GRIZZLY BEAR PREHIBERNATION AND DENNING ACTIVITIES

AS DETERMINED BY RADIOTRACKING

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INTRODUCTION

The grizzly bear (*Ursus arctos horribilis*) is largely nocturnal and the Yellowstone grizzly enters his den for a winter sleep that lasts approximately five to six months. This remnant population of between 175 and 200 grizzlies inhabit an area of about 5000 square miles, 75 to 80 per cent timbered. Studying and observing the species under these conditions is difficult. Gathering data on den site selection, den construction, prehibernation behavior, and denning activities was one facet of a comprehensive ecological study of the grizzly bear (Craighead, *et al*, 1960). To obtain the desired results, it was necessary to develop and employ a radio locating and tracking system (Craighead, Craighead and Davies, 1963; Craighead, F., and J. Craighead, 1965). This enabled us to gather much of the information on grizzly bear ecology presented here.

Relatively little is known of the denning activities and prehibernation behavior of wild grizzlies, nor is there much enlightenment to be found in the literature. It was rather generally thought that the Yellowstone grizzly, like the black bear (*Ursus americanus*) and the European brown bear (*Ursus arctos arctos*) (Couturier, 1954) utilized natural shelters and caves, hollow trees, windfall and dense vegetation as a site for their "hibernation" dens. These were then supposedly improved, enlarged by digging or to

varying degrees prepared as a shelter for the long winter sleep. Invariably den sites and dens reported to us as those utilized by grizzlies turned out to be the dens of black bears, not grizzlies.

In November, 1963, we successfully tracked a barren female grizzly, No. 164, to her winter den (Craighead, F. and J. Craighead, 1965). As far as we know, this is the first instance where radio transmitters were used to actually track and locate a grizzly bear as it entered its winter den. The radiotracking of grizzly bears to obtain information on denning and prehibernation behavior, as well as on other activities, began in 1961 and continued through the fall of 1967. During this seven year period we made 40 instrumentations of grizzly bears, 31 different grizzlies being involved. These animals were tracked or monitored for a total of over 1000 tracking days. Some were followed in deep snow for four consecutive days until the dens were located. One grizzly bear, No. 40, (Fig. 1) was instrumented and monitored for seven consecutive years. Seven other bears were instrumented and monitored for two consecutive years each. Eighteen grizzlies, including family members, were tracked to dens. The winter dens of seven different grizzlies have been located and eleven active dens have been found and information obtained on the size, character and construction of these dens. The winter den of one grizzly has been located for three consecutive years and two others for two consecutive years. Tables 1,2 and 3 show

information gathered on grizzly dens and prehibernation behavior as related to environmental conditions and to the annual cyclic behavior of bear hibernation.

The term hibernation is a controversial one. Literally, it means passing the winter. However, both quantitative and qualitative differences in hibernators have produced varying opinions as to the preferred definition and to the limits of the condition of hibernation. For this reason a short discussion of the subject seems imperative. A comprehensive compilation on the subject has been presented by Lyman and Dawe (1960) and Ch. Kayser (1961). Hibernating species differ in the duration of hibernation, the degree of drop in body temperature, the relation of body temperature to ambient temperature, the accumulation of fat reserves, the depression of metabolic activities, and the variations in specialization of individual organs and tissues for functioning in the hibernating state. The general condition of hibernation reveals a depressed metabolism, as indicated by a low body temperature and reduced heart and respiratory rates, as well as suspension of all general activities. In a sense, hibernation might be considered a condition varying in degree: the bear, for example, showing less change in body functions and being less of a "true" hibernator than the ground squirrel.

If we define hibernation following Hock (1960) as "a periodic phenomenon in which body temperature falls to a low level, approximating ambient, and heart rate, metabolic

rate, and other physiologic functions fall to correspondingly minimum levels", then by this definition the grizzly bear is not a hibernator. Instead of hibernation, Hock has proposed the term carnivorean lethargy. Hock has also pointed out, as have others, that due to the shortened season into which hibernators must compress their annual cycle of activities, nearly all facets of their life history and consequently their physiologic functions reflect the fact that they are constantly preparing for hibernation, hibernating, or recovering from that condition. Thus, the whole year is involved in a cyclic phenomenon that is hibernation. To a considerable degree, this is true of the bear. Those suggesting that the bear is not a hibernator point out that though bears go into a deep sleep and are inactive for considerable periods of time, they do not become torpid and helpless as do most hibernators. They can generally react quickly and energetically to disturbance and their body temperature does not approach the ambient temperature. However, depression of the body temperature below the normal range (31°+ C.) has been reported (Kalabukhov, 1956). Following anesthetizing and instrumenting of a hibernating black bear, the body temperature of the bear dropped to 28.5° C. and gradually rose to 36.0° C. twenty-one and a half hours later (Craighead, F. and J. Craighead, 1967). Morrison (1960) points out that because of its low critical temperature, the bear should have difficulty in cooling and that this would be so even with a considerable increase in conductance. He goes

further to state that it may also be calculated that because of its low thermal conductance the bear cannot maintain a body temperature near the ambient temperature, and he concludes "in any event, it is clear that bears lie in the interfacial zone between animals which might last through the winter at or near their basal metabolic rates and those which cannot".

An animal's potential energy reserve is proportional to body weight in animals of all sizes, but the basal metabolic rate is weight dependent. Thus the fasting potential will vary directly with weight--the larger the animal, the lower the metabolic rate. The larger animal can thus fast longer than the smaller without modifying his metabolic level. The average bear going into winter sleep with the usual fat reserve can readily fast 200 days (7 months) without greatly reducing body temperature and basal metabolic rates as do "true" hibernators. However, low ambient temperatures, deep snow, and the unavailability of food make it appear that hibernation or winter sleep is essential to the survival of bears in the Yellowstone area. Morrison suggests that the limited observed depression of body temperature and metabolism in the bear may qualify the bear as an "ecological" hibernator, while the limited extent of these changes and the lack of adaptations for functioning at low temperatures may disqualify the bear as a "physiological" hibernator. This distinction is a useful one--so, taking this viewpoint, we will consider the bear not as a nonhibernator but as an ecological hibernator.

Another view that helps to clarify terminology regarding

the winter sleep condition of bears is that of Matson (1946) who compares hibernation to dormant state, as does Eisentraut (1933). For him, hibernation is a "torpid state", "torpid" being defined as "having lost, partially or wholly, sensibility or the power of motion". This is considered a state from which the animal can be aroused only with difficulty. The condition of bears during their sleep might be described as dormant rather than torpid in the sense that they are rather easily aroused to action.

