FOOD HABITS OF THE COUGAR IN UTAH AND NEVADA

W. Leslie Robinette, Jay S. Gashuiler, and Owen W. Morris

This paper concerns a food-habits study of the cougar or mountain lion (Felis concolor) made by the writers in Utah and Nevada from 1946 to 1955. The study included a more comprehensive one at the Montana State Fish and Game Department. The writers wish to acknowledge the assistance given by the many hunters who collected cougar stomachs and intestinal tracts, following being especially helpful: Willis Volpe, George Noy, Walter Nelson, Adria Sturm, Austin Johnson, Albert Stewart, D. O. Okeron, Joseph Pearson, Vernal Montaner, Jeff Carroll, Snap Palmer, George Harris, Noble Hanchett, Harold Johnson, O. Hurst, LaVere Kidman, Edward Conklin, E. Boyd Twitchell, Wallace Adams, Russell Shores. Appreciation is also extended to Charles Sperry, formerly of the U.S. Fish and Wildlife Service, and Stephen Durant, University of Utah, for assistance in identification of food items, and to

The writers collected cougar stomachs, intestinal tracts, and scats whenever possible and were assisted materially by many federal and private hunters who were provided with Formalin in which to save specimens. Additional information on the animal's food habits was obtained from winter trailing studies.

Food found in the stomachs was identified and the wet contents weighed (after draining off surplus fluids) separately by species. Compilation of stomach contents was made on the basis of frequency of occurrence, weight, and an index described by Martin, et al. (1946) as the aggregate-percentage method. In the last-mentioned method, each stomach with contents was given equal weighting regardless of the amount of food. Compilation of the analysis of choppings and intestinal samples was made only on the basis of frequency of occurrence.
Thirty were summer stomachs, and analysis revealed that this sample was biased because of the high proportion of domestic sheep that they contained. Most cougars in our area of study are taken well into May, and fresh snows make for easier trailing; summer hunting is largely confined to individual cougars that have been preying on domestic sheep. As a consequence, it is not surprising that domestic sheep should be so prevalent in the summer stomachs. On the other hand, we believe that the summer stomachs and the winter stomachs, included samples, and scats were randomly collected and consequently comparable, at least in the frequency of occurrence method in this study.

### Table 1.—Analyses of Food of Cougars Taken in Utah and Nevada, 1946-58, Based on 30 “Summer” and 245 “Winter” Stomachs Containing Food

<table>
<thead>
<tr>
<th>Method</th>
<th>Occurrence</th>
<th>Weight</th>
<th>Aggregate</th>
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<tr>
<td></td>
<td>No.</td>
<td>Per Cent</td>
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<tr>
<td><em>Summer</em></td>
<td></td>
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</tr>
<tr>
<td>Domestic sheep</td>
<td>18</td>
<td>60</td>
<td>649</td>
</tr>
<tr>
<td>Mule deer</td>
<td>8</td>
<td>27</td>
<td>310</td>
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<tr>
<td>Porcupine</td>
<td>4</td>
<td>13</td>
<td>44</td>
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<tr>
<td>Bobcat</td>
<td>1</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>Marmot</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Lagomorph</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Grass</td>
<td>2</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Unidentified bird</td>
<td>1</td>
<td>3</td>
<td>Tr.</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>36</td>
<td>109</td>
<td>1,024</td>
</tr>
</tbody>
</table>

| *Winter*     |            |         |            |          |               |               |
| Mule deer    | 184        | 75      | 4729       | 77.0     | 17,885        | 73.9           |
| Porcupine    | 30         | 15      | 538        | 8.8      | 3,357         | 12.6           |
| Domestic sheep | 10        | 4       | 360        | 5.9      | 788           | 3.0            |
| Lagomorph    | 9          | 4       | 121        | 2.0      | 706           | 2.9            |
| Beaver       | 3          | 1       | 208        | 3.4      | 210           | 0.9            |
| Grass        | 13         | 5       | 5          | 0.1      | 734           | 31             |
| Skunk        | 1          | Tr.     | 54         | 0.9      | 100           | 0.4            |
| Horse        | 1          | Tr.     | 59         | 0.8      | 100           | 0.4            |
| Cow          | 1          | Tr.     | 26         | 0.4      | 100           | 0.4            |
| Dog          | 1          | Tr.     | 33         | 0.5      | 100           | 0.4            |
| Packerat     | 1          | Tr.     | 4          | 0.1      | 100           | 0.4            |
| **Totals**   | 269        | 104     | 6,119      | 100.0    | 24,100        | 100.0          |

1. Food contents were measured in ounces for each food species. The percentage contained in each was then determined.

2. In the aggregate percentage method, the food of each stomach was considered as a whole—100 per cent for each stomach (Martin, et al. 1946). Percentage separations for individual food items in each stomach were derived from actual weight values. The percentages were totaled for all stomachs by food items and the percentage each represented to the whole determined.

3. As the summer cougars were not taken at random—sheep killers being selectively taken for many months (refer to text)—these results are of restricted value.

### Table 2.—Analysis of 62 “Summer” and 229 “Winter” Stomach Samples from Cougars in Utah

<table>
<thead>
<tr>
<th>Food Items</th>
<th>Frequency of Occurrence</th>
<th>Weight Percentages</th>
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</thead>
<tbody>
<tr>
<td>Mule deer</td>
<td>181</td>
<td>75</td>
</tr>
<tr>
<td>Spotted fawn</td>
<td>111</td>
<td>(11)</td>
</tr>
<tr>
<td>Older deer</td>
<td>235</td>
<td>(23)</td>
</tr>
<tr>
<td>Porcupine</td>
<td>10</td>
<td>(10)</td>
</tr>
<tr>
<td>Domestic sheep</td>
<td>18</td>
<td>(18)</td>
</tr>
<tr>
<td>Lagomorph</td>
<td>1</td>
<td>(1)</td>
</tr>
<tr>
<td>Grass</td>
<td>9</td>
<td>(9)</td>
</tr>
<tr>
<td>Beaver</td>
<td>3</td>
<td>(3)</td>
</tr>
<tr>
<td>Elk</td>
<td>2</td>
<td>(2)</td>
</tr>
<tr>
<td>Domestic goat</td>
<td>1</td>
<td>(1)</td>
</tr>
<tr>
<td>Pocket mouse</td>
<td>1</td>
<td>(1)</td>
</tr>
<tr>
<td>Striped skunk</td>
<td>1</td>
<td>(1)</td>
</tr>
<tr>
<td>Ground squirrel</td>
<td>1</td>
<td>(1)</td>
</tr>
<tr>
<td>Coyote</td>
<td>1</td>
<td>(1)</td>
</tr>
<tr>
<td>Horse</td>
<td>1</td>
<td>(1)</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>67</td>
<td>130</td>
</tr>
</tbody>
</table>

