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Bodoni Italic

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Greek and Math Symbols

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MESH HALFTONE WEDGES

65
85
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110
133
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A Technic For Den-Use Study

Richard J. Hartesveldt

January, 1947

A Technic For Den-Use Study

By

Richard J. Hartesveldt

Submitted in partial fulfillment of the requirements for the degree of Master of Forestry, School of Forestry and Conservation, University of Michigan. January, 1947.

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INTRODUCTION

In most research studies of small wild mammals, data concerning the activity of these animals are of great value, especially when they can be correlated with the use of dens. The nature of wild mammals is timid and shy. Thus, they do not allow themselves in many instances to be observed entering or leaving their dens. Often, however, identifying hairs can be found in den entrances where they catch on roots and sharp rocks. It was, therefore, the purpose of this research to develope a technic by which the use of ground dens could actually be determined by means of catching hairs with a small device set in the entrance of dens. The hairs so caught would be subjected to microscopic analysis where ordinary visual examination would not suffice for identification.

Devices of a similar nature were used in 1934 by Drahomer (5) at the University of Michigan with reported success. In raccoon research, Steuwer (19), in 1940, reports using "wire combs" for the purpose of catching hairs on artificial raccoon dens to determine whether or not they were being occupied. The success encountered was not indicated.

The construction of the most successful types of hair-catching devices, the field and laboratory technics involved in working out this problem, the amount of den use, and multiple den use will be thoroughly discussed. However, it is beyond the scope of this paper to discuss all of the potentialities of further studies involving the use of these technics.

The author wishes to express his appreciation to Dr. W.W.

Chase and Dr. E. C. O'Roke for their beneficial guidance and assistance in working out the technics herein presented. This appreciation is also extended to Mr. Herman Franzblau, Mr. T. L. Hanaghan, and the Detroit Edison Company on whose lands this work was permitted.

Locality of the studies

The land on which the field work was carried out comprises about 650 acres of farmland four miles east of Ann Arbor, Michigan in section 36, T2S, R6E, and in section 31, T2S, R7E of Washtenaw County. The study area is bounded on the north by the Huron River.

Typical of Washtenaw County, the soil is glacial moraine. Miami silt loam and Bellefontaine sandy loam are the two dominant soil types with Fox sandy loam and Carlisle muck in smaller amounts. Most of the dens were located in Bellefontaine sandy loam, and with few exceptions, the dens were located on sloping terraine.

The land is generally quite hilly with an elevation difference of 80 feet from the river to the highest point. There are two large marshes and many potholes, most of which are wet in years of normal precipitation.

The ground cover can be broken down into these classifications: cropland, 296 acres (including orchard), grassland, 145 acres, woodlands, 158 acres (about one-third pine plantation, 30 years of age), marsh, 28 acres, and shrubland, 23 acres.

Developing the devices

Of the many types of devices used in the field studies, three have proven of value for snaring hairs in quantity. The most successful device used was made with the seed heads of the common burdock (Fig. 3). The construction is simple and it requires about ten minutes to make, not counting the time required for the glue to dry.

The materials consist of a piece of thin wood about an eighth of an inch thick, 1.75" x .75, a piece of stiff wire (9 - 12 gauge) 10" to 12" long, waterproof glue or a "mend-all" and dry burdock seed heads. The glue used for the devices in these studies was "Hold-all" brand liquid solder. It proved to be quite successful.

Two holes were burned in the wood about $\frac{1}{2}$" apart (Fig. 1). If burned with a piece of the same size wire as is being used, a snug fit will be obtained. The wire is bent into a U-shape (Fig. 2) and then slipped through the holes in the wood. Following the directions on the tube of glue, 4 or 6 burdock seed heads were glued on to the wood and allowed to dry thoroughly. The bottom barbs of the burdock were clipped off to effect more success in gluing.

