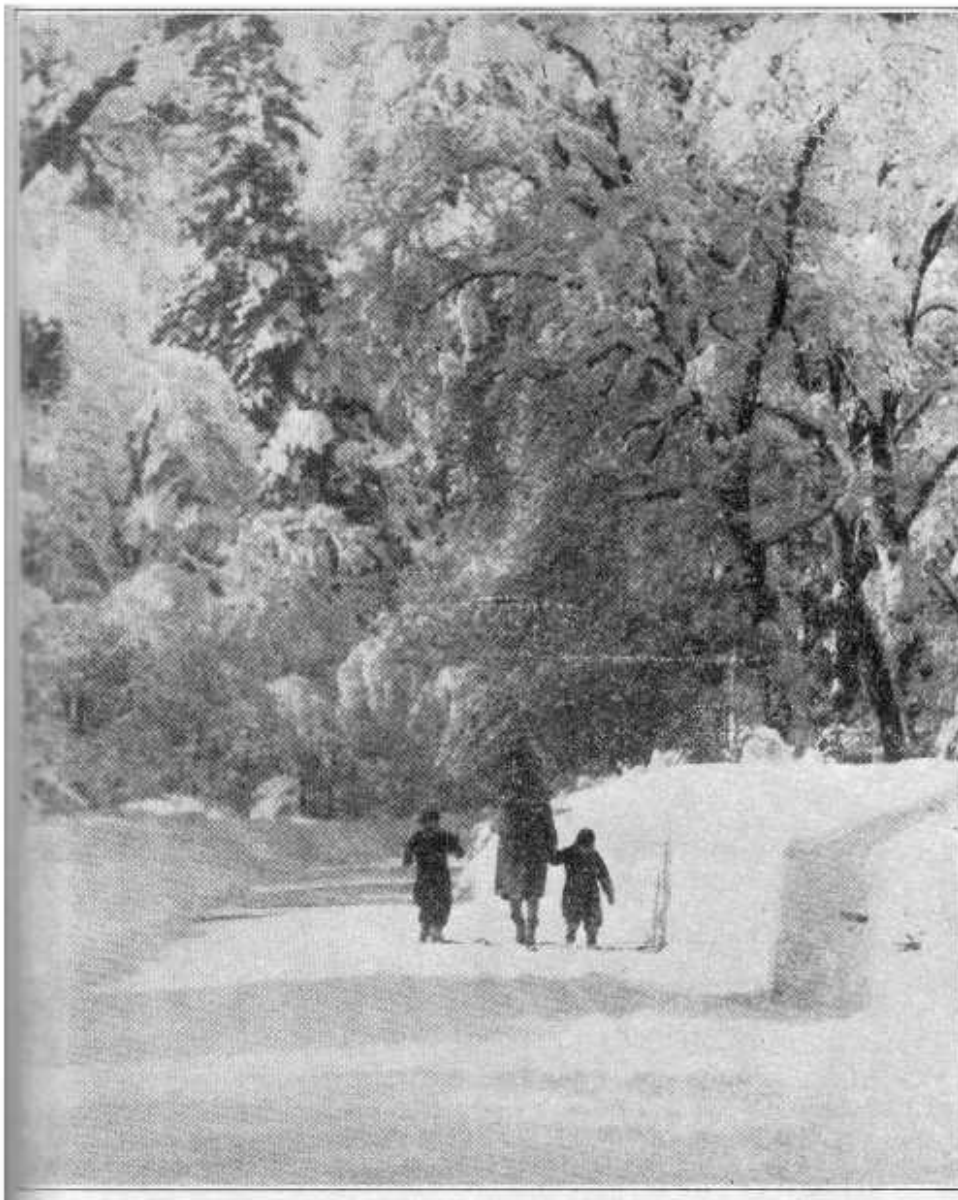
YOSEMITE NATURE NOTES



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Yosemite Nature Notes

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Hibernation

By Raymond M. Gilmore

The winter season, December to March, is noted for the occurrence in certain mammals of a special phenomenon known as hibernation. The visitor to Yosemite National Park in winter at once notices the absence of certain diurnal mammals perhaps familiar to him in summer, such as bears, chipmunks, golden-mantled ground squirrels and California ground squirrels and the twilight or crepuscular bats. Were he able to visit the higher altitudinal areas of the Park, he would also notice the absence of marmots and Belding ground squirrels. All these mammals which are so conspicuous in summer, together with the nocturnal and consequently little-known jumping mice, and perhaps badgers at the higher elevations of their range (meadows and flats from 8,000-10,000 feet) are, at this season, hibernating, occasionally or continuously, in a state of semi- or complete torpor.

Hibernation, or winter sleep, is an inactive state (not necessarily, though generally occurring in winter) in which the animal exists in an intermittent, more or less comatose condition with reduced bodily activities. It is deeper and different from ordinary sleep.

Hibernation appears to be inseparable from cold temperatures and consequently is generally restricted to the temperate and frigid zones and is commonest among cold-blooded animals. It is found among many land invertebrates, such as snails, slugs, certain crustaceans, insects, and perhaps spiders, and in such cold-blooded vertebrates as frogs, toads, turtles, lizards and snakes. Everyone is acquainted with the winter disappearance of many of these forms, especially the snakes. Fishes are not definitely known to hibernate, though there are some cases of winter lethargic conditions in the carp. Of the warm blooded animals, the birds and mammals, in which the body heat-

regulating mechanism is moderately too highly developed, the body is generally able to produce the normal amount of heat in spite of cold surroundings. This is especially true in the case of birds, none of which are known to hibernate, and most of the mammals. It is only those mammals whose heat-regulating mechanism is relatively poorly developed and thus subject to marked fluctuations that hibernate, and then apparently only in cold climates where their food supply is not available during a portion of the year.

