Grackles clustered. For the winter period, much as reported for the data from Kentucky and Alabama, the Redwings and Cowbirds clustered, followed by the Grackles (Fig. 3).

Food Overlap -- Alpha Levels

The data available from the turn of the century reported by Beal (1900) are presented in α_F indices (Fig. 4). For this presentation all α_F values are computed against Redwings. Even though the presentation is made complex by plotting the monthly values of several species, it is obvious that a pattern of overlap emerges (Fig. 4). The data, shown from April to March, suggest a sine-wave pattern over the year for several species: Yellow-headed Blackbird, Rusty Blackbird, Bobolink (for as long as it is in North America), Crow, Brewer's Blackbird, and Grackle. The Brown-headed Cowbird does not show this pattern. It remains relatively high throughout the year at similarity levels above 0.6 (Fig. 4). The average year-long overlap conditions for all species compared against Redwings are shown in Fig. 5. These data substantiate the notion that there is a cyclic pattern in the diet overlap analysis.

Plots of α_F for modern data show more or less the same types of overlaps as do those for Beal's data, but the information is sparse and does indicate variations (Fig. 6). Another difference is that the Starling, not present during the time Beal collected his data, is inserted in the overall picture. The Cowbird still shows high overlap levels during the winter, but less so during the rest of the year for Meanley's (1971) data. However Keeler's unpublished data suggest that in Alabama the overlap remains high. The Grackle overlap could well be cyclical; however, there are variances in the data as now available. The data available from Kentucky show nearly identical positions for the Starling and Grackle when compared with the Redwing, but the data from Alabama show a much lower position (Fig. 6).

Interpretation of Overlap Indices

The question that must be answered in this approach is, to what degree, if any, do these icterid and Starling species compete for food during the year, particularly during the winter? In order to provide an answer we must have information other than diet overlap, although this index can be very helpful in determining what is likely occurring currently.

A model of the potential interactions is presented in Fig. 7. Two major hypotheses exist. (1) The resources may be distributed in patches where all resources 1….n are distributed where only species 1, 2, species$_n$ frequent (as in A, Fig. 7). Such conditions may exist in fields throughout the southeast where birds forage. Alternatively, each resource may be distributed uniquely in patches where single species forage, as in B (Fig. 7). This condition is exemplified by feed lots throughout the southeast where Starlings alone may concentrate. (2) All resources are distributed in all areas where all species commonly forage. Such conditions may exist in fields with large resources or in spatial areas encompassing large regions.

The degree to which the species compete is predicted by the tabulated conditions in Fig. 7. For instance, if the α_F is greater than 0.6 (a value commonly thought to be the threshold difference between competitiveness and noncompetitiveness) and the feeding sites are different (D), competition would be absent; and the relative abundance of the two species would be high. If the foraging areas are the same (S), competition would then be high, and population levels of at least one of the species would theoretically be constrained. In contrast, if α_F values are less than 0.6 and foraging levels are different, there would be little direct competition and both populations would be high. If the feeding areas are the same, there would be little to no direct competition for the same resources, and again both populations could be high. Obviously, as Colwell and Futuya (1971) stated, going by the α_F levels, or any other single index, could be "irrelevant" for determing niche status, unless other factors are known.

The two key aspects are knowing what various bird species are eating and where they are eating it. These two requirements are the reasons why so much of the dietary Information about these species are not as meaningful as they ought to be, notwithstanding the feelings of some biologists who have expressed the opinion that diets have been sufficiently researched.

The problem can be solved simply. It is one of providing for adequate samples in time and space in order to make a strong evaluation of potential competition, whether in wintering areas or on summer breeding grounds. The low α_F values give strong clues (Fig. 4, and 6): there probably is little chance for competition; but high α_F values must be further studied before we can adequately state that competition does or does not exist.

Management Relationships

Notwithstanding the inherent problems of looking at overlap or similarity indices in determining what may be occurring in southeastern ecosystems during the winter, there are several potentials that must be examined before managers of these large populations can give reasonable predictions about what might happen during control operations. For instance, if there is now significant competitive interaction among any of the species, and that interaction is interrupted, we must ask what might be the consequences? Under some circumstances, we might encounter situations where there is absolutely no effect on the bird populations in terms of subsequent changes in potential competition for food. This would occur during two conditions: (1) when α_F is low and either or both populations are removed from the ecosystem, or (2) when when is high and the suppressed species does not forage in the same areas as other species eating the same food items.

