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PRELIMINARY STUDIES OF BOBCAT ACTIVITY PATTERNS

J. Thomas Kitchings and J. D. Story

Environmental Sciences Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

Galley proofs should be sent to: J. Thomas Kitchings

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DISCLAIMER

PRELIMINARY STUDIES OF BOBCAT ACTIVITY PATTERNS

ABSTRACT

Home range and activity patterns were determined for two radio-collared bobcats, one male and one female, in an eastern Tennessee hardwood forest. Home range of the male was calculated to be approximately 3076 ha while the female utilized 1416 ha. Both bobcats' ranges were larger than previously reported values for the southeast. Measurements of both average net distance traveled per day showed the male moved a statistically significant greater distance than the female. The larger home ranges may be primarily the result of relatively low prey populations in the mountainous terrain of East Tennessee as compared to upper coastal plains areas where most of the previous research on southeastern bobcats has been carried out.

INTRODUCTION

In recent years the bobcat (Lynx rufus) has become an economically important fur bearer, in part due to the animal's becoming a substitute for the large spotted cats whose fur is no longer available on the international market (Laycock 1978). This change in the bobcat's status has brought an urgent need for more knowledge about the animal's behavior. While progress has been made in gaining this knowledge in some parts of the United States, the bobcat has received relatively little attention in the Southeast, in general, and virtually no attention in the State of Tennessee.

On the Department of Energy's Oak Ridge Reservation in East Tennessee more knowledge of the bobcat's habits was needed for the overall wildlife management program. In March 1978, a study of bobcats of the area was initiated with the radiotagging of an adult female and the subsequent capture and tagging of an adult male. The prime objective of this initial study was to determine the approximate size of home ranges of bobcats on the Oak Ridge Reservation, but we also hoped to obtain information on movement patterns while evaluating the use of radiotracking equipment in the ridge and valley terrain of the Reservation. We gratefully acknowledge the assistance of Dr. Hiram Kitchen at the University of Tennessee School of Veterinary Medicine in Knoxville, Tennessee, in anesthetizing the bobcats in this study.

MATERIALS AND METHODS

Study Area

The Oak Ridge Reservation is located 24.1 km west of Knoxville, Tennessee. Its southern, western, and eastern boundaries are formed by the Tennessee Valley Authority's (TVA) Melton Hill and Watts Bar Reservoirs on the Clinch River. The city of Oak Ridge forms the northern boundary. The area has been under government control for thirty years and has not been unduly disturbed except for experimental use, regulated forest management, highways, and transmission lines.

The dominant oak-hickory association on the 15,000-ha Reservation contains elements of the mixed mesophytic association commonly found in the adjacent Cumberland Mountains. The oak-hickory association is

typified by extensive stands of mixed yellow pine and hardwoods as well as oak and hickory. Yellow poplar often forms nearly pure stands on well-drained bottomlands and lower slopes, while willow, sycamore, and boxelder border streams and are dominant on poorly drained floodplains. Species more commonly found in the mixed mesophytic association, such as beech, sugar maple, magnolias, buckeye, and basswood, often occur in coves and sheltered slopes. In addition, approximately 2000 ha of the Reservation were planted in loblolly pine between 1947 and 1956 while smaller acreages have since been planted in loblolly pine, black walnut, river birch, sycamore, and poplar (Kitchings and Mann 1976).

Trapping Procedures

Bobcats used in our study were captured in Sullivan live traps using parts of road-killed whitetailed deer (Odocoileus virginianus) as bait. Traps were set along gravel backroads where bobcats had been observed. Captured animals were taken to the University of Tennessee School of Veterinary Medicine where they were transferred to a squeeze cage and then anesthetized by an intramuscular injection of Ketamine hydrochloride. The first animal, an adult female, 6.8 kg, caught on March 2, 1978, was equipped with a transmitter and released March 4, 1978, at the capture site. The second bobcat, a 9.5-kg adult male, caught on March 31, 1978, was measured, ear tagged, equipped with a transmitter, and released at his capture site on April 4, 1978. While the animals were held in captivity, food and water were supplied ad libitum.

Radio Equipment

Transmitters used in this study were the pulsing, high frequency type in the 150-mHz range, purchased as prepared units from Wildlife Materials Incorporated. Battery life for these units is listed by the manufacturer as 555 days ± 111 days.