The poor heat-regulating device of hibernators is easily demonstrated by experimental tests which show more fluctuations in body temperature in this group when exposed for short periods to external temperature change, than in non-hibernators. One may, with reservation, determine which mammals hibernate, or are able to hibernate, by noting the degree of fluctuation of body temperature between day and night in the laboratory. Along this same line a German investigator, A. Horvath, in 1874 and 1881, published a rule-of-thumb test for determining which animals are constitutionally able to hibernate. This rule is: If the body temperature of an animal, which is immersed to the neck in cold water, falls below 19 degrees C. (66.2 degrees F.) and the animal remains alive, it will or at least can, hibernate under proper conditions. If however, the animal dies when its body temperature falls below this critical point, it is incapable of hibernation. Two later investigators, J. Tait and S. W. Britton, in 1922, found that a marmot (a complete hibernator) would recover if its body were cooled as low as 3 degrees C. (37.4 degrees F.) by immersion.

The general pattern of hibernation (the conditions of physiology and sequence of actions) is much the same for all hibernators; the differences—and they are great—between species depends mainly upon the degree and duration of torpidity, and the places of denning. During hibernation in all species the body temperature falls, the heart-beat rate and circulation are sluggish, and the respiration rate is retarded. In addition, the metabolic rate is decreased, the sensitivity of the nervous system is dulled, and a loss of weight is experienced. The temperature of "heavy" hibernators often falls to within a few degrees of freezing (apparently never below, or death would result), but among "light" hibernators it remains relatively high. Heart-beat and respiration rate drop as low as 1 to 10 per minute, whereas normally they average between 100 and 200. Respiration in some hibernating bats apparently is entirely suspended, but their wing membranes are so thin and vascular that breathing probably takes place through the skin area. With other

mammal hibernators absolute cessession of breathing would undoubtedly result in death, and it is extremely likely that death in hibernation results from just this cause rather than from the failure of the heart to beat. Evidence in support is afforded by the extreme hardiness of the heart muscles; exposed hearts of hibernators have been found to continue beating for 6 to 8 hours after contact with cold air. Weight loss may amount to 50 per cent of the total weight of the animal. Pre-hibernating weight is, of course, greater than normal due to great quantities of fat; consequently, the average loss during hibernation of 25 per cent of the usual weight probably would not be an excessive figure.

