of the flora. The whole number of species is 136. The group of paludose plants contains 48 names, of which 2 are trees, 6 shrubs, 32 perennials. and 8 annuals. These plants are not representative of the true arid flora of the valley, for they have in most cases an abundant supply of water. Comparatively few of these species are confined to the desert, many of them occur in the humid regions of intramontane California, several extend quite across the southern United States and Mexico, and a few are found throughout the subtropical region of the world. It is a general law, of which this part of the Death Valley flora is but a single example, that aquatic and paludose plants do not follow those laws of distribution which govern a true terrestrial flora.

The second group of plants constitutes the arid flora of the region. Of trees there are none, shrubs 20, perennials 18, and of annuals 50. Fourteen of the perennials are suffrutescent at base and carry on the functions of life throughout the year above ground. Three of the remaining four are grasses, the stems of which also retain some vitality through the winter. One plant only, *Cucurbita palmata*, is a true perennial, but it does not grow in the very arid parts of the valley, and comes almost in the category of moist-soil plants. Functionally, therefore, the arid flora of Death Valley is made up of shrubs and annuals. The reason for this state of affairs is found in the extreme heat and dryness of the climate, these being the two, or we may almost say the only, types of vegetation adapted to such conditions.

The geographic affinity of the arid flora of Death Valley is clear. A few species, such as *Mentzelia reflexa* and *Oxystylis lutea*, are known only in the immediate vicinity of the valley, but nearly all the others are common to the desert region of south-eastern California, Arizona, and north-western Mexico. The topographic position of Death Valley, as the deepest basin (480 feet below sea-level) in this desert area, renders the valley capable of supporting a vegetation belonging characteristically to the southern portion of the region. Several southern species, so far as the present data show, reach their northern limit in Death Valley.

The adaptive modifications of the flora are practically the same as those of the general vegetation of the surrounding desert, and will be discussed in considerable detail in the report of the expedition.

NOCTURNAL SONGSTERS, AND OTHER BIRD-NOTES.

BY ROBERT RIDGWAY, M.S., CURATOR OF THE DEPARTMENT OF BIRDS, U. S. NATIONAL MUSEUM.

DR. GIBBS'S interesting article on birds that sing in the night, in *Science* for Dec. 2, reminds me that much may yet be written on this subject. Some of our best songsters are unfortunately not represented in that portion of the country (Michigan) of which Dr. Gibbs writes; otherwise, his list of night-singers would not only have been considerably longer, but would have included at least two species, the mocking-bird and the yellow-breasted chat, that are every whit as notable as the nightingale itself. The night-singing habit of the mocking-bird is well known to all who are familiar with this "master of song." It is as much a characteristic of the bird as its powers of mimicry, for not all mocking-birds mimic, of which, however, more presently.

Next to the mocking-bird in this regard, though perhaps it would be better said equally with it, is the yellow-breasted chat, a bird remarkable for the oddity of its song rather than for its musical quality. Its notes are, however, loud and emphatic, and therefore are sure to attract attention whenever heard at night-time. Its nocturnal song — in no respect that I can discover different from that which it sings by day — has been familiar to me from boyhood, first in southern Illinois, then in California and other far-western States, latterly in Maryland and Virginia. A pair of chats live during summer close by my home (in a suburb of Washington), and few are the nights in May and June when the male does not sing, at more or less frequent intervals, the whole night through. I once thought that moonlight nights were particularly apt to excite birds to sing; but this particular chat kept no account of the almanac. His most brilliant performance, or at least the occasion which most compelled my interest, was during a specially dark night, when I purposely kept awake to make observations. From the time that darkness settled until 3 o'clock in the morning (when I shortly fell asleep) the longest interval between his songs was twenty minutes, but during the greater portion of the night he had scarcely finished one performance than another was begun.

Several others of our birds may properly be termed "habitual" night-singers. Here, about my home, I hear every night during the nesting season (unless it be storming) songs of the chipping sparrow, the field sparrow, the indigo bird, and the golden-crowned thrush, or oven bird; not merely once, but repeatedly. The night-song of the last-named bird is quite the same as that which John Burroughs says is the love-song; but I am puzzled to know whether at night, in the darkness, the singer launches from his high perch into the air, as is his habit during the waning light of daytime. I have heard the night-song of the oven bird so often and been so impressed with its exquisite though transient beauty, that I feel sure Burroughs was right when he suggested that Thoreau's "mysterious night-warbler" was really no new bird at all, but one he was otherwise familiar with; in short, was none other than the oven bird. Speaking of Burroughs, recalls an erroneous statement in one of his charming books ("Birds and Poets," p. 98). He says: "No bird can look our winters in the face and sing, as do many of the English birds." Surely had he passed a winter south of the parallel of 40° in the United States he could hardly have made this assertion. Here about Washington, and westward to beyond the Mississippi, the Carolina wren sings the winter long; and the colder, more crisp, the weather, if only the wind does not blow, the louder rings his powerful carol. So, also, does the tufted titmouse heed not the cold of winter, but bravely whistles his cheery tune of *pé to, pé to, pé to* — some would not call it a song, but it is loud and clear enough, and surely is no mere call-note. The cardinal, too, sings more or less all winter, and so do the white-throated and tree sparrows, though there are periods, caused doubtless by meteorological conditions, to us intangible, but of which the birds take note, when birds are little heard.