STUDY METHODS AND TECHNIQUES

Information on prehibernation behavior and denning activities of grizzlies was obtained by means of radiotracking. This was accomplished by plotting the position and movements of bears from the intersection of bearings (fixes) made from a distance. Then by moving in on foot with portable directional receivers, the grizzlies were observed at close range. Changes in signal strength and regularity also provided information (Craighead, F. and J. Craighead, 1965). For example, an interrupted signal often indicated that a grizzly was either digging a den or moving in or out of a den.

The radiotracking system was designed so as to be as flexible and as portable as possible, thus making it of maximum use in various types of field work. Basically, the system consists of transmitter-collar assemblies that are placed around the necks of the bears (Fig. 2). A padded tuned loop-antenna acts as a collar. The transmitters are variously pulsed so that individual bears can be identified by the

different pulse rates. The signal is picked up by portable, fully-transistorized receivers that are directional when used with various types of antennas. With the hand-held portable receiver, a loop antenna was employed in conjunction with a sense antenna (whip).

The equally sensitive lobes of the loop antenna resulted in a 180 degree ambiguity, making it difficult to determine signal source or direction unless the sense antenna was activated. This suppressed one lobe of the loop antenna pattern, thus providing a 13 db suppression of the reverse lobe and a 3 db enhancement of the forward lobe, giving a 16 db front-to-back ratio (Varney, 1963). In practice, this proved very effective in accurately determining signal direction.

At the base station, a five-element antenna was connected to the receiver; and for our mobile and other portable units, a three-element antenna and a portable quad antenna were utilized. The system thus consisted of a base station, a field station, several mobile tracking units and the portable hand-held tracking receivers. The frequency utilized was 32.02 mc. The output of the transmitters was approximately 100 milliwatt pulses when powered by seven Mallory mercury cells, type 1450 in series. The range varied from 15-20 miles with a five-element receiving antenna to 2-3 miles with the portable receivers and loop antenna under average conditions of terrain and shielding effect. The maximum life of the continuously pulsed transmitters was over three months and the

life of the extended-life transmitters, with an ON-OFF period of 10 and 20 seconds, respectively, was approximately one year. The performance of the system is difficult to express in terms of degree of accuracy or percentage of error of bearings. This is due largely to the varying conditions under which the work was carried out. However, some idea of system performance can be obtained through the citing of examples. For instance, a transmitter dropped by a grizzly was recovered using a bearing made from a distance of nine miles. When two miles away, we "homed in", using a portable receiver with loop antenna and sighted the radio-collar when within 15 feet of it in dense timber. The collar was lying within a small depression. The average distance at which we jumped instrumented grizzlies from day beds in dense timber and windfall was 125 feet.

Figure 3 shows intersecting bearings made from our base and field stations when monitoring and tracking grizzly No. 150 on two consecutive days--October 10 and 11, 1964. The dotted line is the course taken in following the signal to jump or intersect the grizzly. Allowance was made for wind direction in making the final approach. The position of the grizzly was eight miles from our base station to the north and three from the field station. The bearing from base plotted on October 10 was about 2.5 degrees in error, assuming the grizzly had not wandered in the interval between the time the bearing was made and the moment when jumped. The elevation of the base station was 120 feet lower than the grizzly.

Between the two locations was a timbered ridge rising several hundred feet above the instrumented grizzly. This shielding ridge was 300 to 400 feet above many of the locales where grizzly No. 150 was monitored from base.

In 1964, grizzly No. 40 and grizzly No. 158 were radiotracked to their dens in the course of a four-day trek. Fixes were plotted, using a set of bearings from base station located about 12 miles from the instrumented bears and another set obtained from the field station, 4.5 miles distant. One field station bearing, as verified later, went directly through the den site of No. 40 and the other slightly to the east of No. 158's den.

DEN SITE SELECTION AND CONSTRUCTION

The winter dens of seven different grizzlies have been located, some for consecutive seasons. Thus eleven active dens have been found and information obtained on their size and construction. All of the dens were located either while they were being constructed, or at or close to the time the bears entered them for their winter sleep. One den was found in late fall of 1963, two in 1964, two in 1965, and three in both 1966 and 1967.

A fairly representative cross section of age classes was tracked to winter dens. These included one young adult female (barren), one young adult female with her first cub, two adult pregnant females, two adult females with cubs, and two adult females with yearlings. One of these was a rather

old bear. Two young male bears were tracked to their dens. One was tracked as a weaned yearling and again as a two year old; another as a yearling with his mother and two litter mates (Fig. 2). Very large boars were instrumented and tracked to denning areas but none successfully tracked to winter dens. The den of one female grizzly was located for three consecutive years; the dens of two other bears, for two successive years. Table 1 presents information relative to construction, site, size and character of the grizzly dens. All dens were completely dug and prepared by the grizzlies themselves. This is in contrast to the European brown bear where natural shelters are often used (Couturier, 1954). No natural shelters were utilized by the grizzlies though natural shelters ranging from matted windfall to rock caves were available. All of the dens were located in timbered areas and all but one on northern slopes with the den entrance facing north. Couturier found the brown bear preferred a den that faced south. A north-facing den entrance appears to be advantageous to the hibernating Yellowstone grizzly as more snow accumulates on northern exposures and there is less chance of snow melting during a warm period or winter chinook. Water trickling into a den would certainly be disturbing and undesirable. The deep snow that accumulates in such locations insulates the den chamber from the extreme ambient temperatures that may drop as low as -40 to -60° F. Though grizzlies den throughout the Park and beyond, all of the active dens were located in the general area of Hayden Valley

and ranged in elevation from 7800 to 9200 feet. All dens, except those that were abandoned prior to using them, were lined with conifer boughs or other bed material (Fig. 4). This served to insulate the sleeping bears from the cold ground. No dens contained any excrement or any traces of urine.

All of the dens were located relatively far from human habitation or human activity. Snow insulation above and boughs below created a den chamber with a microclimate less extreme and less variable than the outside environment. It appeared that isolation is a factor that the grizzlies need and seek when spending six months of their lives under rather vulnerable conditions. Primitive man and the American Indian undoubtedly found that the odds were more favorable for killing a grizzly when it was lethargic during winter sleep than when active in summer. Seeking isolation during hibernation would be a factor favoring survival of the species. Six of the ten dens illustrated in Table 1 were dug at the base of trees (Fig. 5). Three others were dug at the base of stumps or with the entrance excavated beneath a horizontal log. Erickson (1964) found that most black bears favored dens dug beneath objects such as logs, stumps, or holes dug into hillsides. No mention is made of dens excavated beneath trees. The Yellowstone grizzly appears to prefer to dig a den entrance at the base of a tree, tunnelling in through the large downward and outward sloping roots as illustrated in Figure 5. These roots limit the size of the

opening and others act as a ceiling or support for the earth roof. Although the Yellowstone grizzly does not always select the base of a tree for its den site, it may be instinctive for it to do so if a suitable location is available. The young grizzly, No. 202, dug his dens in a steep rocky talus slope of the Yellowstone Canyon (Table 2). Neither of these dens was dug at the base of a tree, but both were dug with the entrance under a horizontal log (Fig. 6). However, the grizzly initially made several unsuccessful attempts to dig a den at the base of large trees but was prevented from completing the dens due to his inability to remove large rocks and boulders from the narrow entranceway between the roots of the trees. A similar situation was noted when an interrupted signal indicated that No. 40 might be digging a den. We moved in to investigate and found the sow digging a den entrance at the base of a large fir tree. Number 40 never completed this den, perhaps because we disturbed her but more likely because the space between major roots was too narrow for a den opening. The fact that all grizzly bear dens located were completely dug by the bears with no use of natural shelters might indicate that it is instinctive for the grizzly to dig a winter den rather than appropriate or modify a natural cavity.