As an added protection from moisture, paraffin was melted until it smoked and was near the consistancy of water. The entire head of the device was dipped in the melted paraffin and allowed to dry. Paraffin, if used when very hot, does not impair the

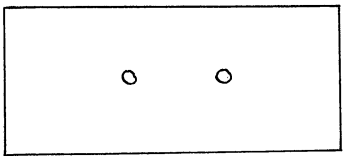


Fig. 1

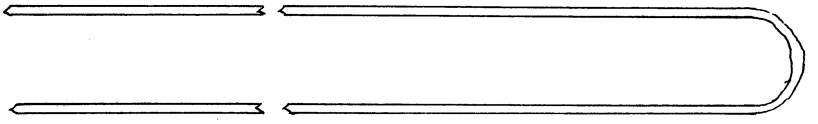


Fig. 2

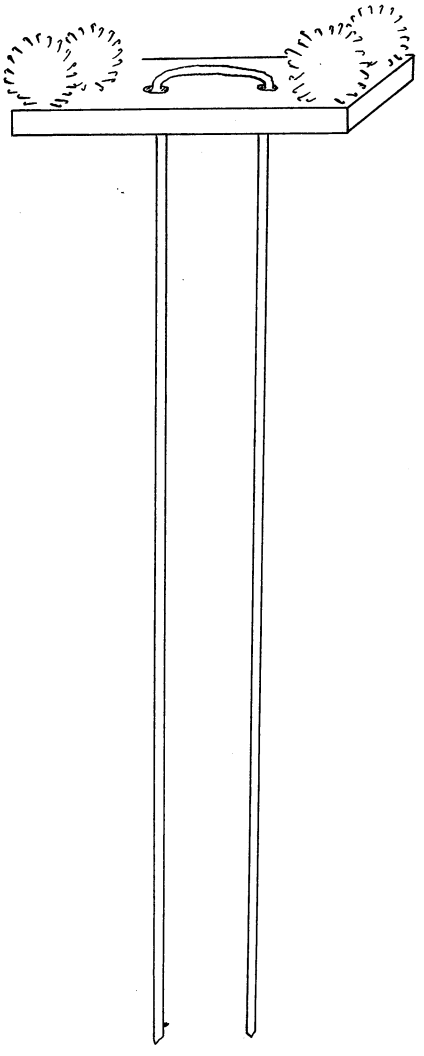


Fig. 3

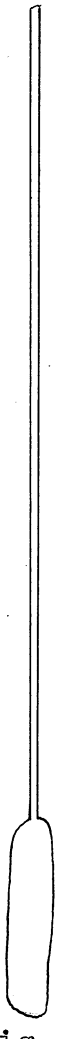


Fig. 4

Fig. 5

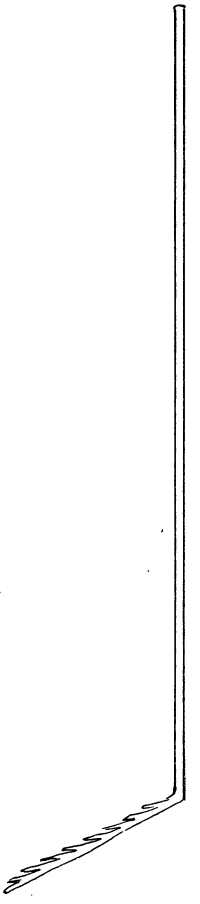


Fig. 6

Details of hair-catching devices. Fig. 1, Wooden base for burdock device. Fig. 2, Wire for same device. Fig. 3, Completed burdock device. Fig. 4, Wire device in initial stage with end ball peened. Fig. 5, Device showing peened end cut with barbs. Fig. 6, Side view of the straight wire device after completion.

pulling quality of the burdock barbs. Not only does this waterproof the device, but it serves as a binder to hold the seed head together. Untreated seed heads pull apart easily when soaked with water.

When carrying a number of these devices into the field, it is necessary to wrap each one separately with paper. This prevents the burdock seed heads from catching together and being pulled to pieces when separated.

Easier to use and transport to the field are two types of wire devices. The time required for construction is somewhat greater than for the burdock devices and they are not quite as successful for catching hairs.

A single straight piece of stout wire (9-12 gauge) about 7 inches long was used in the first case. With a ball-peen hammer, about 1 inch of one end of the wire was flattened (Fig. 4). The flattened part was made as thin as possible without spltting the metal while being peened. With sharp tin snips, small barbs were cut on either side of the peened area about an eighth of an inch apart (Fig. 5). The barbed section was bent at about a 70° angle to the main shaft (Fig. 6).

