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FURTHER OBSERVATIONS ON THE HIBERNATION OF THE POOR-WILL

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Earlier I gave an account (Condor, 50, 1948:45) of the behavior of a Poor-will (*Phalaenoptilus nuttallii*) which I found in a state of profound torpidity in the winter of 1946-47 in the Chuckawalla Mountains of the Colorado Desert, California. What was presumably the same individual was found in the same rock niche in a comatose condition on November 26, 1947. From this time on this Poor-will was visited each weekend, excepting two, until February 22, 1948, when it was found to have resumed its normal active state and flew out of hand as I picked it out of its place of hiding. Since it was still in a condition of complete lethargy when I visited it on February 14, I must conclude that sometime in the following seven days a pronounced physiological change took place. The known period of profound hibernation torpidity for the 1947-48 season was about 85 days.

On December 20, 1947, Mr. Joseph Brauner kindly sent me two centigrade thermometers, one slow-registering, the other quick-registering. With these and thermometers of my own I began taking a series of rectal temperatures every fourteen days. The feather-insulated bird was held in the hand and the bulb of the thermometer was thrust into the coprodaeum and into the rectum to a depth of one and a half inches. There the instrument was held until the reading became constant; usually this was achieved in three minutes. The readings were as follows:

	Rectal temperature	Time	Air temperature
December 30, 1947	19.8°C. = 67.6°F.	11:30 a.m.	17.5°C.
January 4, 1948	19.8°C. = 67.6°F.	10:30 a.m.	23.2°C.
January 18, 1948	18.0°C. = 64.4°F.	10:20 a.m.	17.5°C.
February 1, 1948	18.0°C. = 64.4°F.	10:21 a.m.	22.3°C.
February 14, 1948	18.8°C. = 65.8°F.	10:55 a.m.	24.1°C.

The air temperatures were taken in the shade just outside the crypt where the Poor-will was hiding. The site was a much protected pocket, hence when the wind did not blow the air temperatures were sometimes higher than elsewhere in the open.

It will be seen from this record that the internal temperature was almost constant over a period of eight weeks although there was considerable variation in the surrounding air temperatures. The daily maximum and minimum air temperatures recorded at the nearby Hayfields Pumping Plant of the Metropolitan Water Company during this period are given in the accompanying graph (fig. 11). The weather conditions at the two places are very similar.

Since the crypt in which the bird remained has a southern exposure and the sun shines into the lower part of it during late morning and early afternoon hours for an average of about 3½ hours, its air temperature during times of sun exposure is somewhat higher than that of air in the open. The rock on which the bird rested was cooled during the night and because of this retained a lower-than-air temperature during most of the daylight hours. This doubtless tended to counteract any absorption of heat by the bird from the more highly heated air surrounding it.



Fig. 10. Poor-will in hibernation crypt in face of granite rock. Chuckawalla Mountains, Riverside County, California.

Photograph by Kenneth Middleham.

A series of weights was recorded beginning on January 4, 1948. The bird was weighed on a Welch triple beam, agate-bearing balance. The following data were obtained: January 4, 1948, 45.61 grams; January 18, 45.58; February 1, 45.50; February 14, 44.56. The gradually diminishing weights of the middle and latter part of the 1947-48 hibernating period are of interest when compared to weight on December 5, 1948, near the opening of the 1948-49 season of hibernation, at which time the weight was 52.68 grams.

On February 14, 1948, an attempt was made to listen to the heart beat with the aid of a medical stethoscope, but no sounds could be detected. A cold metal mirror was held directly in front of the nostrils, but no moisture collected. No movement of the chest walls could be detected. All this together with the low internal temperature I take as evidence that the bird was in an exceedingly low state of metabolism, akin, if not actually identical with hibernation as seen in mammals.

During the entire period of observation there was no passage of fecal matter or voiding of nitrogenous waste. Once when the thermometer was being introduced into the cloaca there was a little leakage of clear mucus.

