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Wind Direction and the Species Composition of Autumn TV Tower Kills in Northwest Florida

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Radar studies of autumn bird migration in eastern North America show geographic variation in the orientation behavior of birds with regard to wind direction. In New England and the Canadian Maritimes there are down-wind flights with northwesterly or westerly winds over the Atlantic Ocean and a southwest flight along the east coast of North America with in-flight correction for wind effects. There are occasional reverse northeast flights with southerly, southwesterly, or westerly winds (Richardson 1972, Williams, Williams, Ireland, and Teal 1977). Autumn migrants departing overwater from Miami, Florida fly essentially southeast in all winds, and there are no reverse flights (Williams, Berkeley, and Harris 1977). Thus, some migrants appear to be able to navigate on a goal-directed flight and to adjust for the effects of abeam or head winds. In Louisiana and Georgia, however, Gauthreaux and Able (1970, 1971) and Able (1972, 1974) found that nocturnal passerine migrants fly consistantly down-wind regardless of wind direction and with frequent reverse flights to the north. Because the magnitudes of flights with north winds are greater than those of flights with south winds (Able 1973), the result is presumably a strong net movement in the "proper" direction (Able 1972). Another interpretation of Gauthreaux's and Able's data is that the changes in flight direction in response to wind changes is actually selection by different populations for following winds relative to different goals (Evans 1970, Emlen 1975: 187, Richardson 1978: 237). Gauthreaux and Able have not rejected the latter interpretation (Gauthreaux and Able 1971, Able 1974: 227), but the hypothesis has not been tested because radar cannot distinguish between species or between populations with potentially different goals.

Birds killed during night migration flights with known wind directions could provide a suitable test, however, as species and relative abundances are known. Bird casualties at the 308-m WCTV tower in northwest (Leon Co.) Florida are recorded daily, and during 1955–1967 Herbert L. Stoddard, Sr. and his associates plotted on maps of the tower grounds the location of each dead bird for most days when five or more birds were found. These maps clearly show the wind direction at the time the birds were killed (see examples in Stoddard 1962, Stoddard and Norris 1967), because the birds lie down-wind on the tower grounds. I chose from these tower-kill plots (on file at Tall Timbers Research Station) all that showed a clear southeast or southwest cluster of 15 or more birds on the grounds of the WCTV tower during August–October 1956–1963 and 1965–1966 (plots of kills for 1964 are lost). A southeast cluster on the ground implies northwesterly winds; a southwest cluster implies northeasterly winds. I compared wind data from Local Climatological Data sheets for Tallahassee, Florida (33 km south of WCTV) with the selected WCTV tower plots; for this analysis, I rejected nights for which the Tallahassee and WCTV wind data seemed different. Relatively few nights were left, but, for each, the wind direction at the time the birds were killed was well-defined. I rejected one additional night (with northeasterly winds: 4–5 October 1957), because the aberrant sample then (2,300+) was nearly three times greater than that of any other night. Seventy-six nights met my criteria (Table 1). Numbers for species with large sample sizes (usually equal to or greater than 20) are listed for northeasterly or northwesterly winds; italicized totals are significantly at variance from equality by Chi-squared tests ($P < 0.05$) weighted for the disparity between the number of nights for each wind class.

TABLE 1. Numbers of birds killed in northwest Florida (WCTV) and peninsular Florida (WDBO) compared with numbers killed at WCTV with northeasterly and northwesterly winds (see text).