The grizzly dens were not extensive excavations, but were adequate to house the number of bears involved, whether a single individual or a family. Sows with cubs as well as sows with yearlings were found to spend the winter in the same den. The dens were usually constructed so that there

was an entranceway leading into the bed chamber (Fig. 7). The average size of this chamber determined from nine dens was: 55 inches long, by 53 inches wide, and 38 inches high. The den entrance varied from no entrance at all, where the opening went directly into the chamber, to an entrance tunnel 60 inches long. The width and height of the entrance or the den opening varied from a narrow width of 14 inches to a maximum of 33 inches. Heights ranged from a minimum of 20 inches to a maximum of 54 inches. The den openings seem relatively small considering the size of the grizzlies. In some instances, it was difficult to visualize even a medium sized bear squeezing through the opening and into the chamber beyond.

The beds were usually composed of spruce or fir boughs sometimes laid as deep as 14 inches (Fig. 4). Occasionally a bed platform lay slightly above the entranceway, similar to the bed platform in a snow house, thus creating a heat trap that prevented warm air from escaping out the den opening (Fig. 8). Digging a den so as to create a heat trap is probably accidental, but there may be an instinctive tendency for the animals to prepare their dens in this manner when it is feasible to do so. Dens not so prepared but with the bed lower than the entranceway were usually situated so that the entrance would fill up with snow (Fig. 9). Thus in effect a similar result was obtained, the snow forming a sealed chamber with little transfer of air. The grizzly bear winter den is, as mentioned previously, a very localized environment with temperatures warmer and more constant than

those existing outside. In addition, when a deep insulating bed of boughs is used, a microclimate is created between the bear and his bed that is considerably warmer than the general ambient temperature of the den chamber. The bough bed prepared by grizzly No. 202 was circular and cuplike in shape. The diameter of the depression across the top was 31 inches. It was 12 inches deep.[1] The yearling bear curled himself up in this bed cavity with his head and shoulders protected by the partially dug den (Fig. 6). The rest of his body was covered and insulated by accumulating snow.

Some idea of the microclimates between a bear and his bed was obtained by placing a body-temperature transmitter between a black bear and his well insulated bed. The winter bed was fashioned from a porous mixture of dried pine needles and finely shredded twigs. Here a microclimate was created between bear and bed with a temperature approaching that of the bear's body. The maximum temperature reading of this microclimate was 36° C. and probably occurred when the probe was in a position under a portion of the bear's body where his hair was thin and heat conduction was efficient. The bear had been awakened and was alert, and at this time probably had a body temperature close to the normal activity temperature of 37.8° C. The microclimate between the bear and his bed constituted an estimated area of approximately

1. The depth was measured in spring following winter use. It was probably closer to 16 or 18 inches deep when first constructed.

three quarters of the bear's body surface when curled in sleep. The insulated bed was 18 inches deep by 30 inches in diameter, cuplike in shape, with nearly perpendicular walls against which the bears body snugly fit (Fig. 10). Bed materials differed from those used by grizzlies, but in its dimensions and structure the bed was very similar to that prepared by grizzly yearling No. 202. When the black bear was curled in his sleeping position just slightly below the rim of the bed cavity, he was in a microclimate where temperature changes were minimized. Possibly the resulting microclimatic temperature achieved when the bear is sleeping determines within limits the degree of hypothermia or of lethargy needed and achieved by the bear in its winter den, whether it be a black bear or a grizzly. In other words, the dormancy temperature may be influenced by the environmental microclimatic temperature enveloping the bear, and this in turn may to a considerable extent vary with or even be regulated by the bear's thermoregulatory processes. Winter sleep conditions of wild bears thus may vary considerably with individuals and with the care and extent to which each prepares a den and bed. It probably also varies considerably from conditions observed in captivity.

UNKNOWN GRIZZLY DENS

Table 2 reveals information on six additional grizzly bear dens. These were constructed by unknown grizzlies and were not in current use. After a few active dens were located, a general pattern of den site location emerged which

enabled us to seek for and locate dens other than those found through radiotracking. The inactive dens were on north facing slopes, in timber, in secluded areas, and quite often were dug at the base of large trees. The bed chamber measurements averaged 50 inches in length, 58 inches in width, and 36 inches in height. Three out of four of these dens, where complete measurements were obtained, revealed that the den chamber was wider than it was long. We suspect these were used by sows with offspring as in the case of grizzly No. 39 where the den sheltered her instrumented yearling No. 158 as well as two littermates. This den was almost as wide as it was long. The 1966 den of No. 40, housing the sow and her two large cubs, was wider than it was long and the three bears slept within curled up side by side (Fig. 4). This might indicate a tendency for sows with cubs and sows with yearlings to dig wider dens than do those bears that are hibernating alone or with only a single cub.

DISTANCES TRAVELLED TO DEN SITES

Instrumented grizzlies travelling to their winter dens or sites from fall or summer foraging areas covered the following airline distances:

Grizzly Number	Distance Travelled
40	5 1/2 miles
40	5 1/2
40	6 3/4
101	2 1/2
101	11

Grizzly Number	Distance Travelled
202	8
202	8
187	11
39	5
14	16
164	14
7	14
34	16+
150	6
96	30+
76	21+

Observations of marked animals, made during the fall period of dispersal to den sites, revealed that some grizzlies travelled even greater distances than those measured by radio. Some definitely travelled beyond the boundaries of Yellowstone Park.

ISOLATION OF BEAR DENS

The hibernation dens of the young male grizzly No. 202 were dug in rocks on a forty-five degree talus slope in a steep, nearly inaccessible part of the Yellowstone Canyon. Snow avalanches run down these slopes each spring. Huge rocks periodically break off from the cliffs and start small rock avalanches on the slopes below. There are few trees not deeply scarred by the careening rocks. Islands of timber, some containing quite large trees, have established themselves between the avalanche runs. However, even these islands of timber do not appear to be a safe place for a

bear to hibernate; yet No. 202 dug his dens in such a spot. The one thing that this and other known den locations seem to provide is isolation, and it may be that this need for isolation is such that grizzlies, particularly young insecure ones, even take the risk of selecting a denning site on or close to avalanche slopes in order to be assured of privacy. This den was difficult to approach in summer and practically impossible to reach after the first snows.