The sequence of actions in hibernation involves the following steps: The accumulation of fat under the skin and about the visceral mesenteries, the drowsiness and torpor produced by an onset of cold weather and an absence of food, perhaps intermittent awakenings during the winter and feeding if food is available, loss of weight, and the spring awakening. Laboratory experiments show that fat hibernators become inactive sooner than thin ones and of two fat-conditioned hibernators, the one with available food hibernates later than the one which faces starvation. Mammals experimented upon in the laboratory were found to awake irregularly during the winter and perhaps partake of food if it was available. These awakenings are probably due to an impulse from the mid-brain, brought about perhaps by the lowering of the body temperature to near the freezing point, or a raising of the body temperature, or hunger. The mid-brain is necessary for awakening; when it is removed the mammal does not awake and death ultimately results. This, however, is not the case when the fore-brain (cerebrum) and part of hind-brain are exised, for then awakening is almost normal.

Efforts to link up the activity or inactivity of the ductless glands as causes of hibernation have so far proved futile; the change in these organs is more likely an accompaniment of the other changed conditions in the body. The presence of light appears to have no effect on hibernation.

That hibernation is perhaps an instinctive behaviorism in hibernators is indicated by the fact that all effected species accumulate layers of fat in excess of their immediate needs before the advent of winter, and this fat is essentially their nutrition during the long sleep. This instinct to hibernate may be potential, for a non-hibernating African dormouse, when brought to Europe, hibernated as was the regular habit with its European relatives.

In late summer, a state of inactivity, which is similar to hiber-

nation, is common to certain mammals such as the ground squirrels. These mammals are known to "hole up" in August or September, at which time the weather is hot and dry, and the vegetation is dessicated. It is supposed that because of heat and the impossibility of adequately feeding, the squirrels retire to their dens and pass into an inactive state. This inactive state then increases as the colder weather of fall and winter comes. Such an early state of torpidity is known as aestivation, and it is generally recognized that such body activities as heart beat, respiration and metabolism, are retarded during this period, and also that a heavy accumulation of fat was stored up before retirement. As there is no evidence that a true hibernating state ever takes place above 24 degrees C. (75.2 degrees F.) air temperature, it has been assumed that aestivation in hot surroundings is not true hibernation. However, it seems possible that, if true torpor exists during aestivation, the ground temperaure in the burrow is considerably lower, as a result of evaporation of the sub-surface moisture, than the body temperature of the animal. In addition, dry food has been found, experimentally, to cause hibernation sooner than succulent food, and an early hibernation may also result from a succession of cold nights following warm days. A condition of confined air in the den with less than normal oxygen and more carbon dioxide may speed up the process. Any one or all of these conditions may cause aestivation, but probably only if cool den surroundings are also present.

Interesting parallels to hibernation in the physiological conditons of human beings have occasionally been suggested. Generally these are pathologic cases, in which retarded body functions and especially lowered temperature were produced by alcoholism, spinal injuries, deep anaesthesia, rabies, paralysis, hysteria, hypnotic states, pituitary deficiency with excessive adiposty, some abnormal mental states, etc. Some writers have reported the peasants in parts of Russia and Siberia, during times of winter famine, to have conserved their energy by voluntarily sleeping most of the time for several months or longer, doing only the necessary things and eating sparingly. In this case, metabolism was probably slowed but it seems hardly likely that body temperature was reduced, so the resemblance to hibernation is more apparent than real. Again, fakirs in India have often been credited with the feat of remaining underground for several months without physical harm. Though the truth of these cases of suspended animation have received some support, the possibility of deception has often been raised. Until voluntary suspension of animation in humans is an established fact,

there is no need to investigate the possible concomitant physiological disturbances. In all, it appears that the constitutions of human beings cannot survive the conditions of hibernation, though people may be temporarily narcotized by cold.