Species	WCTV 1973–76	WDBO 1969–72	WCTV: 1956–66 NE	WCTV: 1956–66 NW	Group
Empidonax virescens	22	1	20	4	A
Contopus virens	4	1	12	3	A
Troglodytes aedon	47	117	70	*31*	B_2
Cistothorus palustris	16	191	15	*10*	B_2
C. platensis	27	51	27	*41*	B_2
Dumetella carolinensis	119	172	169	*66*	B_2
Toxostoma rufum	16	1	*75*	7	A
Hylocichla mustelina	41	3	41	6	A
Catharus guttatus	4	0	11	7	A
C. ustulatus	102	18	*68*	7	A
C. minimus	23	9	25	4	A
C. fuscescens	159	28	*272*	13	A
Regulus calendula	26	33	51	*34*	B_2
Vireo griseus	41	94	*168*	15	C
V. flavifrons	14	8	26	7	A
V. olivaceus	1032	153	*826*	105	A
Mniotilta varia	115	185	*144*	22	C
Protonotaria citrea	32	3	24	5	A
Limnothlypis swainsonii	9	58	20	*16*	B_1
Helmitheros vermivorus	29	42	46	9	C
Vermivora chrysoptera	9	1	14	6	A
V. peregrina	86	14	41	*30*	C
V. celata	2	1	7	*16*	D
Parula americana	105	412	129	*73*	B_1
Dendroica petechia	26	13	15	2	A
D. magnolia	163	13	52	*32*	C
D. coronata	16	7	22	*29*	B_2
D. cerulea	19	4	*32*	1	A
D. fusca	116	15	72	22	A
D. dominica	13	42	23	*15*	B_1
D. pensylvanica	97	4	86	34	A
D. castanea	125	14	27	14	A
D. pinus	19	21	15	*15*	B_2
D. discolor	27	109	90	*56*	B_1
D. palmarum	104	531	45	*81*	B_1
Seiurus aurocapillus	243	936	82	27	C
S. noveboracensis	69	206	88	36	C
Oporornis formosus	62	2	*94*	11	A
Geothlypis trichas	211	3192	216	64	C
Icteria virens	6	5	*14*	1	A
Wilsonia citrina	99	2	*153*	22	A
Setophaga ruticilla	99	704	93	37	C
Dolichonyx oryzivorus	39	174	*194*	20	D
Piranga olivacea	17	1	*53*	6	A
P. rubra	12	1	*72*	3	A
Passerina cyanea	39	13	*150*	25	A
Pipilo erythrophthalmus	6	1	18	6	C
Passerculus sandwichensis	27	23	39	*34*	B_2
Ammodramus savannarum	10	8	21	*14*	B_2
Spizella passerina	5	0	11	*9*	B_2
Zonotrichia albicollis	8	0	20	3	B_2
Melospiza georgiana	28	31	59	*37*	B_2
M. melodia	4	0	25	5	B_2
Number of nights			59	17	

At WCTV, northeasterly winds are conducive to trans-Gulf migration, and northwesterly winds will start the birds down the Florida peninsula on a circum-Gulf flight. Probably large numbers of some species go both routes, but others are known to use one or the other route primarily. To quantify route preferences for comparison with the WCTV wind data, I have also listed in Table 1 the numbers for each of the present species killed during August–October 1973–1976 at WCTV (my data) and for the same months in 1969–1972 at the WDBO tower in central peninsular Florida (Taylor and Anderson 1973, 1974). The WCTV and WDBO towers probably sample the two migration routes (Crawford 1978), and the totals for each tower in Table 1 show that some species have a preponderance at one or the other tower. These differences are correlated ($r = 0.93$, $P < 0.01$ by arcsin test, Snedecor and Cochran 1967: 180) with the totals recorded for northeasterly and northwesterly winds at WCTV.