The other type is of similar construction, but differs in form. In place of a straight shaft, a U-shaped piece of wire 6 or 7 inches long was used. The U-end of the wire was peened flat (Fig. 7) as described in the preceding paragraph, and likewise

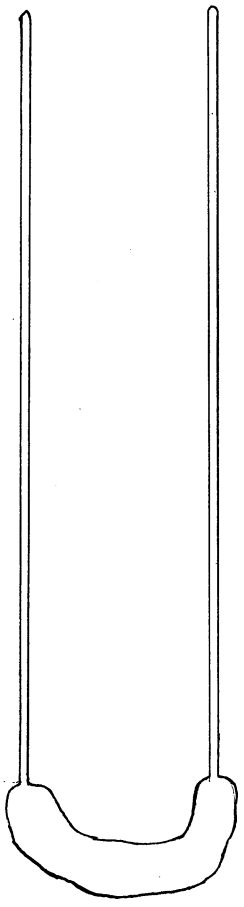


Fig. 7

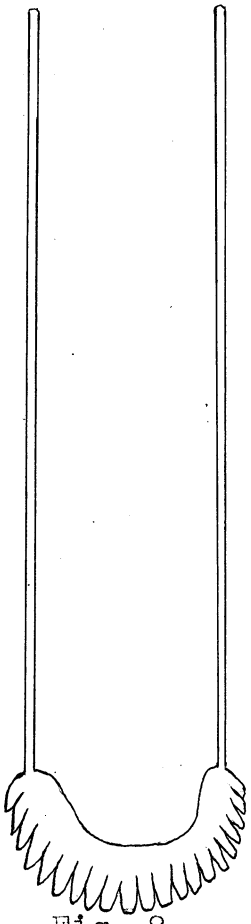


Fig. 8

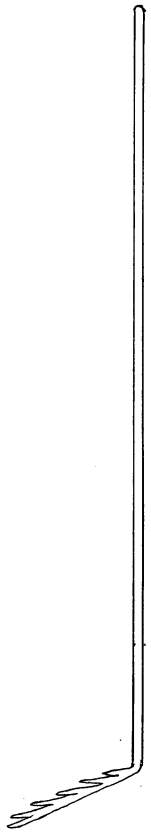


Fig. 9

Details of U-shaped wire hair-catching device. Fig. 7, U end of device peened flat. Fig. 8, U end cut with barbs. Fig. 9, Side view of completed device.

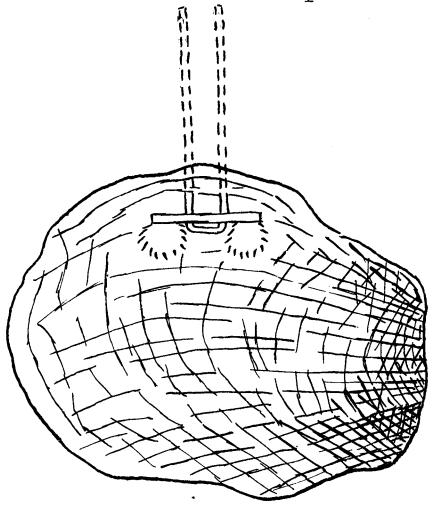


Fig. 10

Fig. 10, Installation of a burdock device in the entrance of a ground den.

cut with barbs (Fig. 8). Again, the barbed end was bent out at a 70° angle (Fig. 9).

Installation in dens.

The installation of all three devices is the same (Fig. 10) and requires only that the wire be pushed up into the ground somewhere inside the den. It may be installed in the side or even the bottom of a den if the overhead consists of roots or rocks. Success with burdock devices was encountered when they were set in the top, sides, and bottom of dens. With the wire devices, the barbs should be pointing out of the den. The chance of snaring hairs is greater with animals entering dens than with animals leaving dens because of the speed at which they often enter.

In dens having large entrances, the device should be placed so that the snaring end will be well within the range of the animal's body. This may be accomplished either by placing the device in a narrower portion of the den, or by allowing the snaring end to protrude a greater distance across the den entrance. Longer wires may be necessary in some cases. Burdock devices, even though treated with parafin, should be placed, where possible, far enough down in the den to protect it from rain water.

Devices cannot be installed after the ground becomes frozen. If winter studies are to be made, plans should be formulated far enough in advance so that devices can be installed before

Fig. 11, Burdock device showing hair of the cottontail as caught.

the ground freezes. It is usually necessary to take the burdock devices from the dens to remove all of the hairs. Sometimes, they can be pulled out of the frozen ground and then replaced in the same holes. It is not necessary to remove the wire devices from the ground for this purpose.

Each den equipped with a device was numbered with a small brass tag and the exact location was plotted on a large scale map (1:1584) so that the den could be definitely located. This proved to be of special value in areas of homogeneous cover where identifying land marks were absent.

Form sheets (Fig. 16) were of particular value for recording data gathered in the field. This form sheet was sufficient for working out details of this problem.

