WOOD WARBLERS AND VIREOS IN CALIFORNIA: THE NATURE OF THE ACCIDENTAL.

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Joseph Grinnell (1922) wrote "it is only a matter of time theoretically until the list of California birds will be identical with that for North America as a whole." This prediction is being rapidly fulfilled. However, the many records of "accidentals" obtained in California since 1922 suggest that we should reexamine the application of that term, particularly as applied to such species in California. Specifically we here ask whether the records of accidentals are without pattern, or whether they are in general predictable on the basis of zoogeographic and/or ecological characteristics of the species involved.

The vireos (Vireonidae) and wood warblers (Parulidae) are especially satisfactory groups to consider, because the majority of North American species have been recorded in California and because numerous records of them are available. Records through 1970 have been obtained from Grinnell and Miller (1944); from more recent issues of the Auk, Audubon Field Notes, the Condor and the Wilson Bulletin; from examination of specimens in the California Academy of Sciences, the Museum of Vertebrate Zoology University of California at Berkeley, and the San Diego Natural History Museum; and from personal records of R. Guy McCaskie (San Diego), Richard L. Stallcup (Oakland) and the author. Ranges of species have been derived from the A.O.U. Checklist (1957), Mexican checklist (Miller *et al.*, 1957), and from certain more recent regional publications. Records for the fall season are considered in greater detail, as recent work by Point Reyes Bird Observatory personnel on South Farallon Island suggests that our present understanding of spring abundance of eastern migrants is subject to considerable revision.

I use the term *commonness* to apply to the total population of a species and the term *abundance* to apply to the frequency at which a species occurs in California. I offer no explanation of the commonness of Western (as defined below) species, and only species that breed north of Mexico are considered. Subspecies are neglected except for those of the Solitary Vireo. Nomenclature follows the A.O.U. Checklist, 5th Ed. (1957); Blue-headed, Plumbeous, and Cassin's Vireo are used for the subspecies *solitarius, plumbeus,* and *cassini* respectively, of the Solitary Vireo.

Enough records exist to allow rank-order statistical testing of hypothesis concerning abundance in California. Rank categories are given in Table 1. Parametric statistics cannot be used since degrees of freedom are a matter of speculation. Two non-parametric tests, the Spearman Rank Correlation Coefficient (r_S) and the Olmstead-Tukey Corner Test of Association (Steel and Torrie, 1960), were used exclusively. Probabilities stated are those of observing so strong a correlation under the null hypothesis that no relationship exists between the variables being tested; the square of a correlation coefficient is indicative of the amount of variation in one variable which is due to the other.

Records were treated as two samples, those obtained prior to 1962 and those obtained between 1962 and 1970 inclusively. The abundance of species in the early sample is highly correlated with their abundance in the later sample ($r_s = 0.751$, $P < 0.001$), and, as the latter sample appears more consistent from year to year and also more reliable, all further statistical analyses are restricted to the more recent observations.

Only one source of observer bias is considered. Parnell (1969) has shown that migrants tend to select habitats similar to their breeding habitats while on migration. Migrants also tend to select characteristic strata in vegetation for foraging (personal observations) and foraging habits of some species, e.g. the American Redstart, tend to make them particularly conspicuous. Species were ranked as having foraging habits that would make them inconspicuous (slow moving and ground

Table 1. Rank Categories Used in Statistical Analyses

Rank	Spring Records	Fall Records	Commonness	Habitat Stability	Foraging Habits
0	0	0	—	—	—
1	1-2	1-2	Rare	Early sere	Ground
2	3-6	3-6			Low, skulking
3	7-13	6-14			Low, normal
4	14-19	15-30	Fairly common		Medium, normal
5	20-40	31-62			Med., conspicuous
6	41+	63-126		Climax	High, normal
7	-	127-254	Abundant	—	High, conspicuous
8	-	255+		—	—

— indicates rank not assigned

foraging) or conspicuous (fast moving and tree-top foraging). There is a tendency for species ranked as inconspicuous to be infrequently detected in California (r_S = 0.421, $0.01 > P > 0.001$), but this correlation "explains" only about a fifth of the variation in abundance of these species in California. The magnitude of this effect is probably the result of observers favoring localities where migrants have little choice as to the types of habitat they may select.

I first describe the zoogeographic relationships of these species, then propose and test several hypotheses concerning their abundance in California, and finally discuss the general implications of the results.