1. Three scats contained hair of both older deer.

To no one's surprise, the that deer (Odocoileus hemionus) all-important food species. tance was the porcupine (Erethizon dorsatum) and domestic sheep, number of lesser important snowshoe hare (Lepus americanus), rabbit (Lepus ovis canadensis), and grass.”

### Deer

In our study, deer forage with more food than all other. This finding agrees with Sperry (Young and Gibbons 1937), Dixon (1941), Schwartz (1949), and the finding by Hibben (1949). Schwartz (1949) found that the great hare (Lepus americanus) prevalent than deer in a similar study of cougars from the Oly
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| Table 2—Analysis of 52 “Summer” Droppings and 225 “Winter” Droppings and Intestinal Samples from Cougars in Utah and Nevada |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Mule deer | 39 | 64 | 167 | 74 | 31 | 52 | 131 | 64 | 32 | 50 |
| Spotted fawn | 11 | 31 | 11 | 31 | 5 | 15 | 15 | 45 | 4 | 12 |
| White-tailed deer | 25 | 69 | 25 | 69 | 10 | 25 | 10 | 25 | 15 | 45 |
| Porcupine | 10 | 19 | 10 | 19 | 8 | 19 | 8 | 19 | 5 | 10 |
| Domestic sheep | 8 | 15 | 8 | 15 | 5 | 10 | 5 | 10 | 7 | 15 |
| Lagomorph | 4 | 8 | 4 | 8 | 5 | 10 | 5 | 10 | 7 | 15 |
| Coyote | 4 | 8 | 4 | 8 | 1 | 2 | 1 | 2 | 1 | 2 |
| Domestic goat | - | - | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| Rabbit | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| Ground squirrel | - | - | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| Skunk | - | - | - | - | - | - | - | - | - | - |
| Total | 67 | 104 | 243 | 106 | 1 | 2 | 1 | 2 | 1 | 2 |

† Three scats contained hair of both spotted fawn and white-tailed deer.

To no one’s surprise, the study revealed that deer (Odocoileus hemionus) was the most important food species. Next in importance was the porcupine (Erethizon dorsatum) and domestic sheep, followed by a number of lesser important species such as mule (Odocoileus hemionus), cottontail (Sylvilagus spp.), hare (Lepus spp.), marmot (Marmota flaviventris), packrat (Neotoma g.), skunk (Mephitis mephitis), horse, domestic cow, dog and goat, bobcat (Lynx r.), unidentified bird, ground squirrel (Citellus spp.), coyote (Canis latrans), pocket mouse (Perognathus spp.), elk (Cervus canadensis), and grasses. A more detailed discussion by individual food species follows.

In our study, deer furnished the cougar three times more food than all other prey species combined. This finding agrees with studies by Sperry (Young and Goldman, 1940), ibben (1937), Dixon (1925), and Connolly (1949). Schwartz (1943) found varambore (Lepus americanus) to be more plentiful than deer in a small collection of cougar scats from the Olympic Peninsula of Washington. This exception, however, may reflect sampling variation due to a small sample or the relative abundance of the two species rather than a preference for hares.

Deer are common throughout our region of study and the cougar’s range is indubitably linked with that of the deer. Deer constituted 77 per cent by weight of the cougar’s winter diet and 64 per cent of its summer diet by frequency of occurrence.

Predominance of bucks in the cougar diet.—Hunters frequently report cougars killing more bucks than does or fawns. To learn if these reports had any basis in fact, the sex and age (buck, doe, or fawn) of 156 cougar-killed deer found by the writers and co-operators were tabulated. These kills have been segregated by seasons, and their ratio compared to field-classified live deer in the same general regions (Table 3). The proportion of bucks to does taken by cougars during the winter appeared to be significantly higher than in the live herds ($x^2 = 13.65; d.f. = 1; P < 1$ per cent). The small sample of summer cougars-killed deer, however, gave a buck–doe ratio almost identical to that of live deer. If bucks are taken more readily than does during winter, as our data imply, it raises the question of why. One possible explanation is that bucks are much less wary during the rutting season of November and December—two of the winter months. Another explanation could be that following the rut, many bucks prefer lea gue broken terrain, which is also the preferred habitat of the cougar. We believe that these reasons more logically explain the apparently higher prevalence of bucks killed rather than an actual preference for them by cougars. Stenlund (1955) reported a slightly higher number of bucks (35) than does (28) among adult deer killed by wolves in Minnesota.

Vulnerability of fawns.—Our small sample of summer-killed deer gave a slightly lower proportion of fawns than their prevalence in the herd (Table 3). This may not reflect true conditions, however, not only because of the small sample, but also because a greater proportion of a newly born fawn can be devoured than an older deer,
leaving less evidence of the kill. Summer
scats revealed the remains of 11 spotted
fawns for 25 older deer or 31 per cent of
the total compared to 25 per cent from re-
main of summer cougar-killed deer and 24
per cent for the live herd. It must be re-
membered, however, that the majority of
fawns are not spotted for more than a 2.5-
month period. This period represents only
40 per cent of the 6-month summer period,
so it appears entirely possible that young
spotted fawns could have been taken one
and one-half to two times more frequently
than their relative prevalence in the herd.
Not only should young fawns be more easily
taken than older deer, but they may even be
preferred by the cougar. Pertinent to the
present discussion are the following ac-
counts of cougars capturing young fawns.