Success in catching hairs

The earliest attempts to catch hairs with various types of devices were not successful. A number of weeks passed before the first hairs were caught in a burdock device. It was noted that few dens appeared to be in use at this time and a series of studies was commenced to determine the percentage of den-use.

Careful examinations were made weekly of den entrances to ascertain whether or not that particular den was in use. The indicators used for the basis of determination were: the presence of hairs in devices, the amount of leaves and the disposition in the entrance, and the presence of tracks or other disturbances of earth, grass, etc. Obviously unused dens which were

caved in, filled in with sticks, leaves, covered with spider webs, etc. were not used in the den-use counts.

The numbers of used and unused dens were tallied each week and the percentage of used dens was plotted on a graph (Fig. 12). The minimum daily temperatures for each day of the month was also plotted. The percentage figures are subject to error on the part of the observer because of the few dens observed and the fact that the same dens were not always counted each week. However, exact figures are of no particular value, whereas the up-swing of usage as winter comes on definitely shows that the use of dens can be correlated with the temperature of the air.

It will be noted on the graph (Fig. 12) that 26% of the dens observed on November 4 were determined to be in use. The minimum temperatures prior to this date were not very low. It is believed that this figure is in error to a certain extent in view of the fact that the three following observations averaged 42% in use. Radical increases in den use followed lowest temperatures encountered to that date. The all-high percentage of 75% on New Years day, 1947, followed the coldest weather of the 1946 season. A light fluffy snow made tracking excellent. Den-use determinations were made entirely by the presence or absence of tracks leading to or from entrances. It is believed that there could be little or no error in this figure.

Approximately 50 devices had been installed in dens prior to December 6. It was noted that hairs were found in devices