As we observed this bird from time to time there was a slight change in the position of the head. Generally it was turned far to the right; only once was it turned directly to the left. At times the eyelids were more open than at others. When the bird was picked

up and held with ventral side up, there were on two occasions slight movement of the eyelids.

On January 25, 1948, the Poor-will was visited at 7 p.m. (air temperature 9.4°C). It was in its usual position with head turned to the right but the right eye was almost completely open. We had with us a fountain pen-type flashlight giving a light of 7 candle power as measured by a G.M. exposure meter. The lens was placed within 2 inches of the bird's eye with the narrow beam of light aimed directly into the pupil. The flashlight was held there fully a minute. To this strong stimulation there was no response whatever, not even an attempt to close the eyelid, a remarkable evidence of obliviousness on the part of the bird to what was going on in its environment.

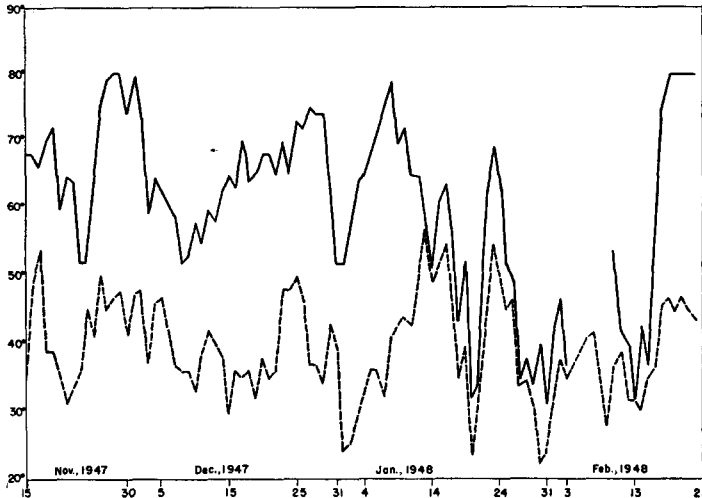


Fig. 11. Graph showing daily temperature maxima and minima at Hayfields Pumping Plant at base of Eagle Mountains 12 miles west of Poor-will locality. Solid line, maxima; broken line, minima.

On December 7, 1947, a hail, sleet and wind storm occurred in the Chuckawalla Mountain area. It was of such intensity that a crust of mixed sleet and hail a quarter of an inch thick was still on the ground in the shade of shrubs 24 hours afterward. To this severe weather the Poor-will was exposed, and when we visited the bird on the morning of December 8, 1948, we noticed that the tail feathers which were exposed at the bottom of the crypt were badly battered, so much so that they remained in poor appearance the remainder of the season; yet the bird had evidently "sat through" the storm unaware of its fury.

In order to identify this Poor-will accurately it was banded on January 5, 1948, with an aluminum band, no. 41-167997, Fish and Wildlife Service. The band number was reread on each succeeding visitation. To my great satisfaction on November 24, 1948, the bird was observed to have returned to its hibernaculum a third season, the band still being in place. A second visit for the third season was made on December 5, 1948, and the bird was weighed. Two weeks following, on December 19, the site was visited but the Poor-will was not to be found, nor could it be located a week later. I am at a loss to know what happened to it. It may have been carried away by some predator or by some inquisitive human. Human footprints in the canyon-bottom sands and remains of a camp fire nearby had been noticed at the time of my first visit on November 24, so I

know that people had been in the area; whether or not they had seen the bird at that time and later returned to carry it away I do not know. In spite of this bad luck so early in the season I had been able to witness a third seasonal return of the Poor-will, indicating clearly that it is a bird of strong homing instincts and of sedentary habits.



Fig. 12. Close-up of Poor-will in crypt.

Photograph by Kenneth Middleham.