Myron Hanisch of Amalissa, Utah, related
to the senior writer the following observa-
tion which he made in August 1934, while
hunting sheep on Monoie Mountain in central
Utah. Mr. Hanisch heard the distressed bleating of a fawn and sub-
sequently saw a half-grown cougar in close pursuit.
The fawn was so exhausted that it fell down only a few feet from the
observer. The lion, upon seeing the human intruder, whirled and left the
scene. A search in the area revealed another half-grown lion and the
severely mauled remains of a young fawn.

Archibald Murchies, of the U.S. Forest Service, fur-
nished the writers with another observation which
his bear patrolman, Walter Ray, made in the sum-
er of 1939. At the time, Ray was about 18 miles
below the Loon Creek Ranger Station within the
Challis National Forest in Idaho when he noted a
bear running, as though troubled, from the heavy
brush bordering the creek. Ray crawled into the
brush and frightened a cougar which he found
playing with a young fawn. The fawn was still
alive but badly mauled and was not from the
cougar's salivating. It was able to walk away but the full
extent of its injuries was not ascertained. Had it
not been for human intervention, it seems certain
that the fawn would ultimately have been killed
and eaten.

In yet another instance, hunter Phil Hurst related
to us how workers on a new gas line near Eagle,
Idaho, came upon a cougar carrying a young fawn
its month, early on the morning of July 1, 1941. The
 cougar dropped the fawn and fled upon seeing the
workers. Hurst was contacted a few hours later
while he was hunting in the same area, and
were unable to follow the scents.

The group of does to fawns killed by cougars
during the winter was almost the same as that observed
among live deer in the herd. Similarly, Stenlund (op. cit.)
found wolves displaying no preference for fawns
during the winter in Minnesota.

Method of attack.—General observa-
tions and accounts in the literature indicate that
cougars, in stalking deer, attempt to steal
within leaping distance, although they are
not capable of running deer down in distances
up to 50 yards. The cougar usually jumps
onto the deer's back, holding on with its
claws as it bites into the nape of the deer's
neck. If the deer is not killed by this bite
or the subsequent fall to the ground, it is
finished off by a series of bites in the jugular
region.

Following the kill, the cougar usu-
ally drags its quarry to some secluded spot under
a tree or ledge before feeding. Fifteen rec-
corded distances over which cougars were
noted to drag deer in this study averaged
305 ft. with a range from 16 to 1,200 ft. The
first feeding is commonly from the live
deer, and lungs through an opening smeared
in the ribs. When full, the cougar usu-
ally covers the carcass with dirt, sticks, snow
leaves, or anything available within 3 or 4 ft
although it will probably not cover the car-
cass if nothing remains to be eaten.

Some disagreement exists in the literature
as to the manner in which cougars kill deer.
Bruce (1922), who in his professional career
looked more than 600 cougars
states that after a deer is killed
by disemboweling it by Bruce of about 165 cougars,
revealed no evidence that they
had been tanned. Musgrave (in
a cougar punctures the neck,
fastening its front claws on
hind claws and
bites through the back of the
neck), in an eyewitness report
the cougar spread out and
the deer's neck, striking
to the rear of the neck.
At about one half to
the deer down
neck, striking

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<th>Cougars</th>
<th>Does</th>
<th>Fawns</th>
<th>Total</th>
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more than 600 cougars in California, and that after a deer is knocked down it is killed by disemboweling. Examinations of about 100 cougar-killed deer revealed no evidence that their throats had been touched. Musgrave (1926) states that a cougar pounces on the back of its prey, grasping its front claws in the shoulders and hind claws in the flanks and killing with a bite through the back of the neck. Wade (1929), in an eyewitness account, states that the cougar spread out and landed full length on the deer's back, its left paw catching the deer's neck, the right hitting the deer's head, knocking it around to one side. The deer went down immediately, and there was no struggle. The cougar proceeded to pull and pull the deer by the neck for 10 to 15 ft. before starting to feed. Allen (1939) observed a cougar kill a deer under captive conditions and reported that the cougar pounced onto the deer from a distance of 5 ft., grabbing the deer's neck in its mouth and its shoulder with a front paw. After the deer went down in a heap, the cougar continued chewing its neck until struggling ceased. Hibben (op. cit.) reports that the neck of a cougar onto a deer may in itself be sufficient to cause death by breaking the skin's neck; however, in all but 2 of some 300 kills examined, tooth marks found on the back and neck were believed sufficient to have caused death. Denton and host (1935) report that cougars bite deer in the back of the neck. All cougars killed by that they examined had broken necks.

To have examined closely only eight deer which killed by cougars. Two of the deer had broken necks. In the remaining six, however, it was evident that death had resulted from a series of bites on the throat, deduced from the large number of tooth marks and clotted blood found in the jugular region. With a single exception, each deer had a single set of tooth marks on the nape of the neck, as was plainly evident upon opening out the neck of each animal.

A bite on the nape of a deer's neck probably has the same paralyzing effect which "nasal" has upon horses. Creasing has occasionally been employed by western range men as a means of capturing wild horses. It consists of a carefully placed rifle shot that barely nicks the dorsal part of the horse's neck. The animal is temporarily stunned, perhaps from shock to the spinal cord, thereby permitting its easy capture. It subsequently recovers, if not seriously wounded. The senior author once shot a deer accidentally in this manner, the bullet barely grazing the back of the animal's neck. The deer dropped immediately and, although it regained its feet shortly after, remained in a standing stupor until dispatched with another shot. A cougar's bite could produce the same effect. If the deer's neck is not broken by this initial bite or the subsequent fall to the ground, our observations would indicate that it is ultimately killed by repeated bites in the throat region. A number of observations are described in the following passages to illustrate some of the hunting and feeding habits of cougars as related to deer.