ZOOGEOGRAPHY OF NORTH AMERICAN VIREOS AND WOOD WARBLERS

I divide North America into four major zoogeographic regions based on breeding avifaunas. These are a combination of traditional biogeographic regions (Udvardy, 1963) and life zones. These regions are the West, the North, the East and the Southwest (Fig. 1). The Northern region is further divided along the east slope of the Rocky Mountains into the Northwest and Northeast subregions. Species that breed in more than one of these regions are referred to the region closest to California in which they are regularly present.

The zoogeography of migratory species is incomplete unless their winter ranges and migratory routes are also considered. The winter ranges of many vireos and wood warblers are poorly known, but the West Coast (including western Mexico), Middle America, the Caribbean (including the southeastern United States), and South America appear to be distinct regions (Fig. 1). Species wintering in more than one of these regions are referred to the region closest to California in which they are regularly present.

Migration routes are not directly considered. As a first approximation it is assumed that species migrate along direct great circle routes (i.e., paths of shortest possible distance) between their breeding and wintering ranges. Indeed, most species wintering in the Caribbean and in South America have more easterly migration routes than species wintering in Middle America. Assuming direct migration, transient individuals would be expected to occur only in the region directly between their breeding and wintering grounds. Thus, the species expected only as transients in California are Northwestern species

FIGURE 1. Faunal regions of North America. Regions based on breeding avifaunas are separated by dashed lines and are written in capital letters. Regions based on wintering avifaunas are separated by dotted lines and are written in lower case letters; the South American region, beginning at Panama, is not shown. Stippled area is above 5000 feet elevation.

wintering on the West Coast. Since many migratory species not meeting this requirement have been recorded in California (Table 2), the preliminary assumption of direct migration must be modified.

The zoogeographic relationships of Northern, Western and Eastern species are indicated in Table 3, the species arranged according to their breeding and wintering range. Values used in statistical analysis of the abundance of Northern and Eastern species in California are presented in Table 2. To avoid biasing the analyses that follow, I do not include Myrtle and Townsend's warbler, both of which winter in California.

Records of the Northern and Eastern species are now numerous enough to suggest some patterns of abundance. Northwestern species wintering in the West Coast region include two species, Myrtle and Townsend's warbler, regular in California and the commonest of the accidentals, the American Redstart (McCaskie, 1970). Species not yet recorded in the state all fall in the lower right corner of Table 3, save the Blue-headed Vireo, which is possibly overlooked among the similar Cassin's Vireo, a common California bird. Although some Palm Warblers may winter in the West Coast region, I have assumed the nearest regular wintering populations are in eastern Texas.

The fourteen Southwestern species of vireos and wood warblers may be described briefly as follows: Hutton's and Bell's vireo have extensive breeding ranges in California; Grey and Plumbeous vireo and Virginia's and Lucy's warbler breed in the southeastern part of the state. Olive, Grace's and Red-faced warbler, and Painted Redstart breed north into Arizona and New Mexico; Black-capped Vireo, Colima and Golden-cheeked warbler breed primarily in Texas; and Yellow-green Vireo and Olive-backed Warbler breed in extreme southern Texas as well as Sonora, Mexico. Hutton's Vireo is essentially non-migratory; the Yellow-green Vireo winters in South America; the Golden-cheeked Warbler in southern Mexico, and the other species in western Mexico. Of the forms not breeding in California, only the Yellow-green Vireo, Red-faced and Grace's warblers and Painted Redstart have been recorded in the state. The latter two species occur sufficiently far northwestward (Johnson, 1965) that their occurrence in California is not surprising, and the group is otherwise too poorly represented to permit analysis.

Table 2. Characteristics of Northern and Eastern Warblers and Vireos.