Family units such as a sow with cubs or sow with yearlings hibernated together. Other than this, however, the grizzlies appeared to prefer to hibernate alone and to seek solitude and isolation during their winter sleep. There was one interesting exception. During the summer of 1966 instrumented grizzly No. 40 with her two cubs established a close relationship with grizzly sow No. 101 and her cub. Throughout the summer months they travelled together, slept together, foraged together, and were apparently inseparable--one always being seen when we saw the other or moved in on a signal bearing to observe them. This close relationship of these two sows and their three cubs continued right up to the time they entered their dens. Apparently the relationship affected the selection of a den site by both bears. Instead of returning to her former distant hibernating site in the upper reaches of Alum Creek, No. 40 dug her den about three and a half miles from this area. Number 101 also dug her den nearby, the distance between the bears' dens being only one and one half miles. A year later, in the fall of 1967, when

the sows had separated, we located the den of No. 101 in the area of Dunraven Pass. This was apparently the general area where she normally hibernated. The usual denning areas of sows No. 40 and 101 were thus approximately sixteen airline miles apart. In 1966 when No. 101 ran with No. 40, she dug her den approximately thirteen miles from her normal hibernating site and, as previously mentioned, in with one and one half miles of No. 40's relocated den. When the two sows denned close together they appeared loathe to separate and to hibernate. Even when snow was on the ground and the conditions seemed favorable for the bears to enter their dens, they travelled back and forth from one den site to the other. Our approach to the den site of No. 101 caused her to abandon the den, so we were unable to determine how long this situation would have continued. This apparent anomaly of two female bears preparing their dens close together and moving back and forth from one den to the other right up to the time that they hibernated reveals a behavior pattern contrary to that exhibited by most of the grizzlies who sought solitude for themselves or families. There was a forceful attraction of these animals for one another and this was further supported by their actions the following spring. Number 40 weaned her yearlings and bred the same spring. Number 101 did not come into estrus but kept her cub and assumed the responsibility of taking care of the two yearlings weaned by sow No. 40. This behavior enabled No. 40 to follow a two-year breeding cycle, yet still have her yearlings receive maternal care.

In practice such a behavior pattern would tend to increase the productivity of the species and would benefit the survival of an age class where mortality is relatively high.

REUSE OF DENS

Bedding material in the debris piles of some dens indicated that the dens had been used in previous years (Fig. 11). This was the case with the den of No. 164. It may also be significant that No. 40 cleaned out her 1966 den prior to leaving it in spring. However, the roof collapsed a few months later making the den unusable for another winter. None of the dens to which we radio tracked the grizzlies was ever reused. In many cases the dens caved in when the soil became saturated with water in late spring, and thus were not suitable for reuse (Fig. 12). Grizzly No. 202 dug two separate dens in consecutive years, and their distance apart was only three hundred feet. His first den was not much more than an elaborate daybed and thus probably was not adequate for reuse the following year (Fig. 7). The second-year den, as indicated previously, was much better constructed than his first one. He removed an estimated ton of rock in preparing it. This might indicate learned behavior reinforcing an instinctive urge. At a number of the active den sites, we found evidence of former dens (Fig. 12). There were three dens, all of them having caved in, very close to the active den of grizzly No. 164, and there was also a caved-in den within a few hundred feet of the 1966 den of No. 40. Plant growth on the debris pile indicated this den was at least five to seven years old. It has not been unusual to find old abandoned dens close to newly dug ones.

Because of this it is interesting to speculate why the two dens at the 1966 den site of No. 40 should be separated in time but spacially close. Possibly the site characteristics are such that the area attracted different bears at different times to this same north facing slope. It is well isolated and within dense forests of lodgepole pine, spruce and fir. It is also conceivable that the old den was the nativity den of No. 40 and she eventually returned to the site to dig a den of her own making.

RELATION OF DEN SITE TO RANGE SIZE AND PATTERN

Two types of grizzly bear seasonal and home range patterns were plotted and delineated by means of radiotracking. One consisted of a distinct continuous area over which the grizzlies wandered and foraged throughout the year or during spring, summer, and fall. The home range unit contained winter den sites or a den. The other range pattern consisted of summer and fall foraging areas, often widely separated from an early-spring and late-fall area that contained the winter den. The latter pattern can be visualized as two distinct ranges, with the bear often traveling rather rapidly from one to the other. The home range of an animal provides all the essentials for life of the individual and thus by definition includes its den site. Den site selection, location and prehibernation behavior are to a certain extent influenced by the range size and pattern. They are also influenced by numerous other factors including age and sex of the bear, social status, topography, vegetation, general and seasonal availability of food and meteorological conditions.

Examples of interesting prehibernation behavior of monitored grizzlies as related to their ranges was recorded. On October 25, 1965, yearling grizzly No. 202 left his regular summer haunts (summer range), swam the Yellowstone River and headed northward directly for his hibernation site on the steep slopes of the Yellowstone Canyon. In 1965 No. 202 was carefully monitored. His first purposeful and independent move away from the summer range of his mother was when he crossed the Yellowstone River and headed for this den site. As far as we know, except during his spring trek from the den of his birth and his return travels the ensuing fall, this young bear spent all of his life in the immediate vicinity of Hayden Valley. This weaned yearling had not prepared his den in advance as mature bears had done, but dug in within a few days of selecting the site. The den constructed by the inexperienced grizzly in rocky talus was not much more than a daybed but it is interesting that he hibernated within the home range of his mother as revealed by evidence gathered on marked sow No. 65.

In comparison to No. 202, weaned grizzly No. 188 also established a summer range within the home range of his mother, No. 40, but left this to hibernate. His summer range was smaller and largely distinct from hers. In view of the fact that this yearling had spent all of his life within a rather restricted area (20 square miles), the range of his mother, it seemed logical that he might hibernate within this familiar territory. However, in late October during a snow storm, he took off into new and strange territory to seek a distant hibernation site thus establishing a range pattern quite different from that of his

mother's and one that he may continue to follow throughout his life. This fall dispersion of young bears is a common occurrence. The young independent bears, low in the bear social heirarchy and insecure, wander both in spring and fall more than do other segments of the population.

PREHIBERNATION MOVEMENT AND BEHAVIOR

In the early years of the study, 1960-61, we observed that the Yellowstone grizzlies moved to their dens during snow storms, and that following these storms there were no tracks anywhere throughout the area where grizzlies had been seen and were previously active. A number of questions were posed including:

When did the Yellowstone grizzlies hibernate?

Did certain environmental stimuli trigger movement of grizzlies to their winter dens?