An eyewitness account that bears recording has been related to us by William Aldredge, Oak City, Utah, of a cougar stalking and killing a deer. At the time, Aldredge was hired by the senior author to assist in a fawn-tagging program. He had spent the late daylight hours of June 7, 1957, on a high ridge scanning the nearby slopes for does with young fawns. About 7:30 P.M., he espied a large cougar about 100 yd. distant on the talus slope below, working its way toward a group of six feeding deer. It took the cougar only a few minutes to make its way through the scrub oak (Quercus gambelii) and waist-high sagebrush (Artemisia tridentata) to within 10 ft. of the closest deer—which later proved to be a yearling doe. The cougar crouched and waited behind a sage brush until the deer came within 5 ft., when it leaped and caught her rear parts with its front paws, having been thwarted in making a clean leap by the intervening brush. The deer was forced to its haunches but started pawing its way down the steep slope with its free front feet, bleating as it went. After struggling for 70 ft., deer and cougar stumbled, rolled over, and disappeared from view through a small
A large boulder weighing an estimated 200-300 lb. had been overturned in the struggle. From the place of kill to the base of the talus slope, a distance of about 30 yd., it was apparent that the cougar had carried its quarry, for there was no drag trail in the lush growth of forbs. At one point, where the cougar had passed between two scrub oaks, deer hair had rubbed off on a branch 18 in. above the ground. At the bottom of the slope, a drag trail was clearly visible. It led for 80 yd. to the edge of a 5-ft.-wide stream, which the cougar had decided not to cross for it retraced its trail to where it had descended from the talus slope. Here the deer was found covered with leaves and weeds beneath a maple tree (Acer graminifolium). A circular opening had been chewed in the deer's side next to the ribs, through which the liver had been eaten and the uncleaned stomach and intestines removed. A number of tooth marks and a considerable amount of dotted blood were found in the throat region, but none on the nape.

Cougars are not always fortunate enough to catch their prey in a single leap, as in the foregoing account. Signs observed in the snow by the senior author in the Eight-mile Area of central Utah on January 22, 1951, revealed that a mature male cougar (later caught) was forced to make 10 leaps covering 144 ft. before catching a mature doe. A trodden-down area of perhaps 100 sq. ft. marked the site where the doe was brought down. She had been dragged 108 ft. to an overhanging ledge and partially covered with snow, sticks, and leaves. The doe had been disemboweled and the heart, liver, lungs, much of the loin, and the ribs on one side consumed. Disembowelment is a fairly common procedure for cougars and, while Bruce (op. cit.) believed this to be the

means by which cougars kill deer, we believe it is merely a sanitary measure, which the cougar removes what it regards as distasteful from the desirable parts. The action probably serves the added function of preserving the meat from early age, especially in warm weather. It is done when driven by hunger that we have served instances where cougars have eaten the intestines or stomachs of prey species.

We have noted a number of deer carcasses where all edible parts have been taken except the stomach and intestines. Upon (op. cit.), upon frightening a cougar from two freshly killed and covered deer, found both had been disemboweled. The entrails were still attached to the carcass, but were outside the body cavities. The only flesh eaten was part of the raw filet of one fawn. When Wright returned 7 days later, nearly all fleshy parts had been eaten, with only the heads, lower legs, and viscera remaining.

In an observation on November 29, 1951, the senior author found where a cougar had killed a yearling buck in the Oak Creek area of central Utah. The cougar had paralleled a group of deer for about 40 ft., sneaking behind some chumps of manzanita (Arctostaphylos patula) until within 8 ft. of its prey before leaping. The deer made two leaps of about 6 ft. each before momentum gave out. It regained its feet, making another leap of approximately the same distance before finally going down. A struggle ensued for about 12 ft. where blood in the snow marked the end for the deer. The drag trail was then followed downslope for about 1,100 ft. to where the deer was found covered with debris, under a pinyon tree (Pinyon monophylla) at the base of a large ledge. The cougar had fed on the front shoulder eaten through the ribs on one side and taken the heart, lungs, and part of the liver. It had been resting on the adjacent ledge but fed on the approach of the senior author, evidenced by the fresh tracks and long leaps registered in the melting snow. Tooth marks were found both on the back of the victim's neck and on the throat, the latter having been thoroughly macerated.
On January 25, 1947, Forrest Romero, a former assistant of the senior author, observed in the snow where a cougar had killed a large mule deer 3 days previously in Salina Canyon of central Utah. The cougar had paralleled the deer for a short distance before changing in leaps of 5, 5, 6, 7, 9, and 10 ft. The deer did not regain its feet after being hit, but a struggle ensued on the ground. Subsequently, the buck was dragged 54 ft. to the cover of a juniper (Juniperus utahensis), where some of the hind quarter, the liver, and chest organs had been consumed. Another mature, cougar-killed buck was found in the same general area. It had been dragged 55 ft. to some cover, where the cougar had fed on the chest organs.

Archie Murchie surprised a cougar that was covering the still-warm carcass of a mature mule deer in the Duck Creek area of Nevada at about 8 a.m. on September 26, 1930. From signs in the dirt, it was apparent that the cougar had slept behind a current bush (Ribes sp.) to within 2 ft. of the deer before springing. The deer was apparently killed on the spot and dragged about 100 yd. before it stopped. An estimated 25 lb. of flesh had been taken from the flank and hind quarter. When he next visited the area 3 weeks later, Murchie found the carcass completely eaten save for portions of the lower bones. Murchie made another interesting observation in the same area on October 1, 1954. He found the remains of a mature doe killed the previous night. The cougar had dragged the deer over 25 ft. into a clump of spruce trees, where it had fed. The only visible tooth marks on the deer's neck were on the nape. Subsequent observations proved that the cougar returned to feed on each of the following 4 nights, covering the carcass back to the last one, at which time all edible parts had been consumed. Only the stomach, intestines, larger bones, and portions of the hide remained uneaten. The cougar returned the second night and fed even though Murchie and family were camped only 50 yd. away.

On still another occasion Murchie found a cougar-killed mule deer doe inside a 40-by-40-ft. livestock enclosure on April 9, 1951. A fence, consisting of 16 ft. of woven wire topped by two strands of barbed wire, had been built around. Blowing in Wasatch Mountain in eastern Nevada to exclude livestock, mass such as water from the spring was not flowing outside the enclosure, the deer had evidently jumped for a drink, only to be killed by the cougar. The chest organs, and lesser amounts from a hind quarter and a front shoulder had been fed on, with no attempt having been made to cover the carcass. Observations the following day showed that the cougar had returned the preceding night for another meal and on this occasion had dragged the doe to two different corners of the enclosure in an attempt to remove her from the fenced area. On October 10, 1951, two deer hunters related to the senior author how they had surprised a cougar feeding on a deer in the Duck Creek area of Nevada.