A single receiver was used with a truck-mounted whip antenna and a hand-held four-element Yagi antenna. Range of reception varied and while signals were received at distances up to 3.79 km on both the whip and Yagi antennas, most bearings were taken at distances of 1.6 km or less from the transmitters. All tracking was done from the ground, and there were a few days when we were unable to locate the bobcats. On the few occasions when we were able to obtain only one bearing for an animal, no attempt was made to estimate the distance to the transmitter along this one bearing; we found that signal strength varied tremendously depending on the cover afforded the bobcat by its immediate surroundings.

Radiotracking Procedure

The general location of a bobcat was determined using the truck-mounted whip antenna and driving until the signal from one of the bobcats was received. This antenna also enabled us to select sites of optimum signal strength before trying to determine the magnetic bearing to the transmitter. Once a site was selected, the truck-mounted antenna was disconnected from the receiver and the hand-held Yagi was connected. The direction of greatest signal strength was then

determined using the Yagi antenna, and the magnetic bearing was read from a Silva Type 1 hand-held compass.

Magnetic bearings were plotted on a 1:24,000 scale map using a Jeppesen Navigation Plotter. While two such plots separated by a sufficiently wide angle (preferably 45° - 135°) showed the approximate location of the bobcat, frequently a third bearing was taken to verify the accuracy of the first two. Practice sessions with the two transmitters used in this study and with other similar transmitters demonstrated that radio-locations were 148 ± 30 m (N = 23) within actual location.

Data Analysis

Home range areas were determined by the convex polygon method to facilitate comparisons of our data with those of other investigators. Jennrich and Turner (1969) pointed out that the convex polygon method severly underestimates the home range, particularly when the sample size low. However, based on subsequent calculations by Gardner (personal communication, Oak Ridge National Laboratory, 1978), the sample sizes in our study and those in the literature are large enough that the convex polygon estimation is almost the same as the area estimation achieved by use of Jennrich and Turner's approach. To compare daily movements between the male and female, the linear distance between five or more consecutive daily locations was measured. The "student's" t test was used to determine statistical significance between the means of the two samples.

RESULTS

Home Range

The total area covered by each of the bobcats during the March 4-May 23 tracking is shown in Fig. 1. The female was located 159 times during 68 tracking-days from March 4 through May 23, 1978, while we located the male 83 times during 34 tracking-days from April 4 through May 17, 1978. Areas used by the female and male were calculated to be 1405 ha (8.67 km^2) and 3089 ha (19.09 km^2), respectively. These calculations were based on 159 and 83 radio locations for the female and male, respectively. The ratio of the area covered by the male to that of the female is 2.2 and overlaps 90% of the female's range (Fig. 1). Visual observations of a third animal near the northeast perimeter of the male's territory indicated that at least one other animal was in close proximity to the two being radiotracked, but attempts to trap this individual were unsuccessful.

Movements

The tracking data revealed that the animals were generally most active between 5 p.m. and 11 a.m. The female utilized easily recognizable daytime resting areas up until the time she chose a permanent den site. After recording daily positions for the female during the first two weeks after capture, we spent two five-day periods (March 20-24 and 27-31) taking periodic measurements of the animal's position from 4 a.m. to 12 p.m. and 5 p.m. to 1 a.m. The number of locations per day varied from 3 to 13. During the first five days (March 20-24), the

female appeared to spend most of her time in the area outlined in Fig. 2, Map A. The daytime resting areas were consistently used during this period. Tracking during the second five days indicated that the female had moved eastward (Fig. 2, Map B) and established a permanent den site. Previous daytime rest areas apparently were abandoned once the major den site was determined. Subsequent daily tracking during the month of April confirmed the continued use of the area as a den site.

In the first week of May, continuous tracking was again undertaken (Fig. 2, Map C). The areas covered by the female bobcat during the March 27-31 and May 1-5 periods were 259 ha and 235 ha, respectively, approximately 18 and 17% of the total home range measured for the entire period from March to May. The existence of a number of temporary dens was indicated. On two occasions the female was disturbed by our presence in the area near the major den site.