However, unwanted conditions could be produced if at any time one of the species is eliminated and the other is not and such a condition then allows expansion of the second species, especially if the second species is the more noxious of the two. This condition exists in the southeast. The Starling, as everyone knows, is an introduced species which has expanded its numbers in this century and shows significantly high overlap with icterids to indicate it has "inserted" itself in the North American ecosystems along side many of the blackbird species (any field ornithologist can determine this simply from observation). The important thing is that if large numbers of icterids are removed (killed) without affecting the Starling population numbers, there is sufficient information to predict that the Starling can move into any "vacant space" left by the blackbird species and probably thrive. The end result of this scenario, in effect a sloppily designed control program aimed at lethal removal, could well be an exacerbation of the overall problem. In short, we would end up with more overwintering Starlings, more Starlings on the breeding grounds, and so on through the life history of the Starling, and thus "breed" more problems than existed in the first place.

If there are any problems producing differential mortality in the southeast, this is exactly what could happen. Evidence accumulated by Lustick (elsewhere, this volume) suggests that the use of tergitol could do exactly this. If roosts containing predominantly blackbirds are treated effectively and Starling roosts are left untouched, this will produce the same results; and a quick scan of information about species and roost locations throughout the southeastern U.S. suggest this is a possibility also. If Starling roosts tend to be located in areas where permits cannot be obtained for treatment, such as in urban locations, we predict present control schemes using toxicants will be more detrimental to eastern landscape and ecological associations involving these birds in both the short and long run than by letting the birds exist and either putting up with their current nuisance levels or concentrating upon other management strategies.

ACKNOWLEDGEMENTS

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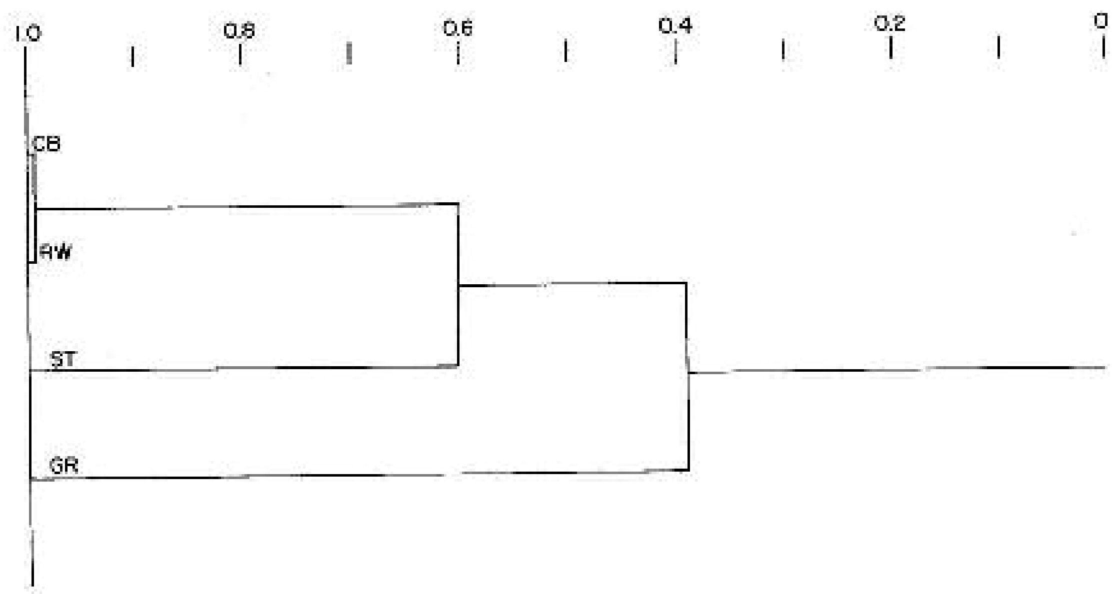


Fig. 1 Diet cluster analysis, using Horn's (1966) R_O method, showing similarity indices for four bird species in Kentucky and Tennessee, winter 1974–75 (CB = Cowbird, RW = Redwings, ST = Starling, GR = Grackles).