Species	Abundance rank[1] Spring	Abundance rank[1] Fall	Foraging habits	Angle of deviation[2]	Commonness	Length of migration[3]	Habitat stability
Warbler, Black-and-white	5	6	6	13	5	1875	4
Prothonotary	2	2	3	88	3	2125	5
Worm-eating	0	2	2	73	2	1925	4
Swainson's	0	0	1	112	1	1550	5
Golden-winged	1	1	3	67	3	2550	2
Blue-winged	0	2	3	73	3	1925	2
Bachman's	0	0	5	133	1	1420	5
Tennessee	4	6	5	38	7	2775	2
Parula	5	5	5	62	4	2300	4
Magnolia	5	5	3	29	5	2600	4
Cape May	0	3	6	54	4	3100	5
Black-throated Blue	0	5	3	88	5	2150	5
Black-throated Green	2	4	7	25	7	2025	6
Cerulean	0	1	5	102	4	2650	5
Blackburnian	1	4	6	58	6	2725	5
Yellow-throated	1	1	5	61	3	1975	5
Chestnut-sided	2	5	5	58	6	2825	2
Bay-breasted	1	3	5	59	6	3975	4
Blackpoll	4	8	5	23	7	5450	6
Pine	0	2	5	61	4	1200	5
Kirtland's	0	0	4	100	1	1400	1
Prairie	0	4	4	102	4	1750	2
Palm	3	7	4	38	5	2225	4
Ovenbird	5	4	1	25	6	2825	6
Waterthrush, Northern	5	5	1	17	5	1650	4
Louisiana	0	0	1	26	2	1975	4
Warbler, Connecticut	2	2	2	59	3	1725	3
Mourning	1	1	2	50	3	2900	3
Kentucky	1	0	2	73	2	1925	5
Hooded	1	2	3	73	4	1925	5
Canada	2	3	3	65	5	3650	4
Redstart, American	6	8	7	13	7	1300	4
Vireo, Black-whiskered	0	0	3	120	6	2025	6
White-eyed	1	0	2	61	3	1200	3
Blue-headed	0	0	3	37	4	2200	5
Yellow-throated	2	1	4	67	3	2450	5
Red-eyed	4	4	4	44	7	3700	6
Philadelphia	0	2	4	25	3	2825	3

[1] Records, 1962-1970.

[2] Degrees from normal migration route needed to reach California in Fall.

[3] Miles from breeding range to wintering range.

Table 3. Zoogeographic relationships of Northern, Western, and Eastern vireos and warblers. Underlined species not recorded from California. Abbrevations: bk - black; bl - blue; br - breasted; cr - crowned; sd - sided; thr - throated; V - vireo; W - warbler; Wth - waterthrush.

NORTH EXTENT OF WINTER RANGE

WEST EXTENT OF BREEDING RANGE	WEST COAST		MIDDLE AMERICA		CARIBBEAN	SOUTH AMERICA
	California	Western Mexico	Southern Mexico	Cent. America		
WEST	Hutton's V Orange-cr W Audubon's W Yellowthroat	Cassin's V Warbling V Nashville W Bk-thr Gray W Hermit W Yellow-br Chat Wilson's W	Yellow W			
NORTH Northwest Oregon	Townsend's W	Am. Redstart				Red-eyed V
Br. Columbia		Northern Wth	Magnolia W	Tennessee W		
Alaska	Myrtle W					Blackpoll W
Northeast Br. Columbia		Bk-&-white W Ovenbird	Bl-headed V Bk-thr Green W	Philadelphia V	Palm W Cape May W	Bay-br W Connecticut W
Alberta				Mourning W		Canada W
Saskatchewan				Blackburnian W Chestnut-sd W		
Manitoba		Parula W	Yellow-thr V Golden-wing W	Bk-thr Bl W Pine W		
EAST North of Ohio River		Louisiana Wth	White-eyed V Blue-wing W Worm-eating W Yellow-thr W Kentucky W Hooded W	Prothonotary W	Prairie W Kirtland's W	Cerulean W
South of Ohio River					Swainson's W Bachman's W	Bk-whiskered V

FACTORS INFLUENCING ABUNDANCE OF "ACCIDENTALS" IN CALIFORNIA.

It is difficult to determine the factors which influence the occurrence of "accidentals" in California, because of interactions between environmental factors and behavioral characteristics. It is not especially satisfying to invoke specific hypotheses for each species, and I consider only hypotheses that can be expected to apply to all species. I first examine possible influence of the migratory path.