Data accumulated on the male bobcat since his release did not indicate the use of a number of well-established daytime resting areas. Nor did the male seem to restrict his movements to any particular area during the period May 1-5 when continuous measurements of his movements were made in conjunction with those of the female. In fact, he was located virtually throughout his range (Fig. 1) during the tracking effort.

While the number of locations per day varied from 3 to 13, net distance between daily locations always was calculated from the first location of each (whether the cat was located three or thirteen times). Measurements of net distance between daily locations showed the male moving a significantly ($P < 0.001$; $t = 126.8$, d.f. 84) greater

distance, averaging a net distance of 3.30 km per day, while the female covered 1.03 km daily. The actual distance that the cats moved on a daily basis is much greater than indicated by daily average net distance. Determinations of average net distance moved by a cat during a day were based only on days on which we obtained five or more locations; the female measurements were based on 96 locations on 13 days, while the male measurements involved 38 locations on 4 days because we could not actually measure the circuitous routes taken by the moving cats. On days when five or more consecutive locations were identified, the female moved an average distance of 3.98 km (range 1.2 - 8.5 km) while the male covered an average distance of 8.81 km (range 5.8 - 11.7 km). These values are significantly different at $P < 0.001$ ($t = 6.41$, d.f. = 14).

Even though no direct observations of hunting by either bobcat were made, the location of animals during the active period pointed to extensive use of early successional vegetation. Maintained experimental old-fields, power-line rights-of-way, and roadsides comprised the majority of locations, with swamp-like floodplain and cutover areas around nuclear waste disposal areas also being used for hunting. These types of vegetational communities would, of course, be prime areas for both rabbits and cotton rats.

It was not unusual to find either animal moving during the daytime. However, most hunting is believed to have been done at night. Vegetative cover was so dense in the areas used by the bobcats that neither animal was observed during radio-tracking operations.

Adult Interactions

We found the male and female together in the vicinity of the den site on seven different occasions. At no time during our night tracking did we find any indication that the male and female worked together during hunting efforts.

DISCUSSION

The area used by the two animals reported in our study are considerably larger than the home ranges calculated for the southeast area by Marshall and Jenkins (1966) and by Miller (personal communication, Auburn University, 1978). The former calculated ranges of 247 and 463 ha for two females and 347 ha for a young male, while Miller reported females utilizing 202 ha and males twice that - 405 ha. In both cases the study sites were composed of larger areas of old-field type vegetation, areas where prey species would be abundant, thus limiting the necessity for extensive excursions for food. The large range of our two cats probably reflects the low food base available in the area. Of the total acreage included in the range calculation for both sexes, there is less than 40.5 ha of actual old-field. While we have no data for prey abundance because these studies are just getting under way, informal discussions with a colleague working with cotton rats indicates that population values are low possibly as a result of the severe 1977-78 winter. Likewise, visual observations of cottontail rabbits along roadsides do not indicate an abundance of this species either. We feel that the usage area of the bobcats is indicative of those areas

in the Ridge and Valley Province where vegetation is principally forest with only a small proportion in active or abandoned farmland.

While small game, such as rabbits and rodents, comprise a large portion of the bobcat's foodstuff, they are by no means the only food source. Literature on bobcat food habits indicate that remains of whitetail deer are a commonly found component of the cat's diet (Marston 1942, Rollings 1945, Progulske 1955, Pollack 1951, and Young 1958). A report on the bobcat in Tennessee (Buttrey 1978) indicated that 20% of stomach content samples taken from animals in the Cumberland Plateau area contained remains of whitetail deer. While more deer was found in bobcat stomachs during hunting season than during spring and summer, and most deer probably was eaten as cassion, Buttrey felt that "regardless of how acquired, deer constitutes a substantial portion of the bobcat's diet." Reports of bobcats attacking and killing adult deer are common (Marston 1942, and McCord 1974), and it is possible that this species provides food for the bobcats on the Oak Ridge area. Deer are abundant on the Reservation because hunting is prohibited and because they are going through a stage of rapid population growth, thus making this species more available to the cats as a food source. The interaction between the deer and the bobcat warrants further investigation.

Bailey (1974) also found the male bobcat's range to be 2.2 times greater than that of the female. As he pointed out, survival of the offspring is highly dependent on the female's successful rearing of the kittens and thus she must be less mobile than the male. This is supported by our finding a significant difference in average net distance

moved daily by males and females and in linear distance between day-to-day locations.