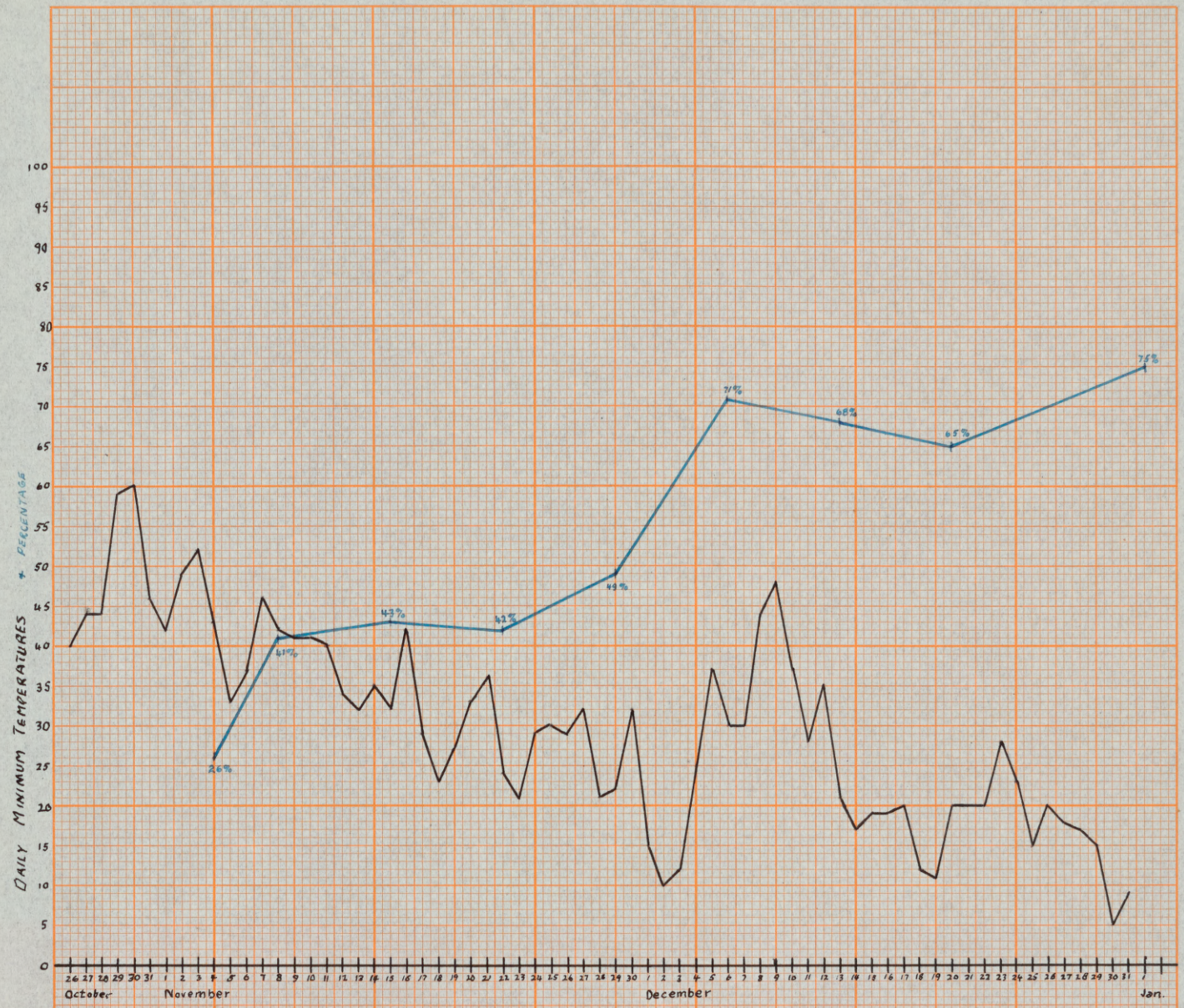


Fig. 12. Percentage of den usage. The blue line represents the percentage of dens being used on particular dates. The black lines represent the daily minimum temperatures. (Temperatures were recorded from University of Michigan Weather Station)

that previously had no hairs snared in them even though they had been set for weeks. The January 1 tracking showed that many dens with devices which were constantly catching hairs were not being used on that date. This indicates that fall and winter dens are not necessarily permanent homes for animals, but that they are being used for shelter mostly and that any open accessable den will suffice.

Use of dens by more than one species of animal has also been indicated in these studies. Use by two species of animal at the same time was not proven although the time intervals in between use by the two species was not very great. The dead remains of skunk have been found near a number of dens now used only by rabbits. The skunks had been killed by the property owner. A January 1 observation showed skunk tracks leading into a ground den used previously by rabbits. A strong skunk odor was present in the den. Skunk and rabbit hairs have been found at different times in the devices of one den. The same is true of the opossum and rabbit. In one den used only by rabbits for some time, weasel hairs were found in a device and scats had been dropped in front of the den. Another den in which a woodchuck had been observied entering, smelled strongly of skunk within the same week.

Of the total number of hair catching devices set during the course of these studies, 81% of them had successful catches of hair in them at one time or another. Many of them had regular catches of hair. This percentage could actually be raised con-

sidering that some of the dens not used at any time during the study had devices set in them.

About 90% of the hairs caught were those of the cottontail rabbit, while opossum and skunk ranked as seconds with fox and weasel each leaving only two successful hair catches.

Difficulties in field work

A few difficulties were experienced in the field work. However, those that were uncontrollable were negligible. Three of the devices were torn out by the animal occupants. One of these was lost when a new tunnel was dug commencing at the same entrance. In the case of another missing device, no disturbance was noted. There is a possibility in this case that if the device were loosely lodged in the earth, it may have caught firmly on the fur of some animal, pulled out, and dragged away. One burdock device was found in the bottom of a fox den; the wooden part was deeply dented with tooth marks.

Many of the first burdock devices set had to be replaced because the seed heads soaked apart, came off entirely, or became so limber from water soaking that they were of little value for catching hair. Careful gluing of the burdock heads, treatment with paraffin, and proper placement of devices in dens eliminated most of this trouble.

Heavy rains caused the loss of some devices when the earth about den entrances collapsed.

A den excavation

An excavation of a rabbit den was made early in December. It was located in Miami silt loam under a dense cover of planted white pine.

About 38 feet of tunnels and rooms were uncovered (Fig. 13) while six branch tunnels were left unexcavated because of their depth. The deepest was 43" below the surface of the ground and the tunnel was still going down.

The animal that had originally dug the den was perhaps a woodchuck. The skeleton of a woodchuck was uncovered at point I (Fig. 13). One of the nest rooms was lined with pine needles and below it were two successive layers of needles separated by a thin layer of dirt. This would indicate that the den had been in use for quite some time, possibly three years.

An observation two days after the excavation had been filled in showed that some animal had been covered up in one of the branch tunnels and it had dug its way out. There is doubt as to the species of animal that was covered up. The exit was near point E (Fig. 13). A device was set but heavy rains caused the earth to settle and cave. The device was lost.

Tracks of a cottontail rabbit were found leading to and from this same entrance on January 1, 1947, indicating continued use of the den even after so great a disturbance.