Experiments with caged birds are interpreted to indicate that migratory birds can use certain (celestial) cues to maintain a "preferred direction" of flight, but variation of 30 or more degrees in the preferred direction of different individuals of a species is also evident; some birds do not orient at all (e.g., Emlen, 1967). Such variation suggests the hypothesis that misoriented individuals constitute the majority of vagrants; specifically, if birds do follow a preferred direction, ignoring all other cues, and if some individuals have a preferred direction that would lead them away from their "normal" migratory routes, it would not be surprising to find some individuals of almost any migratory species in California. Although such deviant individuals might be expected to be predominantly immatures, the predominance of immature birds in the fall samples of "accidentals" is probably overstressed and is not likely to be indicative of the numbers of adults of "accidentals" that appear in California. A similar autumnal predominance of immatures has been found in Northern and Eastern species on the Atlantic coast (Murray, 1966) and in Western species on the Pacific coast (Ralph, 1971), and is possibly a general phenomenon resulting from other behavioral differences between these age classes.

The greater the deviation from the "normal" migratory route a misoriented individual shows, the less likely it is to arrive at a locality favorable for survival. The result of selection should be that most individuals are able to orient correctly. Thus, all other factors being equal, we anticipate that the greater the deviation from the orientation between the breeding and wintering range required to lead a bird to California, the less likely that bird is to occur there. I calculated an angle of deviation necessary to reach California in the fall as the spherical angle between 1) a great circle arc from the western edge of the breeding range to the northwestern edge of the wintering range, and 2) a great circle arc from the western edge of the breeding range to Bakersfield, California (35.5°N, 119°W), a locality approximately central to localities from which most records have been obtained. These angles were then ranked. The abundance of Northern and Eastern species in California increases as the angle of deviation decreases (Fig. 2), the relationship being highly significant (r_S = 0.573, $P < 0.001$), but see below.

Corresponding calculations for the spring records give the same trend but the correlation is not significant. Over half the species are unreported or known from only one record, so this result is not surprising. Because of the geometry of the Americas, most species need deviate less (less than half as much for 16 of the 38 species) from the original migration route to reach California in the spring than they need deviate in the fall, so less variation in abundance due to misorientation should be evident. I have not further analyzed spring records other than to note that species common in the fall tend also to be common in the spring (r_S = 0.678, $P < 0.001$).

The above hypothesis assumes all other factors are equal. Not all warblers and vireos are equally common, and one would anticipate commoner species to occur more frequently in California. There is essentially no quantitative information available, especially for the

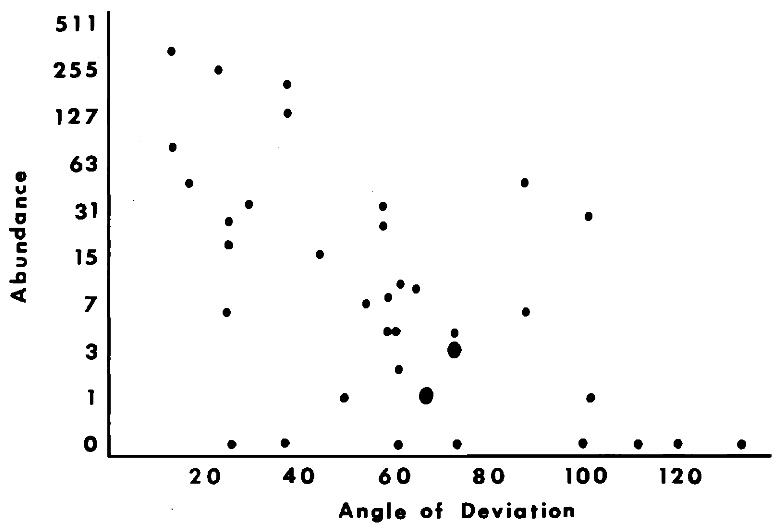

FIGURE 2. Abundance ($\log_2$ [Number of records + 1]) of warbler and vireo species in California in the fall versus Angle of deviation (degrees) from normal migration route needed to reach California by fall migrants. Larger dots represent two species.

western parts of the ranges, but overall commonness can be estimated. The relative commonness of species was taken from Robbins, Bruun and Zim (1966), species ranked 1 to 7 according to the abundance category specified therein, except that species characteristic of the Eastern Region were placed one rank rarer since these tend to be uncommon at the northern periphery of their breeding range. As species become more common they occur more frequently in California (Fig. 3, $r_S = 0.761$, $P < 0.001$). However, the overall abundance ranks proved to be correlated with the angle of deviation from normal migration routes needed to reach California ($r_S = 0.532$, $P < 0.001$). To investigate the influence of angle of deviation when corrected for commonness and of commonness when corrected for angle of deviation I calculated partial rank correlation coefficients using the standard formula (Steel and Torrie, 1960). Commonness remained significantly correlated with abundance of these species in California, but angle of deviation had almost no effect, the partial correlation coefficient being about 0.25 ($0.1 > P > 0.05$). The simplest explanation for this result would be to assume misoriented birds occur rarely, but given that a bird will be disoriented all degrees of misorientation are equally likely.