Various studies (Marshall and Jenkins 1966 and Bailey 1974) have noted a close proximity between sexes on occasion but no long term interaction. None of the literature we surveyed indicated that males have any rearing responsibilities and none of our data supports any conclusion to the contrary.

We believe that, in a situation like that at Oak Ridge, there probably exists a firm territorial system with a set spatial arrangement of resident bobcats as described by Marshall and Jenkins (1966) and Bailey (1974). The protection from hunting probably affords resident bobcats a considerable degree of permanence of their social organization (home range, territory, interactions with other bobcats) not enjoyed by animals in hunted areas. Consequently it may very well be that the Reservation acts as a nursery or reservoir for this species. As young reach an age of independence and leave the mother, they may move off the Reservation into areas where they are then accessible to trappers and hunters. Bailey found that young leaving the protected area in his Idaho study were then being captured by fur trappers.

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FIGURE LEGENDS

Fig. 1. Home range estimates for a male and a female bobcat radio-tracked on Oak Ridge Reservation from March through May 1978.

Fig. 2. Areas used by a female bobcat radio-tracked on Oak Ridge Reservation during three five-day periods of intensive radiolocation efforts.

Map A: Area used March 20 through March 24

Map B: Area used March 27 through March 31

Map C: Area used May 1 through May 5

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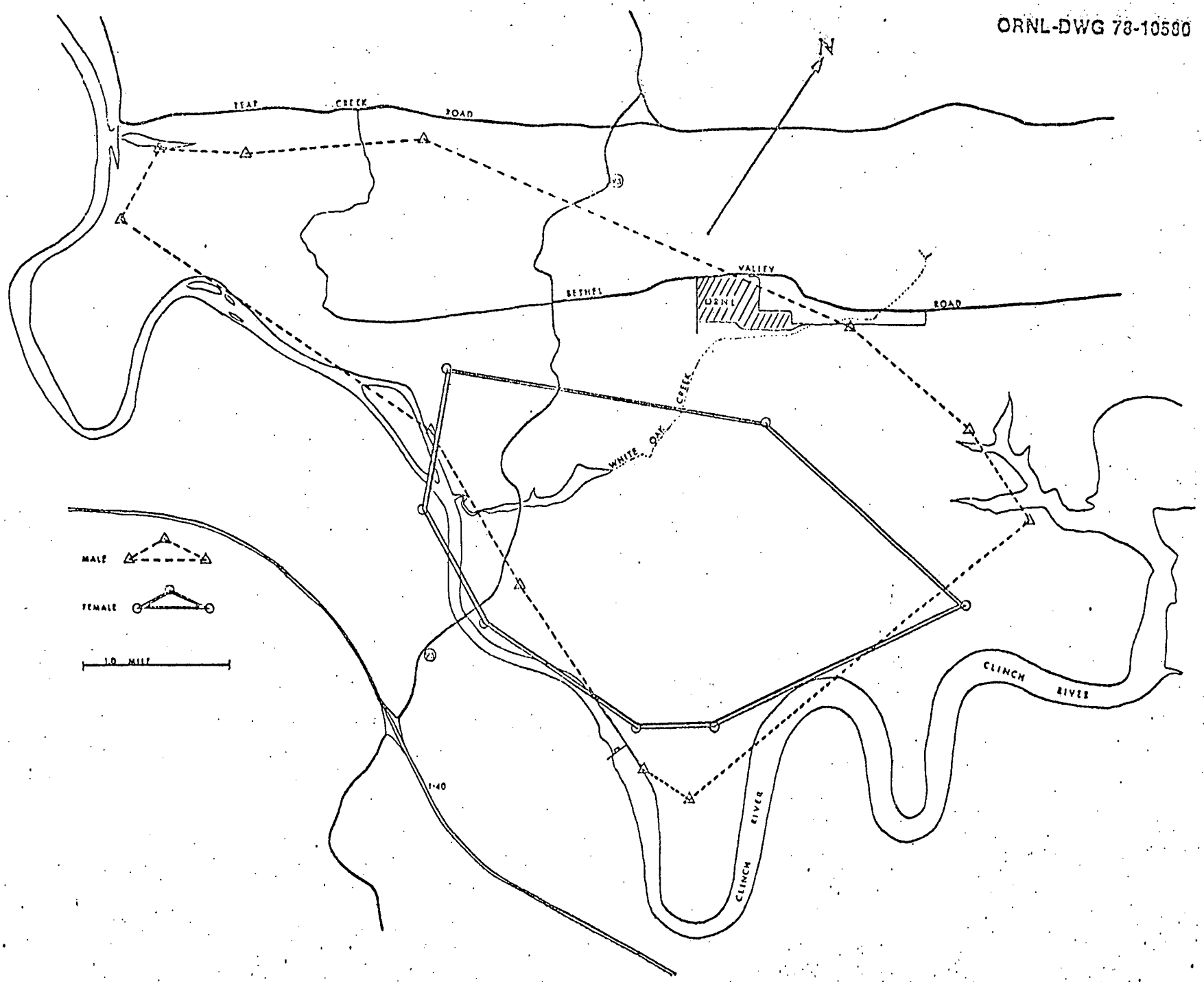