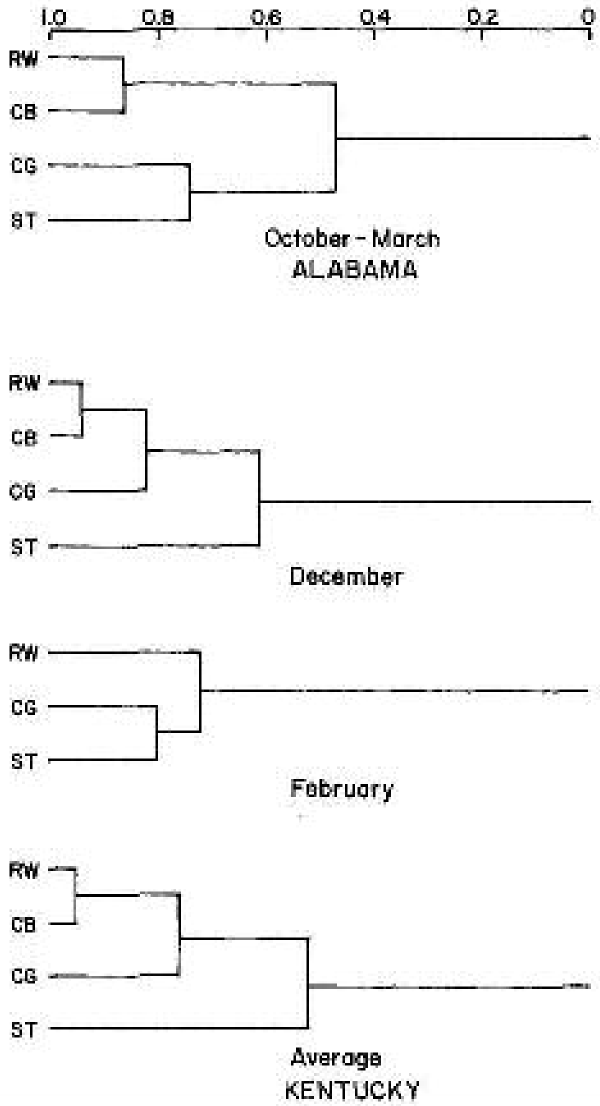


Fig. 2. Diet cluster analysis using the Colwell-Futuyma (1971) method showing similarity indices for four bird species in Alabama during 1967 (Keeler, unpub. data) and in Kentucky during winter of 1975-76. For key, see Fig. 1.

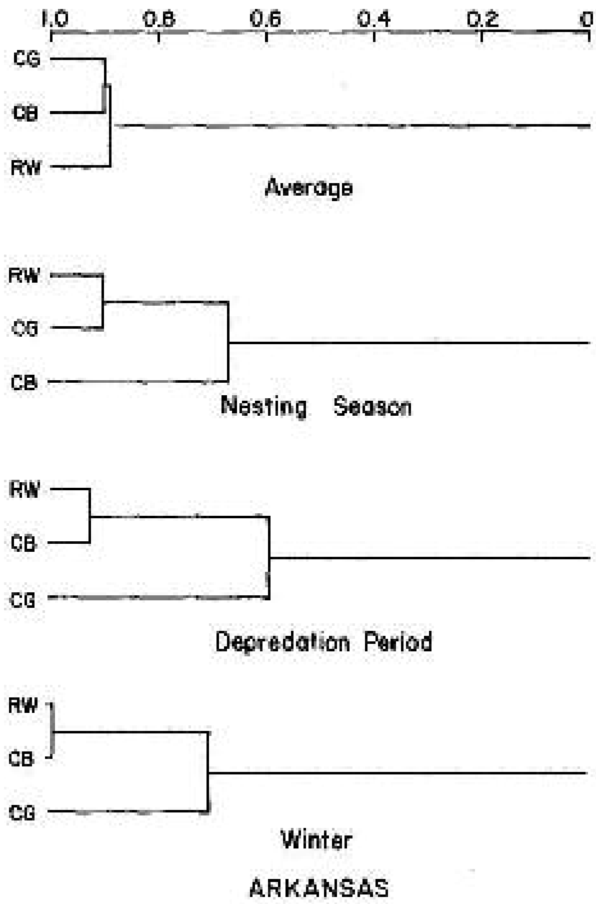


Fig. 3. Diet cluster analysis, using the Colwell-Futuyma (1971) method, show similarity indices for three bird species during three periods of the year, Arkansas (Meanley 1971). See Fig. 1 for key to species.