Among the many myths of popular bird-lore is that of the mocking-birds' habit of mimicry, of which a hint was given in a previous paragraph. In making this statement I would emphasize the word *habit*, as distinguished from the term faculty; since I would not for a moment deny this bird's ability (as a rule) to mimic far better than any other. The point is, that mimicry is not so much a habit of the mocking-bird as most people suppose. The reason for the popular error is very simple: The natural song of the mocking-bird is so varied, and is characterized by such wonderful compass, rapidity of change, and brilliancy of execution that persons not specially familiar with birds' notes naturally suppose the medley to be in large part borrowed; and the listener is further confirmed in this belief by the more or less frequent interpolation of what he recognizes as unquestionable imitations of the notes of other birds. Individual mocking-birds differ greatly in the character and quality of their songs, some being inveterate mimics while others seldom if ever spoil their own incomparable song by imitation. I recently possessed one of the best songsters of this species it was ever my pleasure to hear. His song was wholly his own; almost infinitely varied, wonderfully mellow and clear, bewildering in the rapidity of its changes, and surpassingly brilliant in execution. Yet, with all this, if any one of his notes suggested the note of any other bird I am sure it was not intentional.

Not only do birds' songs differ materially according to the individual, but often each individual possesses a more or less extensive *repertoire*, the separate parts or tunes of which are so different from one another that, heard without the singer being seen, they might readily be attributed to different birds. This is particularly true of the cardinal grosbeak; and I have not the slightest doubt some observers have received an unfavorable impression of this bird's song from having first, or perhaps only, heard one of the less attractive tunes of an individual which half an hour later might be singing a song totally different, and far finer. A pet cardinal, which I had for several years, sang six very distinct songs, besides minor variations. A remarkable peculiarity of this bird (though one which I believe to be characteristic of the species)

was that one of these songs was almost invariably repeated until he himself became tired of it before he changed to another.

The difficulty of expressing a bird's notes by words is well known, but the following attempt may give some idea of the different songs of my cardinal: —

I. *Hoit*,— *whoit*,*whoit*, *whoit* (eleven times); *hoit*,— *whoit*, *whoit*, *whoit* (eleven times).

II. *Wheù*, *wheù*, *wheù*, *wheù*, *wheù*.

III. *Tchew*, *tchew*, *tchew*, *tchew*, *tchew*.

IV. *Bird'ie*, *bird'ie*, *bird'ie*,— *tchew*, *tchew*, *tchew*, *tchew*.

V. *Bird'ie*,— *bird'ie*, *bird'ie*, *bird'ie*, *bird'ie*, *bird'ie*.

VI. *Whoy'it*, — *whoy'it*, *whoy'et*, *whoy'et*, *chichichichichichi* (a jingling trill, so long continued that it apparently ended only when the singer became "out of breath").

The notes of many cardinal grosbeaks are clear and tender — far sweeter than the mellowest notes of fife or flageolet.

One of my most welcome bird-guests last summer was a summer tanager, whose favorite singing station was the summit of a tall scrub pine-tree in a corner of my yard. All day long, from May till August, no matter how hot the sun, he sang, robin-like, this song: *Ter-whit'-ter-way*, — BRING *him* HERE; *ter-whit'-ter-way*, — BRING *him* HERE (repeated incessantly, with very strong emphasis and rising inflection on the "here"). Another male of the same species, whose nest was in a neighboring pine grove, answered thus: BRING-*him*-HERE, *chip'-way*, BRING-*him*-HERE, BRING-*him*-HERE.

This beautiful tanager and the red-eyed virio are midsummer and midday songsters. Perhaps it is because they are representatives of tropical families that they do not mind the intense heat of the dog-days, but sing cheerily, the former from the tip-top of some tree taller than those about it, his glowing red plumage receiving, it may be, increased refulgence from the burning rays of the sun, the latter, of modest olive-green and whitish garb, as he busily gleans his insect food among the shady leafage of the forest trees.