The Hopi Indians call the Poor-will *Hölchko*, the sleeping one. Of high interest in this connection are the remarks recently made to me by Julius Jake, an intelligent Navajo Indian who has been a student during the past winter at Riverside College. While talking to him about the habits of the Poor-will, a bird (called *Bēē'zhe* in Navajo) with which he is well acquainted, I asked him, "Where do they stay in the winter?" Without any hesitation he answered, "Up in the rocks." It is very natural that pastoral people whose habit it is to wander about among the rocks when tending their flocks would occasionally see a Poor-will in winter hiding. I take Mr. Jake's reply as a strong corroboration of my belief that the Poor-wills are rock seeking, hibernating birds in winter. While in the torpid state they are so well hidden and camouflaged that they are seldom seen.

The following communication from J. B. Dixon of Escondido, California, is interesting because he found a Poor-will hiding in a rock crevice. The bird was evidently just at the end of its period of lethargy when he disturbed it.

On March 26th, 1907, I was climbing up over a sandstone cliff at San Onofre, San Diego County, California, and found a Poor-will in a sandstone rivulet on the south slope of the cliff. It was on the warm south slope where the sun would shine warmly a part of the day but the bird was wedged down in the small rivulet caused by rain water running down over the sandstone. I picked the bird up and

put it in my shirt and took it with me to the top of the cliff to show to my companion. In looking it over I held it in my two warm hands and after a period it came to life suddenly and let out a couple of normal *quirk-quirks* and flew away just as though nothing was wrong with it. We thought it was sick and had sought to protect itself by wedging itself in that somewhat inaccessible location. It was where normally wild animals such as wildcats, coyotes, etc., would not go but it certainly had us puzzled after coming to life in such a normal way. This is the only experience I have had of this kind altho we have flushed Poor-wills many times in February and March in rough somewhat inaccessible areas while looking for eagle nests but they all acted normal in every way, flushing and lighting again nearby.

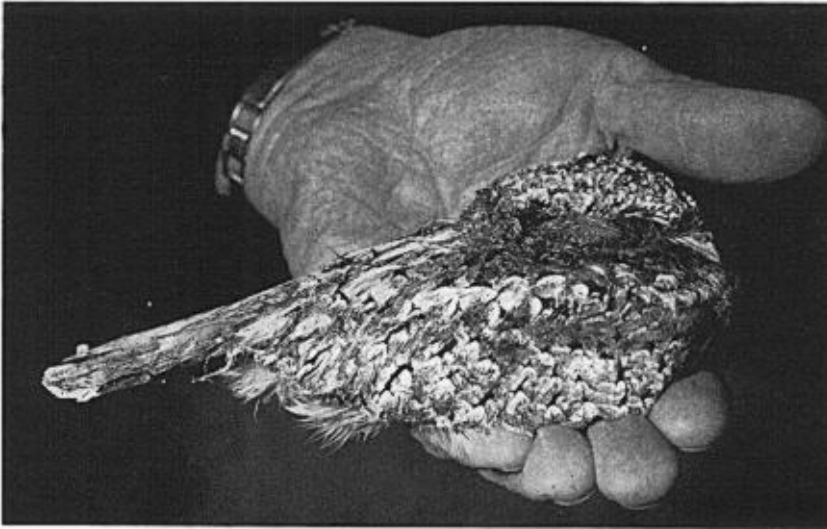


Fig. 13. Dormant Poor-will in hand.

Photograph by Kenneth Middleham.

Food has been suggested as a possible controlling factor in hibernation and I am inclined to consider it to be the chief one in the case of the Poor-will. I took care to note that during the 1947-48 period of lethargy (from November 26, 1947, to February 14, 1948) very few if any insects such as moths came flying into my campfire at night. However, on the evening of February 22, 1948, I noticed that many moths were attracted when I turned on the head light of my car and that many insects flew into the campfire. This was the period of "awakening" of the Poor-will.

The utility of such hibernating habits is obvious. During the period when there is little food accessible, this bird, instead of migrating to areas where insect food is available at night, may go into a state of inactivity. In the same way bats may go into a lethargic state when night-flying insects largely disappear.

Riverside College, Riverside, California, February 15, 1949.