The species may be grouped into four main catagories: A, B (1 and 2), C, and D. Group A, with larger numbers at WCTV than at WDBO and an association with northeasterly winds at WCTV, includes primarily trans-Gulf migrants. Exceptions are *Toxostoma,* which winters in the United States but is uncommon in south Florida and is abundant in migration and common in winter along the north Gulf coast, *Catharus guttatus,* a similar case, and *Pipilo.* Most or all of these species would benefit from selecting northeasterly winds near WCTV. Group B_1 consists of circum-Gulf migrants, with larger numbers at WDBO than at WCTV and a northwesterly wind association at WCTV. *Limnothlypis* may migrate primarily across the Gulf (Meanly 1971: 24), but this species is nowhere recorded abundantly in migration; perhaps many more go down the Florida peninsula than has been previously suspected. Group B_2 consists of winter residents common in peninsular Florida. All of the species in Group B would benefit from following northwesterly winds near WCTV. Group C comprises ambiguous cases: probably large numbers go both routes. Group D has two species. *Vermivora celata* is associated with northwesterly winds at WCTV but is a winter resident not particularly common in peninsular Florida. Its breeding range, however, is to the northwest of WCTV; perhaps it reaches its southeast wintering range by these winds. *Dolichonyx* is an abundant migrant along the east coast of North America in fall (Hamilton 1962) but is rarely recorded by ground observers in the interior southeast (Crawford 1976). Hamilton suggested an "unseen fall migration, leaping over wide geographic areas" that is apparent only at migration disasters such as TV tower kills. Weston (*in* Lowery 1946: 202) noted a large flock of *Dolichonyx* headed south over the Gulf at Pensacola, Florida that was perhaps indicative of a substantial flight, which accounts for the large numbers killed at WCTV with northeasterly winds.

Whatever the explanations for the few seemingly contradictory data, the hypothesis that populations of some birds select following winds for goal-directed flights in the southeastern U.S. seems supported by the passerine data from the WCTV tower. Stoddard (1962: 14–18) recognized and discussed the two main flights, and a similar situation is known from Sweden, where Alerstam et al. (1973) recorded two well-defined categories of directions among nocturnal migrants (one southwest/south-southwest and one south-southeast/southeast) that corresponded to wind direction.

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Differential Utilization of Prey Resources by Great Horned Owls and Barn Owls in Central Chile

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Great Horned Owls (*Bubo virginianus magellanicus*) and Barn Owls (*Tyto alba pratincola*) are sympatric in central Chile (Herrera and Jaksić 1980), but their interactions in terms of prey taken have not been analyzed. This is because no simultaneous collection of pellets has been done at the same locality. We report the prey in 98 pellets of Great Horned Owls and in 151 pellets of Barn Owls collected during September 1979 beneath one nest of each species at La Dehesa (33°21′S, 70°32′W; 875 m elevation; 20 km east of Santiago).

Prey were identified to the species level whenever possible, and the following parameters were computed: (1) food-niche breadth (Levins 1968: 43); (2) food-niche overlap (Pianka 1974); and (3) mean weight of mammalian prey taken (Herrera and Jaksić 1980). The Kolmogorov-Smirnov test with Chi-square approximation (Siegel 1956: 131) was used to test for differences in the distribution of prey sizes taken by the two owl species. Mean weights of mammalian prey available in central Chile were obtained from Herrera and Jaksić (1980); activity times of those prey were reported by Jaksić and Yáñez (1979).

The Great Horned Owls and Barn Owls associated with these nests both preyed mainly on small mammals (Table 1), but some differences in prey composition were obvious: Great Horned Owls preyed on European rabbits (7 adults, 11 juveniles) and on black rats, but Barn Owls did not. The consumption of rabbits by Great Horned Owls was probably associated with the larger body size of this species (ca. 1,500 g) as compared to that of the Barn Owl (ca. 310 g). It is intriguing that black rats were not taken by the Barn Owl, as their activity pattern is nocturnal and their weight, about 158 g, is well within the handling capacity of Barn Owls. This is exemplified by the relatively high proportions of degus and chinchilla rats in their diet (Table 1). Perhaps Great Horned and Barn owls hunted in different habitat patches, where availability of black rats was different. The presence of degus and coruros in pellets of Barn Owls but not of Great Horned Owls may be associated with the diurnal-crepuscular activity patterns of these two rodent species. If Barn Owls hunt over a more extended period than Great Horned Owls, their probability of encountering those prey would be greater, leading to a higher representation of degus and coruros in pellets of Barn Owls. Alternatively, different preferences in hunting habitat may have increased the relative availability of those two prey species for Barn Owls.

The food-niche breadth of Great Horned Owls was 6.90, considerably greater than that of Barn Owls,