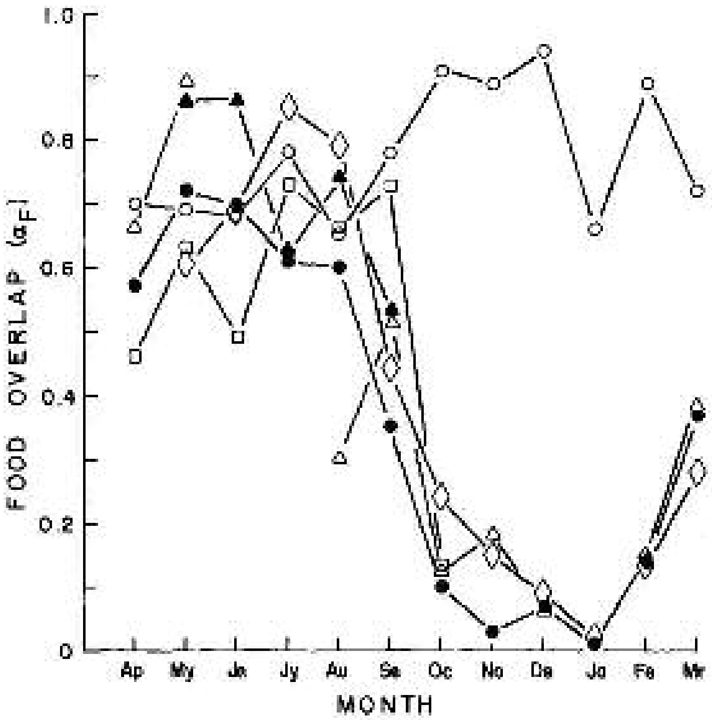


Fig. 4. Food overlap (α_F) indices for six species of birds computed against Red-winged Blackbirds. Data are from Beal (1900).
(= Yellow-head Blackbirds, ▲= Bobolink,
∆= Rusty Blackbird, O = Brown-headed Cowbird,
◊ = Brewer's Blackbird, • = Common Crow).

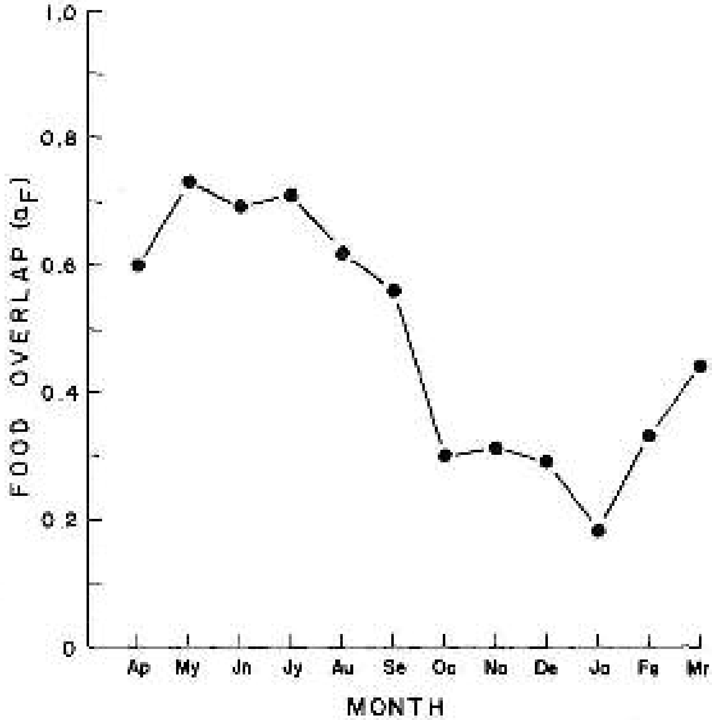


Fig. 5. Average food overlap (α_F) index for six species of birds compared to Red-winged Blackbirds (see Fig. 4).