Did other stimuli retard hibernation?

To what degree did the grizzlies become lethargic and when did this occur?

In order to obtain information on this subject, we instrumented grizzlies in the fall of the year with radio transmitters (Fig. 1). The first two years (1961-62) that we instrumented grizzlies, we were unable to track the bears to their dens. Our first successful tracking occurred in 1963 with improvements in equipment performance (Varney, 1963). Tracking grizzlies to their dens became routine after this. Observations and sight-tracking of grizzlies in the fall of 1960, 1961 and 1962, supplemented in 1963 by radiotracking, provided us with information on the hibernation dates of the grizzlies; that is, the dates

when the grizzlies entered their dens to remain for the winter. These were:

Year	Month
1960	October 29
1961	October 21-22
1962	November 15 (approximately)
1963	November 4-5
1964	November 10
1965	November 11
1966	November 19-21
1967	November 19
1968	November 3-4

All of the grizzlies involved hibernated at altitudes ranging from 7800 to 9200 feet (Table 1). Those ranging and foraging at altitudes several thousand or more feet lower, as at Mammoth or Gardiner, did not hibernate simultaneously with those generally distributed throughout the Yellowstone Plateau. The dates through 1962 were obtained by observing movement of grizzlies during snowstorms and lack of tracks thereafter. The later dates were obtained by radiotracking grizzlies to their dens (Table 3). The date at which the bears entered their dens to remain inside for most of the winter varied by as much as a month over an eight-year period. The earliest date was October 21-22, 1961 and the latest was November 19-21, 1966. The general pattern of prehibernation movement and activity that occurred was as follows:

Most grizzlies prepared winter dens well in advance of the time that they went into hibernation. The earliest recorded den diggings were September 3 and September 8 (Table 3).

The latest occurred November 11 and 15, the bears completing the dens just in time to enter them for the winter. In these latter cases the den construction had been delayed by abandonment of previously prepared dens or had been influenced by one kind of disturbance or another which affected or altered the behavior of the animal. Usually dens were not approached closer than a hundred feet but even so some were abandoned (Den of No. 101) in both 1966 and 1967, No. 187 in 1967). Individuals varied considerably in the degree of disturbance needed to cause abandonment of a completed den. Dates of den digging activity shown in Table 3 are dates when excavating was first detected and do not show the duration of digging. Usually the dens were dug in a matter of a few days with subsequent minor digging activity.

After early preparation of a den, the bears would return to their established fall foraging areas and continue to feed and put on weight. Most early snowstorms did not elicit movement. The grizzlies continued with their regular feeding activities. Sometimes one small storm followed another, causing no change in grizzly behavior. Eventually, however, either a late or a major snowstorm with falling barometer moved the grizzlies back to their den sites. On a number of occasions grizzlies were detected moving to den sites in clear, warm weather with a falling barometer. For instance on October 15, 1965, No. 40 started moving to her den in the morning of a warm sunny day. By late afternoon, a snowstorm was in progress and No. 40 was tracked to her den site. The grizzlies appeared able to detect variations in barometric pressure and such changes seemed to initiate movement

to dens before storm signs were visually apparent.

When moving back to dens, the grizzlies would continue to "rake" dirt out of their dens and often add more bed material. If warm, clement weather followed a storm, the grizzlies tended to return to their fall foraging areas until still another storm sent them denward. In some cases, the grizzlies moved back to their den sites during snowstorms remaining in close proximity to the den opening until a following snowfall and low temperatures put them in for the winter. On other occasions such as in 1961 and 1963, grizzlies moved directly from their foraging areas in falling snow and immediately entered their dens and remained within.

The general picture then of prehibernation behavior and movement of Yellowstone grizzlies is that as early as several months prior to hibernation, some grizzlies dig and prepare their dens for the winter. The time at which each individual does this varies considerably. The dens are not only dug, but are usually lined in advance with a bough bed. Movement back and forth between feeding areas and den sites generally only occurs in the advent of a snowstorm. If the storm is a sizable one and winter conditions prevail thereafter, the grizzlies enter their dens and remain. All or most of the grizzlies living under the same environmental conditions hibernate at the same time. If the weather warms up immediately after a storm, the grizzlies either move back to foraging areas or they stay in close proximity to the dens and then enter them for the winter with the next big storm. The

final movement of the grizzlies to their winter dens has always been during a storm, whether the grizzlies remained close to their dens or were foraging off at some distance. Following the final snowfall that put the grizzlies into hibernation, there have been no tracks evident anywhere throughout the vast areas where the grizzlies roam. Tracks have not even been observed near the den entrances, except in a few cases. This rather simultaneous entering of winter dens during falling snow serves to hide tell-tale signs of the den location and is no doubt a behavior trait favoring survival during a vulnerable period. It is also in contrast to the Yellowstone black bears (Ursus americanus) where hibernation starts earlier and time of entrance into winter dens varies greatly. Table 3 shows the early grizzly bear den-digging dates as determined by means of radiotracking, the date of the final movement to the den area as well as the date of entering the den. Also recorded are weather conditions, presence of storms, amount of snow on ground, maximum and minimum temperatures that accompanied the final movement of the bears to their den area and the date of entering the den for the winter sleep. Minimum temperatures at this time are below 32° F. and undoubtedly the maximum temperatures in the shaded den sites are also below 32° F.

Of all the grizzlies observed prior to hibernation, the only one that did not move to a den site with snow on the ground and during a storm was weaned yearling grizzly No. 202. This animal moved directly to his den site on October 25-26, 1965. He immediately began digging and preparing his den upon arrival. When he traveled, there was only patchy snow upon the ground and the day was clear. However, prior to this on October 15, 1965 during a snowstorm with 3-4 inches of new snow on the ground,

this grizzly left his regular summer and fall haunts and moved to another area. The storm initiated his movement away from his summer and fall foraging area and precipitated the final move to a den site. During most falls, no lethargy was observed in the grizzlies prior to entering their dens, but in 1965 the grizzlies exhibited a very definite prehibernation lethargy.

PREHIBERNATION LETHARGY

In the fall of 1965, we observed what appeared to be a marked lethargy in grizzlies prior to hibernation. This lethargy was apparent at one time or another in all the grizzlies under observation during late fall. For example, on October 14, 1965, we jumped instrumented grizzly No. 188 from his daybed in lodgepole timber. He moved away slowly, but only after we started talking. He soon stopped and sat down on a wooded hillside. Within a few minutes his head began to sway and the bear slumped to the ground so that he was lying with his muzzle on the ground and turned inward under his body. He was aware of our presence and appeared to be trying to remain awake and alert, but acted almost as though he were drugged. On several occasions he made an effort to raise his head only to slouch forward again, resting his muzzle against the ground. This position with the muzzle of the nose turned back under is very similar to the bears' first reaction after being drugged with succinylcholine chloride (Craighead, et al., 1960). We moved to within 100 feet of this grizzly before he again rose to his feet and lumbered off. Similar behavior was observed when we jumped instrumented grizzly No. 202 on the same day.