The hunters reportedly shot at and "bowed" the cougar over, but were reluctant to follow in the heavy cover where it had escaped. Only the chest organs of the deer had been eaten. Five days later, when the senior author visited the site, he found the 4- to 4½-lb. mule fawn completely devoured save for the leg bones (still attached by thin strands of hide), part of the head, the stomach, and some of the intestines. Both ears had been sheared from the head as though cut with scissors, but strangely enough left uneaten. This peculiarity has been noted on two other occasions by the writers. Even the brains of this fawn had been eaten—something which seldom happens to the heavier skull bones. Presumably, a single cougar was involved in the foregoing observation, and if so, it is surprising that it would return to feed after having been shot at.

On January 6, 1959, Austin Johnson of Delta, Utah, observed where a cougar had killed a mature doe about 2 days previously on the Canyon Range in central Utah. The doe had managed to run for nearly 100 yd. after the cougar had jumped on her. The only sign of the cougar showing in the snow during this distance was the drag mark of a hind foot, which probably had temporarily lost its grip on the deer. After the kill, the cougar alternately dragged and carried its victim for about a quarter of a mile uphill before feeding. It was evident that the doe had been carried part of the way across the back of the cougar, for the only drag marks left by the deer during those stretches were from its hind legs.

On February 17, 1950, the senior author found a female fawn in the Duck Creek area of Nevada that had been killed by a female cougar about 6 days previously. It had been dragged about 980 ft., as determined through pacing, before the cougar and her two 25-lb. cubs had fed on the chest organs. The cubs were found sparsely covered with dried grass and sticks under a curlicue mountain mahogany tree (Cercocarpus ledifolius). The fawns and cubs returned to the kill on the night of the 17th. This time they dragged the carcass an additional 65 ft., where it was found uncovered under another mountain mahogany. Most of the flesh from the back and legs had been consumed. During a chase by hounds and the capture of one cub on the 18th, the fawns and remaining cubs returned to the fawn carcass again on the night of the 19th. This time the fawn remains were moved another 10 ft. to another mountain mahogany. All remaining flesh except the stomach and large intestine had been eaten, as had the ribs, many vertebrae, most of the hide, and even the brains. Thus, these cougars in three feedings during an 8-day period consumed an estimated 45 lb. from the fawn. What else they may have fed on during the period was not known, because southern exposures, barren of snow, prevented continuous trailing. However, the exceptionally strong odor of skunk on the morning of the 18th in the vicinity of the fawn carcass suggested that other prey may have been taken.
Food requirements.—Much speculation has arisen in the literature as to the number of deer taken by a cougar during a year's time. Most estimates range from 35 to 100 (Cahalane, 1954; Connolly, op. cit.; Grinnell, et al., 1937; and others), although much higher rates have been reported for shorter periods. We have obtained little quantitative data through trailing observations. However, it seems worth while to make a rough computation of the winter rate from such data as: daily food requirements of the cougar, average amount of flesh consumed from each deer killed by cougars, and proportion of a cougar's diet made up of deer.

The daily food requirements of a cougar in the wild is conjectural. However, mature cougars in the Washington, D.C., and Salt Lake City, Utah, zoos are fed from 5 to 7 lb. of meat daily. Wild cougars perhaps require more because of their greater activity. Earlier in this paper an account was given of a mature cougar cleaning up the edible parts (except the stomach, intestines, larger bones, and a portion of the hide) of a mature doe in 5 consecutive nights of feeding. Hog-dressed weights of mature does from the same area averaged 88 lb. during the 1951 hunting season. Humestrom and Camburn (1950) report the fully dressed weights of mature white-tailed does as averaging 67 per cent of the hog-dressed weight. Thus, we could expect a fully dressed weight of about 59 lb. for a mature Duck Creek doe. While it is true that a cougar consumes the heart, liver, lungs, and parts of the hide, which are excluded from the fully dressed weight, we suspect that these parts may about balance the weight of the vertebral column and leg bones included in the fully dressed weight, but which usually are not eaten. With this assumption, it appears that the cougar in question consumed an estimated 59 lb. of venison in 5 nights for a daily average of nearly 12 lb. This is double the ration mentioned for zoo animals. The heaviest stomach contents for a mature cougar encountered in our study were 9 lb. 9 oz. of domestic sheep, but some digestion had possibly transpired at the time of death. On the other hand, it is possible that the cougar that apparently ate 12 lb. nightly fed more than once each night.

Cougars do not always completely clean up deer that they kill. In some instances they may feed but once, while on other occasions they devour everything edible. We have made estimates of the proportions of edible parts consumed by cougars from 39 cougar-killed deer that were no longer being fed on by cougars, and that we believe had not been fed on by bobcats or coyotes. The observations were made during winter when the snow cover aided interpretations. Carcases being currently used when found were not counted if the cougar disappeared feeding, apparently because of human intrusion. We cannot say categorically that cougars would not have returned to any of the carcasses, the flesh of which had not been completely eaten, but absence of cougar signs and state of the deer carcass were used as criteria in our judgment. An average of the 19 estimates was 63 per cent meaning that this proportion of the edible parts had been taken—excluding stomach, intestines, larger bones, and most of the hide.