Laboratory technics

Hair identification by microscopic analysis is a great deal

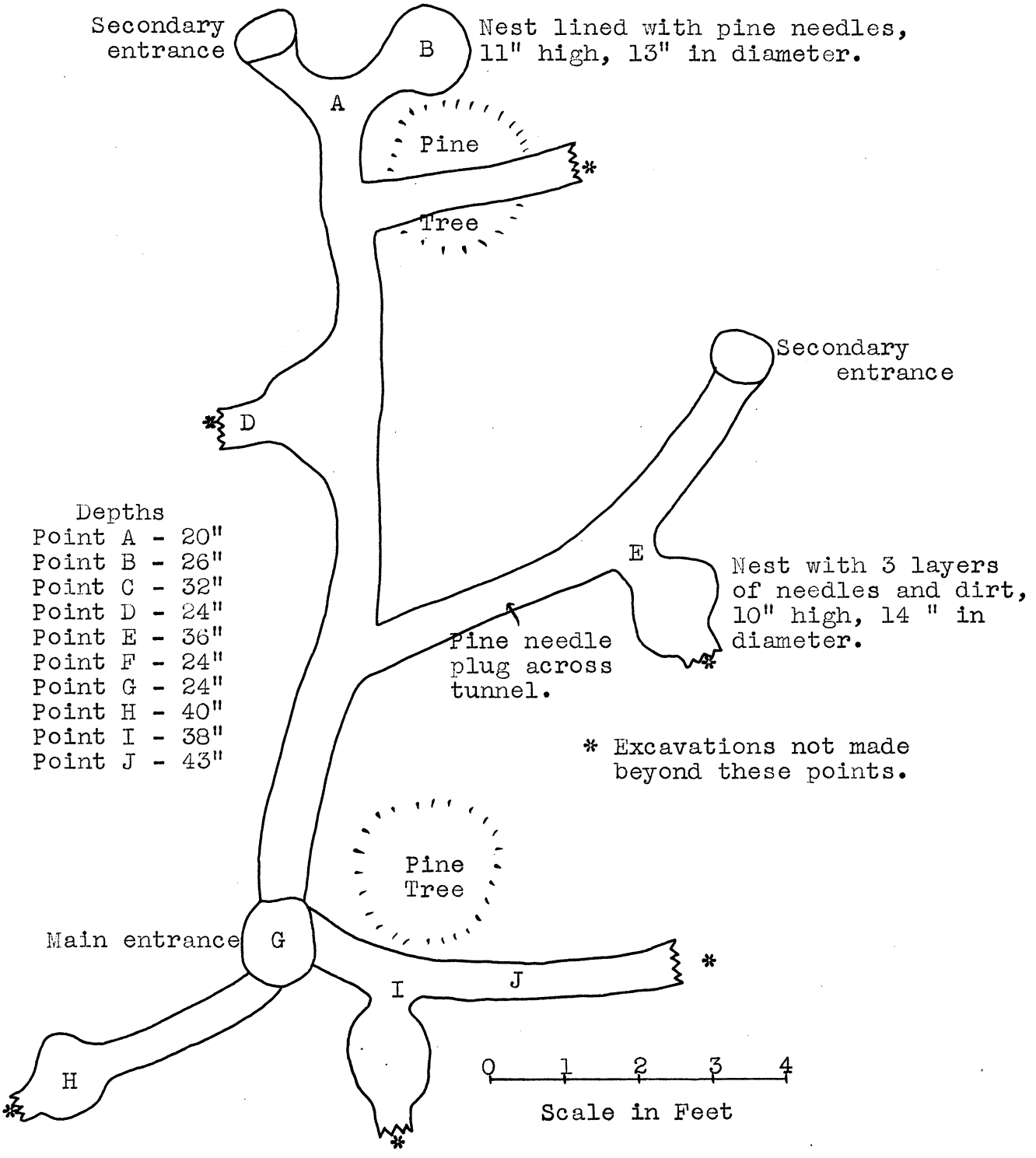


Fig. 13, Top View of an Excavated Den

more difficult than might be indicated by much of the existing literature. The great variation of hair patterns among animals account for much of the difficulty. As the identification of the hairs is a very important part of this work, it is necessary to be familiar with hair as seen with and without the microscope. A combination of characteristics may be necessary in many cases for successful identification. The location of the den may help to narrow down the number of species under consideration.

If little is known concerning the character of hairs, the work should commence with elementary hair studies as can be found in Bachrach (2) or Wight (20). Nomenclature is important in any study, hair being no exception.