About two weeks later while tracking grizzly No. 202 on November 3, this lethargy was even more pronounced. The grizzly's radio signal led us to the edge of the perpendicular walls of the Yellowstone Canyon. Here a three-bearing fix indicated that the grizzly was directly below us. While attempting to locate the bear with binoculars, we loosened a large rock that crashed into the trees below. Simultaneously with the crash, we heard the roar of a startled grizzly. We spotted the animal in a small opening almost directly below us. The sudden noise brought him to his feet and into view. He had been lying at the entrance to his den. For the next half hour this grizzly stood motionless except for an occasional slow movement of his head when he raised his nose in order to seek our scent. Several times the bear seemed to almost fall asleep when he let the muzzle of his nose slide to the ground and turn back under his body, a behavior identical to that described for grizzly No. 188. The grizzly definitely appeared to be in an advanced lethargic condition. He should have been able to have scented us as the wind movement was favorable, but he gave no indication of detecting us.

On October 25, 1965 we moved in and located the den of grizzly No. 40 while the bear was within. We approached to within 30 feet but the grizzly did not come out. She was apparently somewhat lethargic. At this time, No. 40 did not remain in her den for the winter, but in her lethargic state she stayed close to her den and at times within it. This behavior continued from October 15 to November 11, when she entered the den during a snowstorm and remained within for the winter. Grizzly No. 40

moved to her den a full month before entering it. It is reasonable to assume that the early onset of lethargy influenced this movement. The fact that she was pregnant may also have been a contributing factor. The apparent lethargic condition of these bears and their early movement to den sites, particularly the movement of No. 202 to a den site without a triggering storm, seemed to indicate that hibernation physiology, possibly including a hypothermic lethargy, had been initiated prior to actual entering of dens or movement to them.

Higher warm-blooded animals have an activity temperature above 36° C. Rectal temperatures of grizzlies and black bears taken in summer and fall have shown a temperature of 37.8-38.4° C. With protracted action of cold, it is possible to go below the lower threshold of activity and a hypothermic lethargy ensues (Eisentraut, 1960). This did not appear to be the case with the grizzlies under observation, as during other fall periods with more prolonged cold they had not exhibited lethargy prior to denning. However, cold did appear to be an influencing factor.

Weather conditions in the fall of 1965 differed from those of the preceding study years and this quite possibly affected grizzly prehibernation behavior and movement to den sites. An early fall period of snow and unusual cold occurred from September 15 through September 28. This was the coldest early period of snow and low temperatures experienced in the course of the study. Ambient temperatures were lower than at the November 1965 time of hibernation. Four to six inches of snow were on the ground at our Canyon laboratory and more at higher elevations. Minimum

temperatures dropped to 7° F. This cold spell was then followed by warm, mild fall weather. The combination of early snow and low temperatures did not stimulate grizzlies to hibernate, but it did disperse some from summer to fall ranges, and appears to have been a factor triggering hibernation processes so that the bears became lethargic and physiologically ready to hibernate by late October, before continuing cold and the environmental stimulus of a final snowstorm caused them to enter their dens on November 11 for their winter sleep.

It is characteristic of grizzlies to bury or cover the carcass of an animal with dirt, grass, and brush. The animal may be one dying of natural causes or more rarely an animal killed by the grizzlies. They are not consistent in burying a carcass, nor are the reasons for the variable behavior readily evident. The subject will not be elaborated here with the exception of reference to lethargic behavior.

In 1960, we observed grizzlies burying or covering the carcasses of elk as early as September 21. This phenomenon continued throughout the fall. On several occasions when we approached grizzlies feeding on carcasses, we found them sleeping either on or beside their food supply. This was observed as early as October 14 and might have been interpreted as an indication of the onset of winter lethargy. However, these animals when alerted always took off on a dead run and were quite active. Apparently sleeping on the carcass was related to the heavy meals the bears had consumed rather than to any physiological changes connected with the hypothermic lethargy of winter sleep, as observed in the fall of 1965.

ENVIRONMENTAL FACTORS AFFECTING PREHIBERNATION BEHAVIOR

In 1961, the grizzlies hibernated on October 21, the earliest date of which we have records. This was the coldest fall period of the entire study with snow and cold weather starting early and continuing with few breaks until the bears hibernated. The first snowstorm of three to four inches occurred on September 11 and was followed by another snowfall on September 18, adding four to five inches in some areas. September was characterized by periodic snowstorms, with snow on the ground throughout much of the month. However, the lowest minimum temperature for this same period was 19° F., occurring on September 14. This is higher than the low temperature of 7° F. recorded for the 1965 September 18-20 cold spell, after which the grizzlies showed an apparent lethargy prior to hibernating. The average minimum and maximum temperatures for the two falls are somewhat similar. The minimum for September of 1961 was 29° and the maximum 51° F., as compared with 25° and 52° F. in 1965. The October minimum and maximum temperatures in 1961 were 22° and 45° F.; in October 1965, 22° and 56° F. The late fall of 1965 was warmer and definitely not as wintery as in 1961, when the bears hibernated quite early, but was characterized by unusually low temperatures in September followed by relatively warm temperatures in October and November. There is an indication that early snow and continued cold and snow may initiate early hibernation, whereas an early unusual cold spell may initiate hypothermic lethargy prior to entering dens.

Food supply in combination with altitude, latitude, and meteorological conditions affect at what time and even whether or not the grizzly will hibernate. A captive grizzly when supplied with adequate food under relatively cold conditions showed no inclination to hibernate. In 1961, when the grizzlies hibernated early, there was a combination of a cold fall coupled with a shortage of food. The whitebark and limber pine nut crops were poor (practically no nuts were produced) to be followed by a bumper crop the next year. The meadow mouse (Microtus sp.) population was not high and in general the food supply was probably less abundant at this season than during most of the other years. In 1961, on October 19, a number of grizzlies started to feed on an elk carcass in the Sulfur Mountain area in Hayden Valley. A falling barometer and snowstorm on the evening of the 21st continuing into the 22nd started these grizzlies moving to their dens and put them into their hibernation quarters for the remainder of the winter. The grizzlies on the elk carcass consumed a large proportion of this animal, but with deep snow, cold and a general food scarcity they abandoned this ready food supply and took off in the storm to travel to their dens.

In 1966, following storms that did not put the grizzlies into their dens, grizzlies No. 40 and No. 101 with their families continued to leave their den sites and revisit the sparse remains of a buffalo carcass. The presence of this food supply within a relatively short distance of the two dens no doubt influenced the prehibernation behavior of these animals and perhaps delayed their entrance into the dens and into a lethargic state. At least it was one of several factors that kept them active and moving from

their dens rather than dozing close to the den entrance until the final storm and cold weather put them into hibernation.