The subject of midday songsters brings me again to John Burroughs, who, always charming and usually accurate in his descriptions of bird-life, sometimes (like the rest of us) makes mistakes. The bird involved is the grass finch, for which he prefers the name vesper sparrow (since adopted by the American Ornithologists' Union), and all he says of it is true and eminently characteristic except the statement that "his song is most noticeable after sundown, when other birds are silent,"— which does not accord with my own experience in midland Virginia, where, in extensive fields of a large farm, numbers were heard singing sweetly through the hottest part of the hottest day of a hot summer,— the time being about 1 o'clock P.M., the date July 4, 1887, and the temperature 103° in the shade!

But the habits of birds do vary, and one day's observations, in the same locality, may quite contradict those of a previous occasion; therefore, only repeated observations, under varying circumstances of time and place, can give us an approximately correct knowledge of the habits of any species.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

How are Young Spiders Fed?

IN my rambles for botanical specimens in the last three years, many new and curious things have been thrust upon my attention in the insect world, and these I have recorded for future use. One fact in particular struck my attention, and I herewith submit it to the readers of *Science*, partly to record the fact, and partly to ask if any other readers of your excellent periodical have ever observed a similar fact.

We have been taught by the best works on spiders that the young of spiders derive their food mostly from the atmosphere. The "Encyclopædia Britannica" confirms this view.

On the 19th day of June, 1891, I discovered, in a ploughed field, an enormous spider of the *Lycosidæ* species, which was 1½ inches long. She presented a very curious appearance, being covered with scores of tiny spiders from one end of her body to the other. When I touched her with a weed-stem the young spiders scampered off at a lively rate, only to return when left to themselves. The spinnarets and abdomen of the mother-spider were greatly distended. Suddenly, there was a copious flow of white liquid which the young greedily devoured. Examining the fluid under my microscope, I was fully convinced that this was veritable milk, and that this spider, at least, nursed her young, instead of bringing them up on atmospheric moisture. I should be glad to know if any readers of *Science* have ever observed a similar occurrence.

JOHN W. SANBORN.

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Palæolithic Man: A Last Word.

THE world was growing old apace, just as it is now, when Man first entered upon the scene here in the valley of the Delaware. Over the hills and along every lowland water-course forests grew, died, fell, and decayed, helping to make that deep deposit of soil which now covers the gravel and sand that agencies no longer active had spread over the surface of the land. Just what was the outlook that presented itself when the first Man or Men looked about them,. we can only conjecture. Mr. McGee claims that the evidence favors the view that the soil had formed, the forests were old, pines had succeeded oaks, and oaks succeeded pines, and the elk, deer, and bear were the chief sources of food-supply to the wandering hunter that, reaching out from his native land, came, saw, and conquered the valley of the Delaware. But is this true? Has he or has any one so carefully studied the soil-making period that all doubt is dissipated and shown that the Indian of historic time can only trace his ancestry back to so recent a time as when the brute creation that still lingers on our frontiers was its sole occupant? If the reader, curious in such matters, will look into the literature of this subject, he will find that the evidence has been produced time and again to show that with the very commencement of this soil-making period, are so intimately associated abundant traces of a tool-making creature — a man — and in such a manner associated, that the suggestion that all such objects of human origin are "intrusive," has no real weight.

Sections of undisturbed soil, sand, and gravel are not difficult to make and when we find that as a result of a large series of such, we have a uniform result, we are bound, if reasonable men, to accept such as the truth. Now this has been done, as I have said, and the fact obtained that relics of man of a very rude character underlie those of a more elaborate one. In an earlier publication I have ventured to call the former "fossil implements" and the later ones "Indian relics;" although, of course, they were all made, I believe, by the same people, but at different times. The apparent contradiction that rude and elaborate alike are found on the disturbed surface has no bearing upon the question. What the plow or spade has displaced has no longer an archæological significance, save as to its import as a tool or weapon of a particular character. A stone axe is an axe wherever and however found, but if it has been tossed about the fields or washed by a freshet from its original resting-place, what more can we say than that it is an axe? On the other hand, if in a section through the soil and underlying sand we find rude argillite implements and the very rudest pottery, and above them, *wholly in the soil*, axes,.celts, pipes, and pottery of more artistic finish; find this not once, but always; then we have the right to, indeed cannot honestly do otherwise, assert that the deeper, sand-encompassed objects antedate those which occur only in the over-lying soil. This holds good in archæological research in any part of the world, and is just as true as that in building a city to-day, we are building upon the ruins of an Indian village, or at least on ground where once the Indian passed and re-passed, even if he did not tarry long.

But can we go back a step farther? If we can do so elsewhere on the globe, I hold that it is warranted to do so here and for the same reasons. The geologists to effectively prevent this must show that the earth previously was uninhabitable; that the phy-