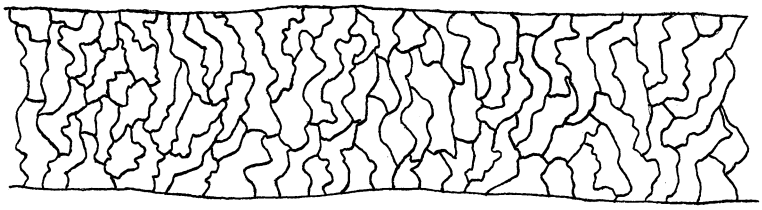
The available literature, however, should not be relied upon too heavily for identification purposes. Photomicrographs or enlarged drawings of hairs that are published in books or journals may be of some help to a beginner in the study of hair, but usually these illustrations do not begin to bring out the tremendous variations encountered in some species.

Mathiak (18) has developed a key for identifying mammal hairs. His first assumption is that the total length of the unknown hair is present. This may not be the case, and if the hair is fragmentary as it often is, the key is of little value. The use of an ocular micrometer and the cross-sectioning of hairs are time-consuming technics that may not be worthwhile in gross microscopic studies. Both are required in the use of this key.

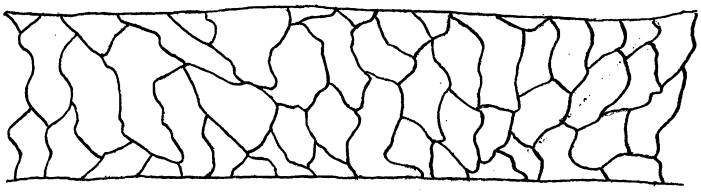
The study of known specimens of hair is the most satisfactory method of developing the required familiarity. Because of the numerous differences to be found, many hair drawings showing variations in each species of animal anticipated on a particular study area should be made. Under the microscope, reflected light often reveals characteristics not seen with transmitted light. Colors are sometimes accentuated with reflected light, but should be noted and not relied on to any great extent as a positive identifying feature.

Microscopic observations of scale patterns proved to be of great value for some species. Hardy (8) and Manby (15) and (16) use a technic involving the use of celluloid to obtain scale impressions. The technic is successful but requires a great deal of care to obtain good results and it also entails considerable work of a delicate nature. The method used in these studies to show the scale pattern was made with a streak of fingernail polish on a clean micro-slide. This method is very simple and good results may be obtained after very little practice.

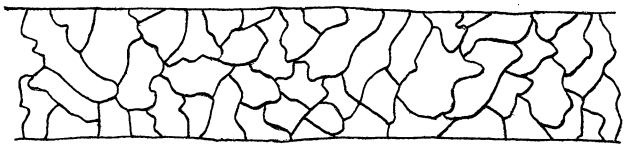
A light streak of nail polish (natural) is made on a clean micro-slide and the hair is drawn tightly through the liquid by holding each end with the fingers until the polish is dry. A thick layer of nail polish shows little scale detail and also causes the edges of the hair groove to tear raggedly away when the hair is removed. Holding the hair straight and tight gives a more even impression and facilitates microscopic observations. When the nail polish has thoroughly dried, the hair is removed.



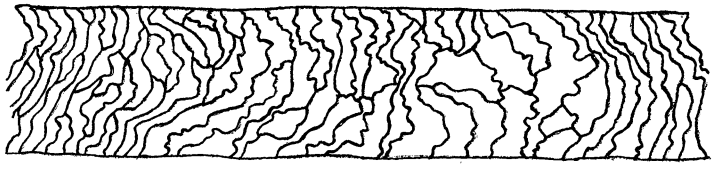
Woodchuck
(Guard hair)



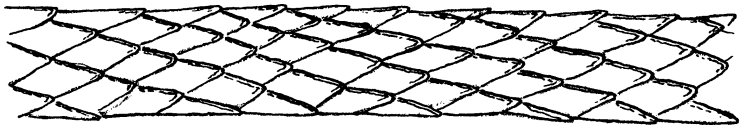
Opossum
(Guard hair)



Skunk
(Guard hair)

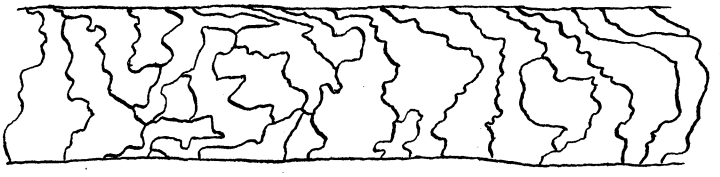


Weasel a.
(Guard hair)