Our observations indicate that prehibernation behavior as well as the time of entering dens are quite definitely influenced by environmental factors. A combination of low temperatures and snowstorms appear to condition the bears and eventually influence the time at which they enter their winter dens. A convenient food supply with relatively high ambient temperatures tends to delay hibernation. On the other hand, adequate and available food will not deter the bears in the wild condition from entering their dens if snow is accumulating on the ground and snowstorms and severe cold occur at the same time. A fall period with general food scarcity combined with cold weather conditions tends to put the bears into hibernation earlier than usual.

The time of hibernation over an eight year period varied by as much as a month. It therefore appears that light or darkness is not a factor in inducing the grizzlies to hibernate. Kayser (1961) mentions that this was also the conclusion of Johnson (1930) following researches conducted on the ground squirrel (Citellus tridecimlineatus pallidus and C.t. arenicola). By measuring the length of hibernation of these two species, Johnson comes to the conclusion that the length of hibernation is independent of light. Hock (1955) working with Citellus undulatus and studying the different climatic and ecological factors that may be influential, states that there is no relationship between the beginning of hibernation and the

temperature, the snowfalls or the amount of available food. The only close correlation observed is between illumination and hibernation. It appears that the findings of Hock working with a "physiological" hibernator are just the opposite to those we have found with the grizzly, an "ecological" hibernator.

Grizzlies appear much more prone to cover or bury carcasses of animals in late fall than during the summer period. This trait also seems to vary from one fall period to another. To some extent burying serves to protect the food from ravens, magpies and coyotes that usually wait nearby for a chance to feed when the grizzly leaves. A partial and reasonable explanation for this burying of food may be that den digging is instinctive behavior for the grizzly. Certainly their long powerful front claws are well adapted for both digging for food and excavating a shelter. In fall, environmental conditions may stimulate a need or instinct to dig more than at other seasons. Thus the grizzlies not only dig their dens and gather boughs for beds, but the bears tend to excavate dirt and to uproot grass and herbaceous vegetation to cover their food supplies. It may also be significant that when the grizzlies move to their dens with falling barometers and in snowstorms, only to remain outside with subsequent clearing and warming temperatures, they busy themselves with a "housecleaning" type of digging both within and outside the den.

EMERGENCE FROM HIBERNATION

In general the Yellowstone grizzlies remain in their winter dens from the time they enter them in late October or

November until about early April. During this time the bears are largely inactive although an occasional animal does come out in mid-winter. Sometimes this is in response to a nearby food supply as was the case with a grizzly that came out in the latter part of February 1967 in the Old Faithful area. The bear was attracted to the carcass of an elk that had died not far from the den. The usual procedure for the grizzly is to fast from the time they enter their dens until they leave them in spring. Some grizzlies emerge from their dens as much as three weeks to a month before they leave the den site for spring feeding areas. Often when they first emerge the snow is too deep for the bears to travel and they wait in the vicinity of the dens until sunny days with warming temperatures, followed by chilly nights, produce a crust on the snow that will support their weight.

In the spring of 1965, number 40 and her yearling came out of their den in late March and then built bough beds on the snow within several hundred feet of the den entrance. The bears slept on these beds and were covered by snow from subsequent storms. As the snow piled up over the sleeping grizzlies, their breathing produced an air shaft to the surface (Fig. 13). Apparently the bears continued in a lethargic state and were still hibernating but on bough beds on the snow surface rather than within the den. Perhaps one reason for early emergence from the den is that in the spring of the year, the outside air temperatures, at least during the day, are often warmer than those within the den. At 10:45 a.m. on April 28, 1965 the air temperature inside the den of No. 40 was 32° F. The air temperature in the shade, outside of the den and

three feet above the snow was 40° F. The ambient temperature in the sun was 50° F. Two years later, this sow emerged from hibernation with yearlings. On this occasion they took off without building bough beds as was the case in the spring of 1965.

LITERATURE CITED

Cout rier, Marcel A. J. 1954. L'ours Brun, Chapter 16 Gite, Tanieke Sommeil Hivernal, Grenoble, France

Craighead, J. J., M. Hornocker, W. Woodgerd and F. C. Craighead, Jr. 1960. Trapping, immobilizing and color-marking grizzly bears. Trans. N. Am. Wildl. Conf. 25:347-363

Craighead, Frank C. Jr., John J. Craighead and Richard S. Davies 1963. Radiotracking of Grizzly Bears, Bio-telemetry, Pergamon Press, pp 133-148.

Craighead, Frank C. Jr., John J. Craighead 1965. Tracking Grizzly Bears, BioScience, Vol. 15, No. 2 pp 88-92

Craighead, Frank C. Jr., John J. Craighead 1960. Seventh Yellowstone Field Research Expedition. Pub. no. 45. Atmospheric Sciences Research Center, State Univ. of N. Y. at Albany.

Eisentraut, M. 1933. Winterstarre, Winterschlaf und Winterruhe, Mitt. Zool. Mus. Berlin 19, 48-63.

Eisentraut, Martin 1960. Heat Regulation in Primitive Mammals and in Tropical Species, Mammalian Hibernation edited by Lyman C. P. and A. R. Dawe.

Erickson, A. W., John Nellor and George A. Petrides 1964. The black bear in Michigan, Research Bulletin 4, Michigan State University, Agric. Exper. Sta.

Hock, R. J. 1955. Photoperiod as Stimulus for Onset of Hibernation. Fed. Proc. 14, No. 236.

Hock, Raymond J. 1960. Seasonal variations in physiologic functions of Arctic ground squirrels and black bears, Mammalian Hibernation, Bulletin of the Museum of Comparative Zoology, Harvard College, pp 155-171.

Johnson, G. E. 1930. Hibernation of the Thirteen-lined Ground Squirrel (Citellus tridecimlineatus) V. Food Light, Confined Air, Precooling, Castration and Fatness in Relation to Production of Hibernation. Biol. Bull. 59, 114-127; Referred to by Ch Kayser 1961.

Kalabukhov, N. I. 1956. The Hibernation of Animals. Reference from Ch Kayser 1961.

Ch. Kayser 1961. The Physiology of Natural Hibernation. Pergamon Press.

Lyman and Dawe 1960. Mammalian Hibernation, Bull. Museum of Comparative Zoology, Harvard College, Vol. 124.

Matson, J. R. 1946. Notes on Dormancy in the Black Bear. J. Mammalogy. 27, 203-212.

Morrison, Peter 1960. Some interrelations Between Weight and Hibernation Function, Mammalian Hibernation, Bull. of the Museum of Comparative Zoology, Harvard College, pp 75-91.