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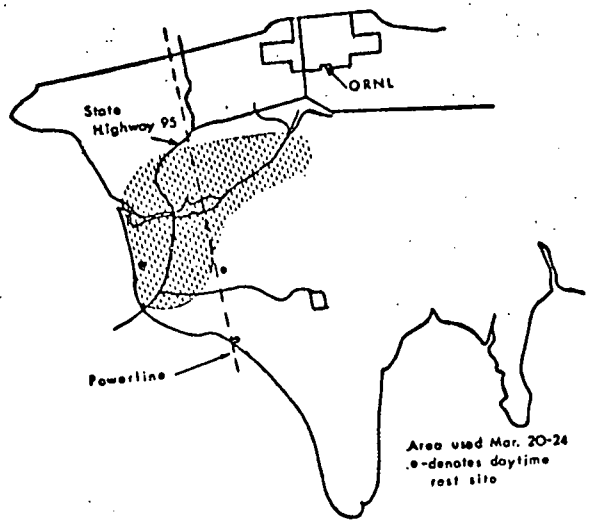
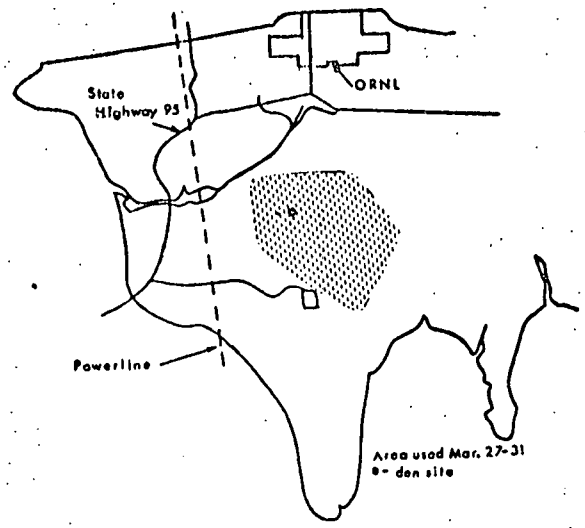


MAP A



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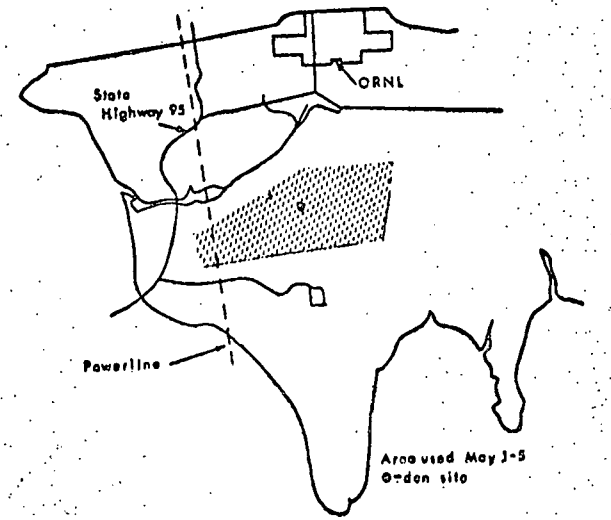

MAP C