Silver metal was stored until it was convenient to convert it to silver nitrate according to the following procedure.

To 4.0 g of silver metal, was added 50 mL of 6 M nitric acid. After the silver dissolved, the solution was filtered through a sintered glass crucible. The volume of aqueous silver nitrate was reduced to about 10 mL on a hotplate. The residue was oven dried (yield: 6.19 g, 98.3%).

Nitrogen dioxide gas forms slowly as silver is oxidized to silver nitrate by nitric acid.

$$Ag + 2\ HNO_3 \rightarrow AgNO_3 + NO_2 + H_2O$$

Nitrogen dioxide is a reddish brown, deadly poisonous gas, and even short exposures to it at levels greater than 200 ppm may cause lung inflamation, edema, and death. Inhalation must be avoided by performing the reaction above under an exhaust hood.

DISCUSSION

The methods have been used successfully to reclaim silver from the chloride and for recycling old silver nitrate solutions to silver nitrate of adequate purity for use as a quantitative reagent.

Important factors in deciding to reclaim silver from laboratory wastes are the relative costs of the reducing agents and silver nitrate. These costs vary. Copper is about $30 per 500 grams and sodium borohydride is about $25.00 for 25 grams (reagent grade, Fisher, 1984). Scrap copper, which costs far less than reagent grade, can be used for reduction of the silver diammine complex. As a reducing agent, sodium borohydride is fast and efficient. One gram will reduce 18.0 g of silver nitrate to 11.4 g of silver metal. There were several opened, pound cans of sodium borohydride in two organic synthesis labs when we began this project. Organic chemists usually will not risk exposure of hard-won synthetic intermediates to reagents of unknown purity, so it was easy to obtain the sodium borohydride "free." Its consumption in reclaiming silver therefore solved two disposal problems. Use of sodium borohydride as the reducing agent, instead of copper, saves time. Students did all this work without pay. If labor costs have to be included, the cost of the silver nitrate, recycled using either technique, might be higher than $300 per pound.

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DENSITY ESTIMATION OF A RACCOON POPULATION IN WESTERN TENNESSEE

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ABSTRACT

Density was assessed for a population of raccoons (*Procyon lotor*) during March of 1982 using mark-recapture techniques. The study was conducted on an upland hardwood forest site at Land Between The Lakes in Stewart County, Tennessee. Twelve raccoons were captured; seven were recaptured one or more times. Density was one per 34.3 ha.

INTRODUCTION

Various investigators have estimated the population density of raccoons (*Procyon lotor*) in a variety of habitats and regions of North America. Lotze and Anderson (1979) summarized much of the available literature. Density estimates for raccoons are difficult to derive. This is partly due to the physical difficulties in working with a species having a large home range and to the fact that in most cases the number of animals included in a sample will be small. However, difficulties in estimating abundance does not exclude the need for such information. Management programs are difficult to construct and implement without knowledge relating to population density.

Minser and Pelton (1982) summarized raccoon density estimates for areas in Tennessee. With the exception of Moore and Kennedy (in press), no estimates are available from western Tennessee. The purpose of this study was to

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assess raccoon density in upland hardwood forest, at a time before parturition, using mark-recapture techniques. Investigations of this type should provide a basis for the understanding of raccoons in western Tennessee and provide general information useful in management of the species.

MATERIALS AND METHODS

The study was conducted in an upland area dominated by oak-hickory forest at Land Between The Lakes (LBL) in Stewart County, Tennessee. The site, located on the dividing ridge near the middle of LBL, was interspersed with rolling hills and moderate to deep hollows having intermittent streams; only two small ponds provided permanent water.

Raccoons were captured using Havahart and folding Tomahawk live traps. Tree branches were piled along the sides and backs of traps to prevent animals from robbing bait (fish or sardines) from the outside. On the morning of capture, animals were immobilized with ketamine hydrochloride and acetylpromazine and tagged in both ears using #3 or #4 Monel ear tags from the National Band and Tag Co. All animals were released in good condition at the trapping site on the morning of capture. Raccoons were usually mobile within 10-15 minutes.

Mark-recapture data were obtained from 13 to 22 March 1982 and from 26 March to 28 March 1982. Trap configuration was that of an 8 x 8 grid (traps spaced at about 230 m intervals) distributed over 259.0 ha. The trapping scheme was based on the work of Allsbrooks (1981), Moore (1983), Smith (1983), Moore and Kennedy (in press), and several months of preliminary trapping on the actual study site. This scheme represented optimum conditions (stable population structure, minimal fluctuations in movements due to seasonal change, and favorable attraction to bait) for estimating seasonal density. To compensate for animals whose movements only partially occurred on the grid, total area of effect (following Moore and Kennedy, in press) was considered to be the area of the grid plus a surrounding border strip equivalent to one half the mean greatest distance between points of capture for all raccoons. Population size was determined according to the computer program CAPTURE of White et al. (1978) as discussed by Otis et al. (1978). Since Moore and Kennedy (in press) reported differences in the probability of capture among individual raccoons, the Jacknife estimator (model M_h) from CAPTURE (Otis et al., 1978), which assumes unequal catchability between individuals, was used to determine population size on the grid. Confidence limits (CI) were determined at 95 percent.

RESULTS AND DISCUSSION

Twelve raccoons (nine males and three females) were captured; seven were recaptured one or more times. The mean greatest distance between points of capture for all animals was 758 m. After adding a strip half this wide (379 m) to the grid, total area of effect was calculated as 549.0 ha. Because some raccoons were caught whose home ranges were not wholly contained within the trapping grid, the addition of this strip should produce a more accurate estimate of density. Using the Jacknife estimator, calculated population size on the grid was 16 animals (CI = 10 to 22). Density was one per 34.3 ha (544.0 ha divided by 16).

The highest raccoon density we found reported in the literature was about one per 0.4 ha (Twitchell and Dill, 1949). Population densities of one per 5.0 ha to 43.0 ha are more typical (e.g., Yeager and Rennels, 1943; Butterfield, 1944; Lehman, 1980; Moore and Kennedy, in press). The overall estimate (over all seasons) of Moore and Kennedy (in press) was one per 7.2 ha for a site in Shelby County, Tennessee. Since this value represented post-parturition samples as well, it is not directly comparable to our minimum density estimate. However, the site studied by Moore and Kennedy (in press) was near the Mississippi River in a large tract of lowland hardwood forest associated with the Shelby Forest Wildlife Management Area. Since this habitat would seem more favorable (with marshes, swamps, and numerous tree dens) for raccoons, higher density in this habitat could be expected.

Minser and Pelton (1982) summarized density values for several studies conducted in eastern Tennessee. Estimates ranged from one per 17.4 ha to one per 52.2 ha and lower (sample sizes reported as too small to determine a density value for some studies). Since these studies included post-parturition samples, they are also not directly comparable to our minimum density estimate. However, there appears to be considerable variation in density estimates in different habitats. Additional studies are needed in Tennessee to better understand density-habitat relationships.

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