Species also differ in their migratory tendencies. There is no direct way to measure this, but an indirect measure might be the length of the migratory route, under the assumption that species having short routes are likely to be less migratory (and migrate over a shorter period) than species with a long route. (A more realistic explanation is that species with short routes live in or near areas where winter

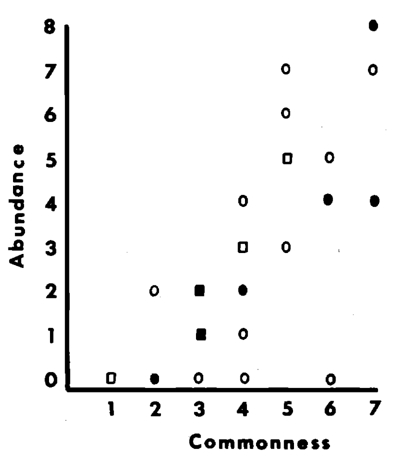

FIGURE 3. Abundance (rank) of warbler and vireo species in California in the Fall versus commonness (rank) of species, in general. Empty circles = 1 species; solid circles = 2 species; empty squares = 3 species; solid squares = 4 species.

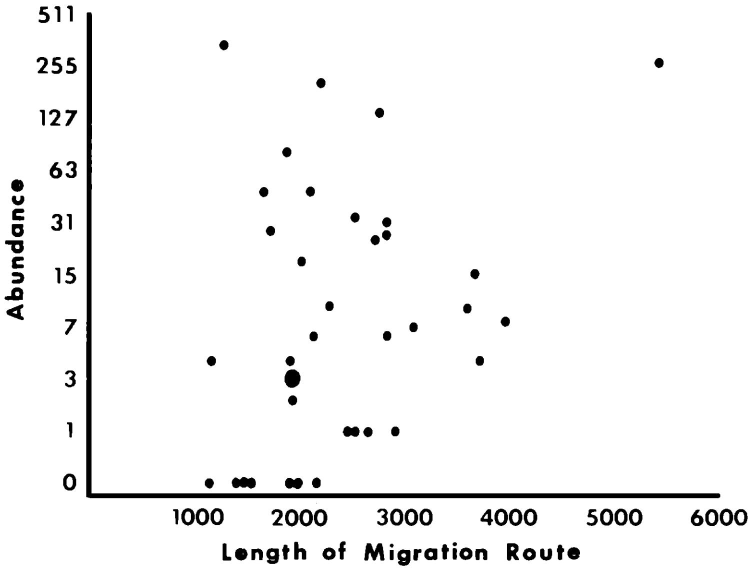

FIGURE 4. Abundance (Log_2 [Number of records + 1]) of warbler and vireo species in California in fall versus length of migration route (miles) from breeding range to wintering range. Larger dot represents two species. Black-whiskered Vireo is not shown.

survival is possible.) A weak positive correlation (Fig. 4, Corner Test = 9, P = 0.1) exists between length of the migration route and abundance of these species in California. However, it is likely that this correlation is spurious and results from a tendency for species with short migration routes to be less common everywhere.

An ecological parameter that might influence the frequency of "accidentals" in California is the seral stage in which the species breeds. Species breeding in early seral stages are likely to find the areas in which they now breed unsuitable in coming years, whereas species which inhabit mature stages can expect to find presently suitable habitat unchanged for much longer periods of time. Correspondingly, one might expect species inhabiting the earlier stages to be subject to less selection for the more accurate navigational abilities needed to return them to the same spot every year and, hence, more prone to vagrancy. Breeding habitats of the species were ranked from 1 to 6 according to their approach to climax. There was no significant correlation between habitat stability and abundance in California.

Another ecological factor that might influence frequency of "accidentals" is the rate of population turnover. The more rapid the rate of population turnover, the more likely a bird breeding for the first time will find an empty territory in the areas where it hatched. The greater assurance of finding a breeding territory there should lead to greater selection for navigational abilities. There are no data with which to test this hypothesis.

