A REVIEW OF TERRITORY, ANNUAL CYCLE AND NUMBERS IN A POPULATION OF WREN-TITS (*CHAMAEA F. FASCIATA*)[1]

By THOMAS T. McCABE

SOMETIMES, in the abundant and depressing output of ornithology as academic discipline, there may appear a work of quality and philosophical purpose. That last of literary types, the doctor's thesis, may fail either to foster insipidity or to mask the purport of that with which it deals. Such fortuities are rare, but on the reviewer's horizon the present study rises like a cheerful portent, with its finely quantitative data which are yet *field* data, its ordering of that somewhat vague thing, natural history, into selective grooves which run fairly to the threshold of major problems.

Inflicted at the start with a project of unrealized difficulty and characteristic purposelessness, it was the author's topsy-turvy problem to find first a technique, second a purpose—and her special distinction to achieve the latter. In fact, the difficulty in the unification of the present dissertation lies in the duality of purpose to which the set-up lent itself, the unraveling of the racial psychology, which determines a certain order of avian society, and the statistical examination of that society in its biological implications. The two trails lead through regions remote in method, in style, and in spirit, to meet in a broad road at last. Naturally, it is the first quest which produces the affectionate and subjective picture of this quaint and elusive micro-vertebrate of the dusty chaparral, known to most of us as *vox et praterea nihil*, ringing from dark green gullies in hills of shimmering gold, best studied in snarls of poison oak under a summer sun.

The meager yield of a year or two of simple watching led to the trial of large-scale trapping, with trap-lines rather than stations, and the solution of the problem of attracting a non-granivorous, largely insectivorous bird by putting glass dishes of water in the traps. This, along with complete and recognizable color-banding, was carried on for three years more, and provided regular proof of the locations of all birds in some sixteen acres of chaparral sharply delimited by intolerable grassland,—a most satisfactory microcosm, with no casual exchange with the larger world.

The structure of the community proved to be stable in the highest degree, perhaps as much so as that of any group in the world of birds. Out of one thousand six hundred fifty identifications during breeding time only two very brief sallies were recorded beyond the rigid linear boundaries of some eighteen territories which could be, and were, instrumentally surveyed and mapped, like human sub-

[1] A study presented for her Doctor's degree (1935) at the University of California by Mary M. Erickson. Published by the University of California Press in 1938.

divisions, even when the lines ran through the monotony of unbroken chaparral. Outside the breeding time some relaxation could be detected by strict accounting—about one observation in ten found a bird trespassing, usually very slightly, and wandering young were tolerated—but of the continuation of the strictly local habitation, the permanent awareness of the same boundaries, there was no doubt. Bound into the sexual physiology or not, the instinct for the ground is as perennial as the recognition of sex. The companionship of a single pair is well-nigh continuous, in season and out—a companionship closer than mere confinement within common boundaries. No pair ever broke up without the complete disappearance of one member. There is every evidence of continuous mating, as opposed to periodic remating. Final answers to the two questions: What is the nature of the retaining force—economic adequacy, competitive pressure, or some far less tangible factor in the shadows of an irreclaimable past? and What is the nature of the mutual attraction, sexual, expedient, territorial?—are still, perhaps, far to seek, but the virtue of this paper is that such problems are clearly formulated, the solution definitely and closely approached.

While the numbers of territories fluctuate to some extent from year to year in correlation with the population, the whole impression is one of fixity, acceptance, not of pressures in uncertain equilibrium. " . . . The general impression was not of birds sparring for an opening." The sizes of the territories, ranging from one-half to two and three-quarters acres and averaging eight-tenths of an acre, are systematically correlated with findings on possible causes of such variations: abundance of food, type of chaparral (of which the area contained a fine assortment), presence or absence of water, marginal or central position, numbers of tangent pairs, and lengths of defensible boundary. All these showed low correlation, far too low for important factors in the planning of the Wren-tit community. Another, the length of the *natural* boundary-line, the part requiring no watching or defense, gave, curiously enough, a far higher positive result than the simple "length of defensible boundary." However, "it must not be thought that established boundaries yield readily to changes in surrounding pressure. Such boundaries are determined not only by the numbers of pairs present, but by the experience of the individual in previous years." And, beyond question, "the territorial motive in the higher groups of birds is woven more deeply into the psychological skein than economic considerations imply."