Hog-dressed weights of hunter-killed deer from central Utah have averaged 124 lb. and 51 lb., respectively, for bucks, does, and fawns. The computed fully dressed weights are 89, 63, and 36 lb., respectively, based on percentages by Humestrom and Camburn (ibid.). Weighted according to the proportion of bucks, does, and fawns killed during the winter by cougars (Table 1), the computed fully dressed weight of an average cougar-killed deer would be 21 lb. If this weight, we estimate the cougar would take 63 per cent, or 38 lb. Table 2 shows the about 77 per cent (by weight) of the cougar's winter diet is composed of deer, some 38 lb. of deer eaten, an addition of 11 lb. of other food is also taken. A normal eating 5 lb. daily would require 10 days to consume 49 lb., whereas only 4 days would be necessary at the 12-lb. rate. The actual rate for a wild cougar population would likely be somewhere between the extremes. The wild population includes many immature animals with appetites that are somewhat less than those of one on which the above rates. Also, in the case of the cougar than an estimated 12 lb. daily for 5 days, it is probable that the rate was somewhat lower if determined period. Offsetting these two, what could be the greater appetites:

Connolly (op. cit.) determined the tracking studies in Utah and that a cougar killed one deer on the every 10 days. From our own and Connolly's reasonable estimate would suggest that cougars take about 1 lb. of meat weekly during the winter period that deer are less prey cougars' summer diet, a condition noted by Sperry's findings (Goldman, op. cit.). This does only mean that deer are killed sparsely. Jack Butler, who is a cougar hunter, having taken a thousand during his career, estimated that cougars kill more deer during summer than winter in any given year. His statement has some because cougars, like most cats, do not eat tainted food and during the summer months spoilage may set in with the following killing. Thewell-fed cougars have a covering may have some preservation and would not only serve to keep the meat, and magpies (Corvus corax), etc., from the kill so readily, but a covering of snow and other debris would make a provision, which might delay often cougars will remove the vis of the deer carcass, an action that like delay spoilage.

The reduced prevalence of the cougar's summer diet is compensated for by increased consumption of domestic lagomorphs, and rodents.

Porcupine

Occupying a strong second position in a cougar's diet is the porcupine. It is a half per cent by weight of the cougar's diet and 19 per cent by frequency.
somewhat less than those of the mature cases on which the above rates were based. Also, in the case of the cougar that consumed an estimated 12 lb. daily for 5 consecutive days, it is probable that the rate would be somewhat lower if determinable for a longer period. Or, setting these two factors somewhat, it could be the greater appetite that wild animals probably have over captive ones.

Connolly (op. cit.) determined from winter-tracking studies in Utah and Nevada that cougar killed one deer on the average of 10 days. From our own computations, this estimate would seem to be a reasonable figure. Table 2 indicates that deer are less prevalent in the cougar's summer diet, a condition corroborated by Sperry's findings (Young and Sperry, op. cit.). This does not necessarily mean that deer are killed less frequently. Jack Butler, who is Utah's top cougar hunter, having taken around one hundred during his career, states categorically that cougars kill more deer during summer than winter in our area of study. His statement has some basis of fact, because cougars, like most cats, do not care for frozen food and during the hot summer months spoilage may set in within a day or two following kill. The well-developed digestive system of cougars have of covering un eaten prey to some preservation values. It had not only serve to keep flies from the carcass, and magpies (Pica pica), ravens (Corvus corax), etc. from discovering the kill so readily, but a covering of leaves, dust, and other debris would provide some insulation, which might delay spoilage. Cougars will remove the viscera from the carcass, an action that likewisewould delay spoilage.

The reduced prevalence of deer in the cougar's summer diet is compensated by an increased consumption of domestic sheep, lambs, and rodents.

Porcupine

Holding a strong second position in the cougar's diet is the porcupine. It made up 1 percent by weight of the cougar's winter diet and 10 percent by frequency of occurrence from scat and intestinal samples for both winter and summer.

Connolly (op. cit.) found from his winter-tracking studies that a cougar killed one porcupine a week on the average. It is generally believed that the cougar kills a porcupine by flipping it over with a paw and attacking the unprotected belly. An eyewitness account related to us by Virgil Draney, presently Supervisor of For Resources for the Utah Fish and Game Department, tends to corroborate this belief. Near evening in October 1937, Draney saw a cougar approach a porcupine that was feeding in a small meadow by Worm Creek, which lies east of Preston, Idaho. The cougar watched the porcupine at close range for several minutes before seizing an opportunity to flip its paw beneath the porcupine. As it did so, it flipped the hapless animal into the air, disemboweling it in the process. The cougar licked its paw and then commenced devouring its prey on the spot.

Clifton Stewart and John Mitchell, seasonally employed by the U.S. Forest Service, were driving up a mountain road in central Utah shortly after a storm in late June 1955, when they noticed fresh cougar tracks in the road ahead. Shortly thereafter, they came upon a freshly killed young porcupine, its belly ripped open and entrails protruding. Apparently, the cougar had been frightened from the kill by the approaching car, for the porcupine was still warm.

The senior author once frightened three yearling cougars from a freshly killed porcupine in Dry Creek near Monroe, Utah, on February 1, 1943. Blood was still oozing from the only visible wound, a large opening on the throat. It was not determined, however, whether the wound had been made by the claws or teeth of the cougars.

The writers have found remains of cougar-killed porcupines on numerous occasions, and the hide always gives the appearance of having been skinned out. The feet may or may not be eaten, but the head, stomach, and intestines are rarely taken. Some quills are consumed by the cougar, as they have been found in the stomach and even stuck in the stomach walls, but apparently with no se-
rious consequences. The following account, however, indicates that preying on porcupines, especially by young inexperienced cougars, is not without its hazards. Hunters Lloyd Roberts and Voyle Hanchett killed a mature female cougar in Monroe Canyon of central Utah in December 1927. It was not until 12 days later, however, that they were able to return to capture her four, 1/3-grown cubs alive. The cubs had subsisted largely on porcupines during the interim, as evidenced by the large number of quills in the three largest ones, but they lived only a week following capture. The fourth cub was a runt and, ironically, the only one to survive. Being a runt and less aggressive than its litter mates, it apparently had been content to let them do the killing, thereby being spared the quills. Cougar young are probably taught the art of porcupine killing by their mothers, but in this instance it was evident that the cub had not yet acquired the art.