The Cordilleras of western North America form a potential barrier to east-west migrations of birds. In the fall the mean rank for abundance in California is 4.25 for species which breed or winter in and west of these ranges and 2.04 for species which occur entirely east of them. In the spring the contrast is more striking; no species of rank 4, 5 or 6 occurs entirely east of these mountains. Even in California the influence of the mountains is suggested by the concentration of "accidentals" east of the White and Panamint mountains, in the southeastern deserts, and along the coast (Fig. 5). The concentration of records along the coast is probably the result of observer concentration and the influence of the ocean on individuals which do cross the mountains. It is difficult to separate any effect of the mountains from that produced by the more westward ranges for species that breed in the Cordilleras, but a possible reason for such an effect can be suggested. Measurements of the altitude of migrating birds, admittedly in low-lying areas, indicates that over 90 per cent of

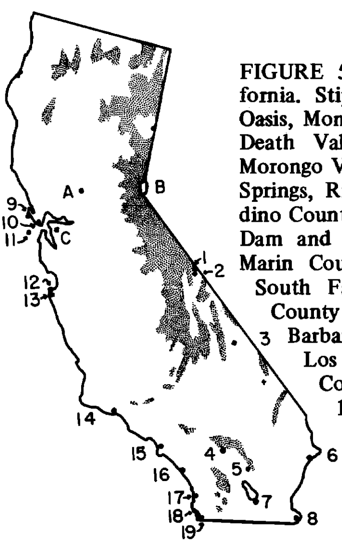

FIGURE 5. Major localities for "accidentals" in California. Stippled area is above 5000 feet elevation. 1) Oasis, Mono County; 2) Deep Springs, Inyo County; 3) Death Valley National Monument, Inyo County; 4) Morongo Valley, San Bernardino County; 5) Cottonwood Springs, Riverside County; 6) Parker Dam, San Bernardino County; 7) Salton Sea, Imperial County; 8) Imperial Dam and Potholes, Imperial County; 9) Point Reyes, Marin County; 10) Point Bonita, Marin County; 11) South Farallon Island; 12) Pacific Grove, Monterey County; 13) Carmel, Monterey County; 14) Santa Barbara, Santa Barbara County; 15) Los Angeles, Los Angeles County; 16) Dana Point, Orange County; 17) Solana Beach, San Diego County; 18) Point Loma, San Diego County; 19) Imperial Beach, San Diego County. Localities where "accidentals" are rarely found: A) Yolo County; B) Lake Tahoe; C) Tilden Park, near Berkeley, Contra Costa County.

all migrants fly below 5000 feet altitude (Eastwood and Rider, 1965), whereas much of western North America is above 5000 feet elevation (Fig. 1). Records in eastern California appear strikingly limited by the 5000 foot contour (Fig. 5). Although most of the western species migrate, especially in the fall, at higher elevations in the mountains (e.g., Austin, 1970), there are also observations of some migrants avoiding these higher elevations (L. Miller, 1957). It is not inconceivable that Eastern and Northeastern species as a group are less prone to cross the higher mountains than Western and Northwestern species but more field work on this point is clearly required.

Present data suggest that the pattern of abundance of these species is largely the result of passive phenomena – the failure of organisms to be perfect navigators and the size of the source populations. As additional records become available it would be desirable to determine if the patterns of abundance are different in the San Francisco Bay area and the San Diego areas, between coastal and interior localities, and also between spring and fall.

DISCUSSION

A large part of the variation in abundance of these "accidentals" in California can be attributed to differences in population size. The influence of the other factors is minimal. Of other possible factors, the amount of deviation from normal migration routes seems most likely to be influential as the abundance of only a few species is predicted poorly by this factor. In the spring exceptional species are Louisiana Waterthrush and Yellow-throated Warbler, which are unaccountably scarce; the former is exceptionally scarce in the fall as well. In the fall two species, Black-throated Blue and Prairie Warbler, are exceptionally numerous. [Subsequent to completing this manuscript I have found reference to Black-throated Blue Warblers breeding in central Sasketchewan. If correct, this would reduce the angle of deviation from 88° to 58°, and the species would no longer be exceptionally abundant by this criterion.] Palm Warbler might also be considered overly abundant by this criterion, but there are now enough records of wintering birds to suggest that it regularly winters in California and is not "accidental" there.