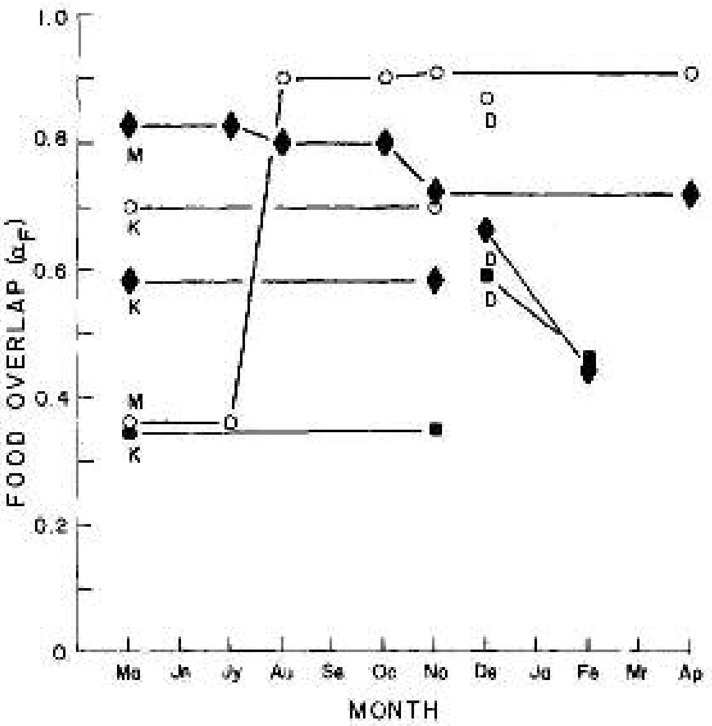
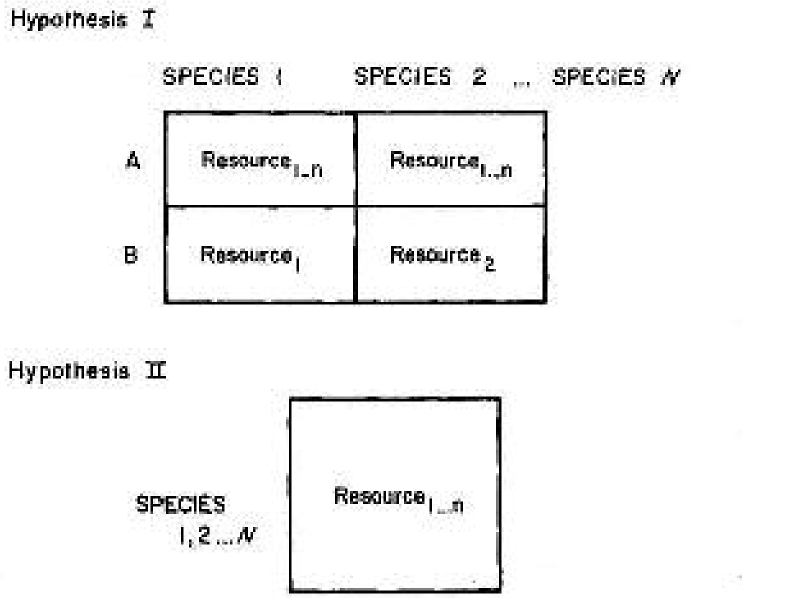


Fig. 6. Food overlap (α_F) indices for recent data, three species of birds from three locations compared to Red-winged Blackbird. (O = Brown-headed Cowbird, Arkansas (Meanley 1971) O, K = Cowbird, Alabama (Keeler unpubl.); O, D = Cowbirds, this report; ♦ = Common Grackle, Arkansas; ♦, K = Grackle, Alabama; ♦, D = Grackle, Kentucky; ■, K = Starlings, Alabama; ■, D = Starlings, Kentucky.



		FEEDING SITE	COMPETITION	RELATIVE ABUNDANCE 1	RELATIVE ABUNDANCE 2
IF: α_F >	0.6	D	O	H	H
		S	H	H	L
				L	H
<	0.6	D	O	H	H
		S	O-L	H	H

Fig. 7. Two major hypotheses stating the type associations of icterid and Starling species in Southeastern U.S. winter ecosystems which may or may not result in direct competition for food resources. In each hypothesis rectangles become the defined spatial boundaries in which the α_F overlap analyses.