While, on the one hand, for practical purposes of mating, a third element—territory—is just as essential as the two sexes involved, the lesson of this study from beginning to end is that there also exist—quite outside the breeding period—individual relationships based on sex, which are not the result of mere habit, or of common confinement within a single area, which may exist between wander-

ing or temporarily sojourning immature birds, and which certainly exists at all seasons between life-long mates. Consciousness of sex, beginning at an early age, is perennial, and mates are not mere functions of territory and season. For the most part the immature birds wander in pairs composed of a male and a female, which shows that there is some sexual response at least early in the fall. "These associations, however, do not appear to be permanent. Whether she [the immature female] would settle with her temporary mate if a territory were available, is a question of much interest, which cannot yet be answered."

The nature of the occupation of the ground once understood, the progress from the natural history of the individual or pair to that of the population demands vital statistics which are drawn from the most detailed study of the reproductive period which the reviewer has read (except for the incomparable wealth of Mrs. Nice's last treatment of her Song Sparrows), parts of which, as the description of the nest-building, possess singular beauty. With about eighteen pairs and a reserve of about five unmated birds, the potential increase was the total average number of eggs hatched, seventy-two. The actual or residual increase by the time the young were ready for independence was only thirty-three. The discrepancy was almost entirely due to nest-destruction, which, largely by elimination, is attributable to predatory animals, though the California Jay was the only one caught in the act. Only fifty-six per cent of the pairs succeeded in fledging broods, but the fledged broods averaged very close to the maximum size. Of the adults, two or three died during the breeding season, and twelve or thirteen during the winter, or thirty-six per cent during an average year. It is not possible to know the winter mortality, with individual precision, of each crop of local young, (in contrast to Mrs. Nice's Song Sparrows), for they disperse widely (of forty-six nestlings banded only one was ever retaken in the area after leaving the home territory), but since probability suggests, and trapping proves, that an equal number of young enter the canyon, the numbers of surviving first-year birds at the next breeding season give the writer the mortality rate of first year young,—twenty-four deaths, or seventy-two per cent. This all adds up to a total average annual mortality of thirty-nine deaths, or fifty-two per cent of the maximum population of about seventy-five grown birds. The population by breeding time declined to about the figure of the year before, eighteen to twenty pairs, plus half a dozen landless and mateless birds. These precise figures would, of course, indicate a slow general decrease, and such, in fact, did take place during the years of work, doubtless to be compensated for by a swing of the narrow margin in better times. Applying the formula worked out by Burkitt, the average age of those individuals which live through their first year is 4.43 years, which checks well with another method based on size of age groups of banded birds of known age.

In a penultimate chapter on "Territory and Population," the purpose of which is to draw to a common conclusion the two lines of thought just briefly outlined, it is emphasized that an average of twelve or thirteen locations were all that became available, annually, for about thirty-three young which attain the age of independence. It is quite possible that more space might mean more survivals. Possession of ground may not be necessary to the individual life—it is certainly essential to reproduction, and ". . . what selection takes place is not based so much on the individual's ability to live, but rather on its ability to leave offspring." "*The ultimate competion is for space.*" The space requirement, rarely compressed to the limit, is a kind of elastic cushion or governor, variously modifiable, but in final control of the potentially illimitable reproductive forces. Yet it is to be noticed that in the period studied, admittedly "depression years," it was not the territorial factor but other agencies of reduction of numbers which lowered the waters below mean sea level. The total young reaching their first spring was not enough to fill the spaces. The territorial control is ever-present, but is the final arbiter of numbers only when other controls are insufficient.

It is a great pity that so high a wall of statistical matter lies between the average reader and these later chapters, as well as that final summation called "A Wren-tit's Life," and we unblushingly advise readers, not concerned with professional technicalities, to skip. "God gives us our relatives,"—no one can control his own birth, and this embryo, which was fit to be a book, was fated to be born a dissertation.

AVIAN HOSTS OF EIMERIAN COCCIDIA

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INTRODUCTION

THE senior author has elsewhere (Boughton, 1937) pointed out to ornithologists that coccidiosis is a disease widely distributed among birds. The two genera of Coccidia responsible for this disease in birds—*Isospora* and *Eimeria*—were distinguished as to type of oocyst development outside the host body and in regard to the orders of birds parasitized. A survey of the literature revealed that various species of *Isospora* are found in birds of the "higher" orders (Cuculiformes, Passeriformes, etc.), while species of *Eimeria* occur in birds of the "lower" orders (Pelecaniformes, Galliformes, Columbiformes, etc.). The nature of Isosporan coccidiosis as it is found in small birds was described. More recently (Boughton, 1938) a host list of some 175 species and sub-