Movement of air masses southwestward from central Canada or northwestward from western Mexico may influence the incidence of "accidentals" in California, but the great distance involved and the complications introduced by topography and by continuously available resting areas in intervening areas make "wind drift" a factor very difficult to analyze. It will prove particularly difficult to separate the role of weather in bringing birds to an area where they do not normally occur from that of grounding migrants that happen to be present.

All of the hypotheses I have proposed should apply to other groups of birds as well. Migratory Northern and Eastern species of other passerine families do not form as clear-cut a pattern as do vireos and wood warblers, although the same trends are evident. The records of these species are difficult to evaluate because of bias in their identification and discovery. Some of these species are not easily identified in the field (e.g. *Hylocichla* thrushes and tyrannid flycatchers); others are both distinctive and are attracted to feeders (e.g. orioles, sparrows). The best potential source of data is probably the records being accumulated on South Farallon Island, but approximately ten years of field work will be necessary to elucidate whatever patterns exist, if past experience is indicative.

Grinnell (1922) pointed out that the "accidental" was "the regular thing, to be expected." He believed the role of the "accidental" was that of the explorer, individuals by which "the species keeps aware of the possibilities of areal expansion." No ornithologist can reasonably deny the first statement, but the second is not as straightforward.

Range expansion of highly vagile animals such as birds is possible under two circumstances. One is through amelioration of environmental conditions around the range occupied by the species of evolved adaptations to these conditions and subsequent range expansion of the species into these areas. The other method is through movement of individuals across unsuitable areas to isolated regions of suitable but unoccupied habitat. I assume vagrancy leading to range expansion occurs primarily by the last method.

There is little indication of range expansion in the records of "accidentals" in California. The only "accidental" proven to have bred in California, and that but once, is the Parula Warbler, whose continued rarity probably results from the scarcity of nesting habitat rather than the scarcity of individuals in western North America. Palm Warbler and American Redstart may be establishing new Pacific coast wintering grounds and the other Northwestern species which appear in small numbers in California may be establishing direct western migration routes.

The rarity of range expansion from long range vagrancy probably owes to the difficulty in meeting several basic requirements. Not only must several individuals find an area ecologically similar to their "normal" range, but the new area should not be occupied by a potentially competing species, as the latter's presence may prevent establishment of the invading species even if the invader is competitively superior (Slobodkin, 1962, ch. 11). The rare instance in which a new population is established may have important evolutionary consequences. It is unlikely that two isolated areas will be identical and, particularly for populations which remain isolated in summer and winter, environmental differences may lead to genetic differentiation. The founder effect (Mayr, 1963) could certainly be important. Also, as the number of populations of a species increases, the likelihood of all simultaneously becoming extinct is reduced. This is, however, a long term view of the role of the "accidental."

The majority of "accidentals" clearly do not accomplish any meaningful "pioneering." As these individuals are leaving the region to which they are adapted, they are in a sense reducing the probability of their own survival. Their genetic survival may not be any greater even if they do not disperse, however, as most species probably consist of fairly completely saturated populations in which more individuals are produced each breeding season than can breed in the following season. Indeed, the low probability of finding new, suitable habitat may mean a wandering individual can have a better chance of reproducing than a sedentary individual. The function of dispersal is uncertain, but its results are clear. Movements away from centers of abundance may lead to the founding of new populations, but this is a result of dispersal, not its function. It may be more appropriate to regard the role of the "accidental" as a reminder of the difficulty of defining the range of highly vagile organisms.

The usefulness of the term "accidental" remains to be considered. The implication of accident seems misleading when one can detect such a strong pattern of abundance as exhibited by wood warblers and vireos in California. Only if idealized animals existed in fixed geographic ranges would the idea of accident have much meaning. The great variation exhibited in any trait of every species attests to the non-reality of ideal animals, just as the many examples of range expansion and contraction negate the idea of fixed geographic distribution. The term "accidental" appears not to indicate so much accident as either ignorance of the true status or extreme rarity in a continuum of abundances within a well understood distributional pattern. In the latter case, the appropriate description of abundance is frequency of occurrence with respect to the distributional pattern, such as "Very rare migrant, not detected annually." In cases when the pattern of occurrence is unknown, a noncommittal way of describing abundance should be employed, such as "One record: . . . . . ". Either form of description passes more accurate information than does "accidental."