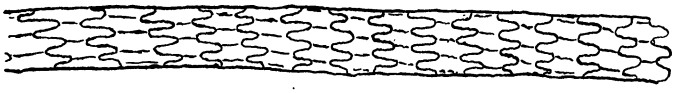


Weasel b.
(Guard hair)

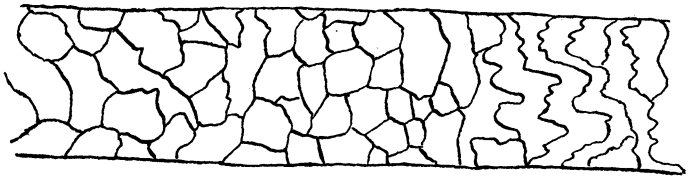
Fig.14, Hair scale patterns of some common Michigan ground-denning mammals.



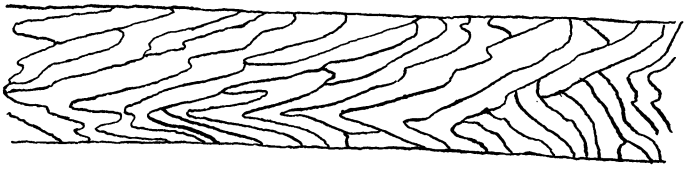
Red fox
(guard hair)



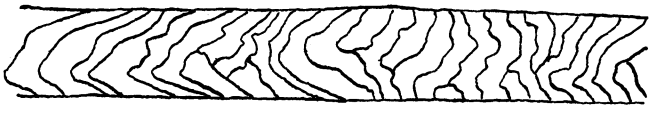
Red fox
(fur hair)



Badger



Rabbit
(guard hair)



Rabbit
(fur hair)

Fig.15 , Hair scale patterns of some common Michigan ground-denning mammals.

The groove left by the hair is studied in the same manner as any other microscopic specimen.

Figures 12 and 13 show hair scale patterns of some of the common ground-denning mammals of southern Michigan. Variations occur in the scale patterns as well as in general hair patterns. A few variations are presented in the accompanying drawings, but they are not to be considered as complete or representative of the species.

Success in hair identification

Varied degrees of success in hair identification were encountered. Most of the hair catches were identified because cottontail rabbit formed the bulk of the hairs caught. Hairs of the rabbit are distinctive and little other than a quick microscopic examination is needed. It is also easily identified without the aid of a microscope, but checks were always made under magnification. Weasel hairs were also quite easily identified in the field. The white hairs of skunk and opossum look very much alike and often considerable amounts of microscopic observations were necessary.

Some specimens required many comparisons with known hairs to identify them. Others went unidentified after more than an hour of comparisons.

Conclusions

1. Hair-catching devices are practical to make and are successful in the field.

2. Hairs of rabbit, skunk, opossum, fox, and weasel were caught and definitely identified. Similar success should be encountered with other species as well.

3. Ground dens receive much more use in colder weather than during warm weather.

4. Dens are used by different species of animals within a relatively short period of time.

5. Hairs of any species or even of one animal may show great variation in their patterns under the microscope.

6. Identification of hairs under a microscope can be accomplished satisfactorily only after thorough studies of known specimens have been made.

7.Use of hair-catching devices is of practical value in small mammal studies where the species of animal inhabitant of a den is unknown. They may be used to determine when dens come into use and when they are abandoned. They may also be used to determine the use of a den by more than one species of animal. Population studies may also be facilitated by the use of these devices.

Year-round den-use studies are yet to be ma de. Intensive studies on dens may indicate better the correlation between temperature, other atmospheric conditions, and the use of dens. Studies on hair identification and the technics involved have only begun to be worked out. Studies concerning variations of scale and general hair patterns must be worked out in detail. Complete examinations of many hairs from various parts of the body of each species would be required to cover the variations

It is also hoped that other technics will be developed to aid in the identification of mammalian hairs.

DATA ON HAIR TRAPS

Date set: _____ Time set: _____

Date observed: _____ Time observed: _____

Location of trap -

Geographic: _____

Geologic (soils, etc.): _____

Cover type: _____

Type of Trap: _____

Den number: _____

Hairs caught: _____

Description: _____

Abundance: _____

Microscopic analysis:

Determination of den use:

Species of animal: _____

Remarks: _____

_____

_____

_____

Odor check with hairs and diggings: _____

_____

Fig. 16

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