Varney, Joel R. 1963. Special Tracking Project Report, Philco Corporation, Western Development Laboratories, Palo Alto, Calif.

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Table 2

GRIZZLY BEAR DENS INACTIVE
YELLOWSTONE NATIONAL PARK
UNKNOWN GRIZZLIES

DEN LOCATION	VEGETATION TYPE	SOIL STRUCTURE	DEN ELEVATION	SPECIES DEN TREE	DEN CHAMBER L W HT	MEASUREMENTS ENTRANCE L W HT	TOTAL LENGTH	DEN LINING
					INCHES			
Upper Trout Creek	Lodgepole Pine	Hard Compacted	8,200	Spruce	43 63 43	64 26 26	107	Conifer Boughs
Absaroka Range Mist Creek	Whitebark Pine	Rocky	9,000	Whitebark Pine	54 60 36	-- -- --	54	Conifer Boughs
Lower Trout Creek	Lodgepole Pine Spruce-fir	Loose Soil	8,000	None	70 52 30	20 27 19	90	Conifer Boughs
Yellowstone Canyon, S. side	Spruce-fir	Natural[1] Rock Cave	7,800	None	33 57 36	54 77 52	87	Scattering of boughs
Yellowstone Canyon, N. side	Douglas-fir	Fine-rock Soil	7,600	Matted Vegetation	-- 48 --	-- -- --	96	Den Collapsed
Ice Lake Area	Lodgepole Pine	Packed Soil	8,100	Mat of Vaccinium scoparium	-- 30 24	-- -- --	84	Den Collapsed

1. Used as a daybed or daytime lair but not as a winter den

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Table 3

GRIZZLY BEAR PREHIBERNATION PHENOLOGY
YELLOWSTONE NATIONAL PARK

DESIGNATION OF GRIZZLY NO.	SEX	AGE	DEN DIGGING ACTIVITY	DATE OF FINAL MOVEMENT TO DEN AREA	WEATHER CONDITIONS PREVAILING	TEMP. °F. MAX.	MIN.	DATE GRIZZLY ENTERED DEN	WEATHER CONDITIONS PREVAILING	TEMP. °F. MAX.	MIN.
164	Young adult female	--	Prior to final trek to den	1963 November 4	Snowing, 4-6 inches on ground	36	28	November 5	Snow storm	31	16
150	Adult female with 3 cubs	--	Prior to final trek to den	1963 November 4	Snowing, 4-6 inches on ground	36	28	November 4	Snow Storm	36	28
40	Female with cub	6 1/2	September 8 (2)	1964 November 1 New den	Snowing, 12-18 inches on ground	45	32	November 10	Snow Storm	40	24
158	Male Yearling with adult sow and littermates	1 1/2	Prior to final trek to den	1964 October 29-30	Snowing, 12-18 inches on ground	58	38	November 10	Snow Storm	40	24
40	Adult female pregnant	7 1/2	September 3	1965 October 15-16	Snowing, 3-4 inches new snow	54 41	30 30	November 11	Snow Storm	43	28
202	Weaned Yearling male	1 1/2	October 27-29. No previous preparation	1965 October 15 left regular haunts	Snowing, 3-4 inches new snow	54	30				
				October 25-26 Moved to den site	No snow Clear	55 63	26 25	November 11	Snow Storm	43	28
88	Weaned Yearling male	1 1/2	After October 15	1965 October 15	Snowing, 3-4 inches new snow	54	30	Probably November 11	Snow Storm	43	28
40	Adult female with 2 cubs	8 1/2	Prior to final trek to den November 2 Some digging	1966 November 15	Snowing, 12 inches snow on ground	40	20	November 21	Snow Storm	38	26
202	Young male	2 1/2	October 10-11	1966 November 6	Snowing, 5 inches snow on ground	38	29	November 21	Snow Storm	38	26
101	Adult female with 1 cub	9 1/2	Some digging November 8	1966 November 14	Snowing, 10-12 inches snow on ground	45	24	Probably (1) November 21	Snow Storm	38	26
120	Adult female	--	Prior to final trek to den	1966 About November 1	Snowing. Snow on ground	40	6	Probably November 21	Snow Storm	38	26
187	Adult female pregnant	4 1/2	September 16	1967 October 27	Snowing	51	10	Probably (1) November 19	Snow Storm	32	25
101	Adult female 1 yearling	10 1/2	Approximately October 11	1967 October 27	Snowing	51	10	Den abandoned November 2-6 (2)			
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Table 1

GRIZZLY BEAR DENS
YELLOWSTONE NATIONAL PARK

DESIGNATION OF GRIZZLY NO.	SEX	YEAR DEN USED	DEN LOCATION	VEGETATION TYPE	SOIL STRUCTURE	DEN ELEVATION	SPECIES DEN TREE	DEN MEASUREMENTS CHAMBER L W HT (INCHES)	DEN MEASUREMENTS ENTRANCE L W HT (INCHES)	TOTAL LENGTH	DEN LINING
164	F	1963*	Upper Alum Creek	Lodgepole Pine	Soft earth	8,200	Lodge-pole	59 53 48	60 17 40	119	Conifer boughs
158	M	1964	Upper Trout Creek	Lodgepole Pine	Packed soil Gravel layer	8,400	Spruce	64 60 60	32 30 42	96	Conifer boughs
40	F	1964	Upper Alum Creek	Lodgepole Pine Spruce-Fir	Packed soil	8,200	Spruce	48 42 48	36 30 30	84	Conifer boughs
40	F (3)	1965	Upper Alum Creek Beach Lake	Lodgepole Pine	Packed soil	8,200	None	54 54 36	66 33 21	120	Grass Moss Rootlets
40	F	1966	Lower Trout Creek	Lodgepole Pine Spruce-Fir	Loose soil	8,000	Dead Stump	60 85 28	30 17 20	90	Conifer boughs
202	M	1965	Yellow-stone Canyon	Spruce-Fir	Rocky (talus)	7,800	Log (1)	47 43 26	-- -- --	66	Conifer boughs
202	M	1966	Yellow-stone Canyon	Spruce-Fir	Rocky (talus)	7,800	Log	43 37 28	-- -- --	63	Conifer boughs
101	F	1966	Lower Trout Creek	Lodgepole Pine	Sandy soil	8,000	White-bark Pine	54 48 30	12 14 36	66	None (2)
101	F	1967	Hedges Peak	Spruce-Fir Whitebark Pine	Packed soil Rocks	9,200	Dead Spruce	63 56 40	45 15 54	108	Fir boughs
187	F	1967	Ice Lake	Lodgepole Pine	Packed soil	8,100	White-bark Pine	-- -- --	36 21 27	--	None (2)

1. Attempted earlier to dig den at base of tree
2. Den abandoned before lining
3. Female pregnant
* Signs of use the previous year