SUMMARY

Records of "accidental" vireos and wood warblers in California form a pattern of species abundance which can be largely explained by the size of source populations. Local distribution of records in California seems to be related to topographic features of the state. Most of the consequences of vagrancy are results but not functions of dispersal processes, and the most important possible consequence is the rare chance of establishment of new population centers with potential for differentiation.

LITERATURE CITED

American Ornithologists Union. 1957. Checklist of North American Birds. Fifth ed., Baltimore, Md.

Austin, G. T. 1970. Migration of warblers in southern Nevada. Southwestern Nat. 15: 231-238.

Eastwood, E., and G. C. Rider, 1965. Some radar measurements of the altitude of bird flight. Brit. Birds 58: 393-425.

Emlen, S. J. 1967. Migratory orientation in the Indigo Bunting, *Passerina cyanea.* Part I: Evidence for use of celestial cues. Auk 84: 309-342.

Grinnell, J. 1922. The role of the "accidental." Auk 39: 373-380.

Grinnell, J., and A. H. Miller, 1944. The distribution of the Birds of California. Pacific Coast Avifauna no. 27: 1-608.

Johnson, N. K., 1965. The breeding avifaunas of the Sheep and Spring Ranges in southern Nevada. Condor 67: 93-104.

McCaskie, G. 1970. The American Redstart in California. Calif. Birds 1: 41-46.

Mayr, E. 1963. Animal Species and Evolution. Cambridge, Mass. Belknap Press of Harvard Univ.

Miller, A. H., H. Friedman, L. Griscom, and R. T. Moore, 1957. Distributional check-list of the birds of Mexico. Part II. Pacific Coast Avifauna 33: 1-436.

Miller, L. 1957. Some avian flyways of western North America. Wilson Bull. 69: 164-169.

Murray, B. G., Jr. 1966. Migration of age and sex classes of passerines on the Atlantic Coast in autumn. Auk 83: 352-360.

Parnell, J. F. 1969. Habitat relations of the Parulidae during spring migration. Auk 86: 505-521.

Ralph, C. J. 1971. An age differential of migrants in coastal California. Condor 73: 243-246.

Robbins, C. H., B. Bruun, and H. S. Zimm. 1966. Birds of North America. A guide to field identification. New York. Golden Press.

Slobodkin, L. B. 1962. Growth and Regulation of Animal Populations. New York. Holt, Rinehart, and Winston.

Steel, R. G. D., and J. H. Torrie. 1960. Principles and procedures of statistics. New York. McGraw-Hill.

Udvardy, M. D. F. 1963. Bird faunas of North America. Proc. XIII Intern. Ornithol. Congr. : 1147-1167.

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POSTSCRIPT

Austin (Condor 73: 455-461, 1971) has recently published an independent analysis of eastern wood warbler abundance in California. He recognizes the possible influence of zoogeographic phenomena in determining abundance of these species in the state, and has additionally made the important contribution of comparing dates of occurrence in California with dates of occurrence in eastern North America. I believe his conclusions on the timing of records in California are subject to some modification, particularly for species with more southeasterly breeding ranges. For such species, dates of appearance in California in the fall would seem to be more closely comparable with dates of arrival on the wintering range, since the distances traveled are comparable. He has not attempted such a comparison, presumably for lack of suitable data. In the spring, dates of occurrence should be related primarily to the phenology of the populations supplying individuals to California and are not necessarily related to those obtained in eastern North America. Moreover, it is my distinct impression that the magnitude of movements in late May and early June is considerably underestimated by eastern observers, who frequently concentrate their efforts in the early spring when the foliage is not fully developed. In both spring and fall, based on my own experience in southern Michigan and central New York, the numbers of "migrating" birds which may be found is not very different from the numbers observed in California at the same time of the year. What seems to be changed is that individuals observed earlier in the season in the East are missing in California (and records from South Farallon Island suggest that even this impression is somewhat erroneous). Lastly, I believe Austin does not realize how localized the records of many of these species are, particularly when he suggests that some of the abundance patterns are recent developments (with implication of during the twentieth century.) Based on my personal field experience it is not at all surprising that, for example, the first records of the Blackpoll Warbler were not obtained in the San Francisco Bay area until 1962, in spite of a hundred year's prior field work there. Records of these species are almost non-existent from localities more than a quarter mile inland of the Pacific ocean, even for observers who are successful at locating these species coastally.