The discoveries in the physiology and activities of hibernation have been due mainly to the laboratory experiments of investigators in Europe and America during the last 50 years. A great deal of work on the thirteen-lined ground squirrel of the Central United States has been done by S. E. Johnson, who has also briefly summarized the latest knowledge in the whole field in an article: "Hibernation in Mammals" (Quart Rev. Biol. vol. 6, pp 439-461, 3 figs. in text. December 1931.) Much of the foregoing account has been abstracted from these pages. It is due to the great difficulty of adequately observing hibernators in the normal, wild state that so much of our information has come from carefully controlled experiments and continual observations on control animals in the laboratory. For the same reason, additional information on hibernation of mammals in the wild would be of great value. The naturalist force in Yellowstone National Park has recently ascertained many interesting features of hibernation as a result of the close observations on the denning activities of their "tame" bears. These bears often retired under the bunk and mess houses, and through elevated boards in the floor, were easily watched under extremely favorable conditions. However, anyone interested in animal life may have the opportunity to record first hand details of the conditions of hibernators and aestivators. Bear

dens in winter have rarely been examined carefully, and when possible, the size and shape of the den should be noted as well as the apparent conditions of the animal (if it is present), such as irritability, primeness of pelage, degree of adiposity, steaming of breath or signs of absence of body heat, etc. With aestivators, the relative temperature and physical condition of the animals, and the presence or absence of food stores should be ascertained. Concisely-recorded, accurate notes on such details of natural hibernation are valuable, and should be brought to the attention of competent naturalists.

Herman Distinguishes Himself

By Ranger-Naturalist Enid Michael

At 6:20 on the evening of September 18 it was already dusk in the shadow of the great south wall. I had just lighted the camp-fire when I was startled by a series of harsh, staccato yelps. Rather high pitched and uncertain yelps as though coming from a dog whose voice was changing. I was mystified; I could not recall ever having heard such sounds before. And then came again the series of unearthly yelps, now even more emphatically voiced. Looking up as I rounded the corner of the tent I saw "Herman," the Spotted Owl, perched in a hunched attitude, with his gaze fixed intensely on the ground. The mystery was solved, for Herman again uttered the weird

notes. As I moved forward the object of his concern came within my range of vision. A bear was wandering through camp.

The commotion brought my neighbors, the Coles, from their tent. Ranger-Naturalist Cole, Mrs. Cole, Joyce Cole and I stood watching the bear as he moved slowly away. Then to our amazement the Spotted Owl came swooping down and fairly brushed the hair along the bear's neck. This maneuver caused the bear to step lively. Soon the bear was out on the talus and headed for the bluff at the far end of camp. In flight through the trees Herman followed, keeping the bear in sight. He did not curse or swoop again. He seemed satisfied to help us convoy the bear out of camp.

The adventure of the bear had helped Herman to find his voice. Previous to this episode his vocabulary had consisted of low chuckling notes and a drawn out hissing "sip." And furthermore the episode illumined the hitherto inexpicable conduct on the part of Herman. Often we of Camp 19 have seen Herman swoop down on his perch and pounce on some object on the all the power of four wings to reground. Such behavior was quite understandable — the bird was merely practising his blood-thirsty profession so that when the opportunity came he could strike a mouse perfectly. His inexplicable conduct had to do with his habit of silently swooping down and combing with his talons the head of any person he happened to catch wandering hatless about the camp. In the

light of what we had seen it seems reasonable to suppose that here again he was practising a manœuver that might be employed to his advantage in later life. A good trick, let us suppose, to frighten some mammal from its kill so that he might enjoy the plunder.

To those not acquainted with Herman this story might read like a fairy-tale. But the fortunate few who have looked into Herman's dark and wonderful eyes are willing and eager to believe any tale of his prowess.