**Domestic Sheep**

The percentage of occurrence for sheep in the summer scats is a high 15 per cent but less than 1 per cent during winter. Analyses of winter stomachs, however, gave an occurrence of 4 per cent. The variation in winter samples is probably due to sampling. It does appear, however, that the kill of sheep is appreciably higher during summer than in winter. This is likely a reflection of availability rather than preference. As mentioned earlier, large herds of sheep graze during summer in the mountains, which are cougar habitat. During winter, however, most of the herds graze in the desert valleys, where cougars seldom range.

The occurrence of sheep in the cougar stomachs and scats is not a true reflection of the damage inflicted on sheep herds by cougars. Frequently a cougar will invade a herd and kill many more sheep than he can ever hope to eat, merely because the killing is so easy. One case in Nevada came to our attention of a cougar killing 17 sheep in 1 night. The cougar rarely can feed more than 1 or 2 nights before the herder or hunters are after him, and so has little opportunity to clean up the kills. We analyzed one cougar stomach that contained half portions of a ewe and of her unborn lamb.

**Lagomorphs and Beaver**

Cottontail and black-tailed jack rabbits (Lepus californicus) were both identified in the cougar stomachs and scats, but no distinction was made in a few instances. Lagomorphs have been treated collectively. White-tailed jack rabbits (L. townsendi) and varying hares, while not specifically identified in the cougar food remains, probably occurred on occasions, for both species are found within the range of the cougars in Utah and Nevada. Lagomorphs probably rank about fourth among cougar food in deer, porcupine, and domestic sheep. Beaver made lagomorphs during winter 3 percent of weight of stomach contents, and their frequency of occurrence indicated that lagomorphs were taken much more frequently both in winter and summer.

On the basis of winter stomach analyses, beaver made up 3.4 per cent by weight of their contents, which exceeded the 2.1 percent recorded for lagomorphs. One stomach containing 7 lb. 10 oz. of beaver, probably inflated the weight percentage excessively. Beaver, when searching for food away from water, should be easy prey for the cougar.

**Grass**

Grass occurs rather frequently in the cougar's diet both in winter and summer. Frequency of occurrence was as high as 26 per cent but, on the basis of weight, it was a minor item. The writers have never received a definitive answer to the question of what cats eat grass. Green grass might be vitamin A or another nutrient, but for coarse, giant ryegrass (Elymus canadensis) and other coarse grasses are taken during winter with equal frequency when the principal content is negligible. Even hayshown giant ryegrass during the winter. Spooner (1930) states that the primary food of vegetables in a dog's ration is to furnish vitamins and minerals, supply bulk, and acting as fillers serve to regulate the bowels. Grass may serve similarly in the cougar.

**Minor Food Items**

Other items of food that appear in stomachs, intestines, and scats during this study were: stripped rat, horse, cow, dog, pocket mouse, unidentified bird, domestic goat, squirrel, coyote, and bobcat.

The single stomach contained from a large male cougar killed by hounds in the Flat Canyon area of central Utah on January 29, 1936. Butolph had killed the cougar, which in turn had killed the tracks of two cows, while a wild horse was noted. Blood and evidence of a struggle served in the snow. About 75 to 100 feet was the carcass of the horse and it was apparent from signs that the cougar had gone down when it had regained its feet and had been able to return to the Flat. The following account, written by Willis Butolph, July 27, 1930, in Cedar City, Southern Utah, is probably due to inaccurate reporting.

The single stomach contained, from a mature male cougar killed by Butolph, July 27, 1930, in Cedar City, Southern Utah. The stomach contained a trace of unidentified small bird and it was entirely possible the particular bird was eaten initially by the cougar. Two of the writers (Robinet and Wiler) were in the Duck Creek area of Nevada on February 19, 1930, and Anton Stittich, biologist with the State Fish and Game Commission, noted a male bobcat recently killed by a hunter. The cat was able to check the scene of the kill. The bobcat had been caught by its feet, which protrude...
Food Items

Other items of food that appeared in the stomachs, intestines, and scats of cougars during this study were: striped skunk, pack-horse, cow, dog, pocket mouse, marmot, unidentified bird, domestic goat, elk, ground squirrel, coyote, and bobcat.

The single stomach containing horse was from a large male cougar killed by federal hunter Willis Butolph while he was hunting in the Flat Canyon area of central Utah, January 29, 1950. Butolph had been trailing the cougar, which in turn had been following the tracks of two cows, when the tracks of a wild horse were noted. Shortly after, blood and evidence of a struggle were observed in the snow. About 75 yd. from the best blood was the carcass of the horse. It was apparent from signs in the snow that the horse had gone down when first hit, but had regained its feet and traveled the 75 yd. before succumbing. Drag marks of the cougar's hind feet were noted for a short distance after the horse fell and regained its feet. While the cougar had apparently lost a grip on the horse momentarily with its hind feet, it had evidently held on securely with its front feet and teeth. The horse was a mature mustang, judged by Butolph to weigh around 900 lb. The cougar had fed here because of the region of the diaphragm. It was jumped by the hounds nearby, and after a short chase was treed and shot.

The single stomach containing bobcat was from a mature male cougar killed by Butolph, July 27, 1950, in Cedar Canyon area of southern Utah. The same stomach also contained a trace of unidentified bird. While we have listed this among the food of the cougar, it is entirely possible that this particular bird was eaten initially by the bobcat. Two of the writers (Robinette and Gashler) were in the Duck Creek area of eastern Nevada on February 12, 1950, when the late Anton Sutich, biologist with the Nevada State Fish and Game Commission, found a mature male bobcat recently killed and partially eaten by a cougar. The senior author was able to check the scene the following day. The bobcat had been covered except for its feet, which protruded from the freshly packed mound of snow. Its mid-section had been devoured—the front and rear sections being held together only by some of the hide. Although numerous cougar, bobcat, marmot, and rabbit tracks in the vicinity somewhat obscured reconstruction of the action, it appeared that the cougar had surprised the bobcat at a deer carcass, which was discovered about 70 ft. away. The bobcat's stomach, which was located in the snow mound, contained 3.5 oz. of deer. The head and neck of the bobcat, when skinned out, revealed that death had resulted from a single bite in the neck. The bobcat weighed 17 lb. despite the loss of several pounds eaten by the cougar. Bruce (op. cit.) and Young and Goldman (op. cit.) have mentioned that cougars occasionally take bobcats. On February 4, 1951, Butolph found where three lions had killed and completely devoured a bobcat, that had been followed by the cougars, that had been caught in their traps.

Domestic cow was found in but one stomach—this being from a mature male cougar killed by federal hunter George Nay in Willow Creek of northeastern Utah, January 14, 1952. While he was hunting, Nay chanced onto the carcass of the recently killed, immature Hereford. He caught the cougar shortly after. In our area of study, cattle are generally unavailable to cougars during winter. However, the fact that cow did not appear in any of the summer scats, at a time when cattle are available, leads us to believe that they are not often molested, if deer are plentiful.

Miscellaneous Observations

Cougars live almost exclusively on prey that they have killed. Occasional exceptions have been noted; however. Federal hunters in Utah and Nevada have found several cougars that apparently died from feeding on "1080" poison stations placed out for coyote control. We likewise have encountered three authentic cases of cougars having fed on field-dressed deer left in the
mountains by hunters to cool out overnight. In still another instance, the stomach from a cougar killed during winter in Utah contained 7 lb. 10 oz. of beaver. The contents were unusual in that no hide was present—only an occasional hair permitted identification. Absence of hide suggested that the cougar had fed on a skinned carcass.

An unusual stomach was taken from a mature female cougar killed by Willis Butolph and Adria Ahlstrom in the Corn Creek area of central Utah, on January 4, 1951. The stomach had a conspicuous constriction about its midsection. Removal of a heavy covering of connective tissue revealed an opening through the wall of the stomach in the region of the lesser curvature. The opening presented the appearance of a person's pursed lips. In the forepart of the stomach were 2 oz. of deer liver, while a similar amount of deer hair and bones was found near the pylorus. Cause for the wound is a matter for speculation. It could have resulted from a rifle shot or possibly a splintered deer bone, but whatever the cause, it was surprising that the cougar had been able to survive.

Summary

In this study, 277 intestinal tracts and scats and 401 stomachs from cougars were collected in 1946–58 in Utah and Nevada. Only 275 of the stomachs, however, contained food. Only two seasons—"winter" and "summer"—were recognized in the analyses. Mule deer was by far the most important food, making up nearly 80 per cent of that taken during winter and nearly two-thirds during summer. Porcupine comprised about 10 per cent, with other foods, such as domestic livestock, lagomorphs, beaver, squirrels, mice, elk, coyote, bobcat, skunk, and grass, making up most of the remainder.

Buck deer appeared to be killed by cougar more frequently than their proportionate numbers in the herds during winter. The same condition is possible true for young fawns during the first 2 or 3 months following birth, but the evidence is not conclusive.

Some rough computations based on the daily food requirements of cougars, the amount of meat consumed from the average deer, and the proportion of the diet consisting of deer indicated that a cougar kills a deer every 4 to 10 days for an average of one weekly during the cool winter months (November–April). There is some reason to believe the kill rate might be greater during summer.

A number of observations on the hunting habits of cougars are recounted.

References Cited


A Vegetation

Botany Dept.

The white-tailed deer (Odocoileus virginianus) inhabiting central Wisconsin utilize the low-growing, green winter browse. Such plants to the deer in this region (because the snow accumulates the snow cover up to 15 inches), as winter food, are wintergreen (Gaultheria procumbens), willow (Salix nigra), a stitch evergreen (Erica scoparia), and purple loosestrife (Lythrum salicaria).

Preliminary observations of the deer range in central Wisconsin indicated that these imponderables were decreasing in their observations by personnel of the Conservation Department in the study reported carried out during the summer project was designed to obtain information on the phytosociology of the study.}

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A VEGETATIONAL STUDY OF THE CENTRAL WISCONSIN WINTER DEER RANGE

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The white-tailed deer (Odocoileus virginianus) inhabiting central Wisconsin utilize the low-growing, ground-layer plants for winter browse. Such plants are available to the deer in this region (Fig. 1) primarily because the snow accumulation is not ordinarily great. The important ground-layer plants that provide a rather high percentage of the winter food supply in central Wisconsin are wintergreen (Gaultheria procumbens), dewberry (Rubus pubescens), purple berry (Mitchella repens), bearberry (Arctostaphylos uva-ursi), pipsissewa (Chiclophila umbellata) and trailing arbutus (Epigaea repens). Of lesser importance are devil's walking stick (Pyrola spp.) and blueberry (Vaccinium angustifolium).

Preliminary observations of the winter deer range in central Wisconsin led to the hypothesis that these important browse species were decreasing in numbers. These observations by personnel of the Wisconsin Conservation Department prompted the initiation of the study reported here, which was carried out during the summer of 1958. The project was designed to obtain accurate information on the phytosociological behavior of the ground-layer plants in the forest-community succession in central Wisconsin, and, also, to determine whether or not the present level of winter deer activity imposed on these plants is exerting a detrimental effect on their numbers.

CHARACTERISTICS OF THE REGION

Two principal areas in central Wisconsin (Fig. 1) were included in this study: (1) the Central Wisconsin Conservation Area (C.W.C.A.), located in northwestern Juneau County and portions of Monroe County; and (2) the Black River State Forest, situated in Jackson County. Together, these two state-owned tracts comprise approximately 116,000 acres.

The Black River State Forest and the C.W.C.A. are both located within the Wisconsin Driftless Area, and the C.W.C.A. itself lies entirely within the bed of Glacial Lake Wisconsin (Martin, 1932). Much of the central Wisconsin area may be described as a nearly level sand plain with occasional sandstone and quartzite hills and cliffs projecting above this plain (Whitson, et al., 1914, 1923). There are also extensive areas of marshland in the region, many of which are used for cranberry cultivation.

Early descriptions of the vegetation in central Wisconsin (Ellis, 1857; Roth, 1898; Bordner, et al., 1934) reveal that much of the area was a mosaic of tall-grass prairie, pine and oak openings, and islands of mature red pine (Pinus resinosa) and white pine (P. strobus). Essentially, this was a mixture of vegetational elements representative of both southern and northern Wisconsin plant communities.