Herman is now about four months old and he is getting to be a real owl. He is in almost full plumage, there are only a few juvenile feathers remaining at the back of his neck. When he first came to camp he was an innocent babe about a month old. He was trustful of everything and everybody, but he has learned a lot. He has developed caution. Not that he is afraid of his human friends, but when feeding on the ground he is ever alert if fearful lest some enemy pounce upon him. He no longer stays on the ground to eat. Now as soon as he is satisfied that he has made his kill he flies to a perch to eat in safety.

He can strike a mouse perfectly from a distance of fifty feet. He strikes the mouse with both feet and his talons appear to close simultaneously with the striking. Momentarily he hovers the victim with his wings, then he stoops over and crushes the skull with his mandibles. He now runs the whole mouse through his mandibles, cracking the bones. Now holding the dead mouse in one closed fist he flies to a perch. He usually rips into the skull and eats the brains, the remaining portion of the mouse he gulps down, the tail disappearing last.

Herman's digestive apparatus is a wonderful institution. Somehow the bones of his victims are nicely wrapped in a coat of fur so that when he disgorges the refuse he will not scratch the lining of his throat.

Albino Western Chipping Sparrow

Claude A. Wagner, Jr.
Jr. Park Naturalist

Late in the afternoon of September 22 I was standing at the Museum window looking out at the low clouds swirling about the ragged south rim of the Valley, when a woman's voice from below attracted my attention by exclaiming "Look at that white-headed bird" I glaced down expecting to see a White-headed Woodpecker, but to my surprise I saw a mixed band of Juncos, and Western Chipping Sparrows feeding in the grassy plot to the west of the main entrance, and one of the flock had, as the woman had exclaimed, a white head. I grabbed my glasses off the desk and hurried downstairs for a better look.

The white-headed bird appeared to be a Junco whose black had been replaced by white, but closer inspection showed it to be a Western Chipping Sparrow (Spizella passerina arizonae) whose head, throat and nape were pure white. Its bill appeared to be lighter than that of its fellows, but except for white areas mentiend above, and the secondary coverts, which were also white, the rest of the coloring was normal. After watching it for two or three minutes I decided it was undoubtedly a partially Albino Chipping Sparorw.

The same bird has been seen several times since then and by different persons, in the neighborhood of the Museum.

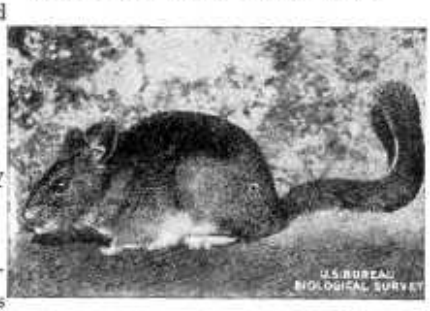
A NEW RODENT FOR YOSEMITE VALLEY

(By A. E. Borell, Naturalist)

The wood rat is of wide distributon throughout the United States and is known by many different names such as pack rat, trade rat, mountain rat or brush rat.

Two species are found in the Yosemite region, the Streator or Round-tailed Wood Rat (Neotoma fuscipes streatori) and the Bushy-tailed Wood Rat (Neotoma cinerea cinerea.).

The Streator wood rat lives primarily in the brushy Upper Sonoran Life Zone and is common about Mariposa and El Portal. The bushy-tailed wood rat inhabits the rocks of the Canadian and Hudsonian Life Zones and to some extent the Artic-Alpine. Since Yosemite Valley is typically Transition Zone it lies between the ranges of the two species and apparently does not provide suitable environment for either species as wood rats are rare in Yosemite Valley. In the past a few Streator wood rats have been reported on the Valley floor, but so far as I can learn the bushy-tailed wood rat has previously never been found on the Valley floor.



It was therefore somewhat of a surprise when Mrs. Mary Tresidder brought to the Museum an adult female bushy-tailed wood rat from her garden at Camp Curry, Yosemite Valley, 4000 feet elevation, Mariposa County, California. It was caught in a box trap July 28, 1934, and is now No. 450 in the Museum collection.