AN ANALYSIS BY TAG RETURNS OF THREE YEARS CONTROLLED SQUIRREL HUNTING

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INTRODUCTION

Each year in the State of Louisiana countless thousands of hunters take to the woods, swamps and creek bottoms in quest of the elusive squirrel. If the total yearly kill were known it would probably run into staggering figures. Yet in spite of the annual pounding by hunters the squirrel manages to hold its own except in areas where the habitat is altered by extensive timber stand improvement and timber cutting operations. It was in an attempt to gain some limited knowledge of the effects of hunting pressure on squirrels that this study was begun. Laymen have long contended that open seasons on squirrels in the game management areas "wipe out" the squirrels. Strong criticism of such open seasons has in the past prevented management areas from opening.

It should be made clear from the beginning that this study was originated and executed with the sole purpose of providing basic information on the effects of hunting pressure on squirrel populations. Other information was taken from the trapping and/or bag check records only in cases where the continuity of the records and the size of the samples involved would permit unbiased analysis.

DESCRIPTION OF AREA

Grant-Rapides Game Management Area was chosen as the area on which to conduct a study of the effects of hunting pressure on squirrels for two main reasons. First, there was an existing high population of squirrels; and second, it had a fairly accurate system of recording the number of hunting efforts expended and the number, sex, and approximate age of all squirrels taken from the area. Both of these factors are prime requisites for a study of this type. The following is a brief history of the managed hunts held on Grant-Rapides Game Management Area.

Year	*Date Season Opened*	*Bag Limit*	*No. Days Opened*	*Total Hunts Made*	*No. Squirrels Killed*	*Average Kill Per Hunting Effort*
1955	10- 1	10	15	2,540	5,281	2.1
1957	10-18	10	14*	1,410	2,445	1.7
1958	10- 1	8	10*	757	1,059	1.39
1959	10-17	6	10*	1,020	1,901	1.86
TOTAL				5,727	10,686	1.86

* Half days only.

The primary species of squirrel encountered during this study was *Sciurus niger subauratus*, the bottomland race of the Fox Squirrel. A small number of Grey Squirrels, *Sciurus carolinensis carolinensis* were also tagged.

Geographically speaking, Grant-Rapides G. M. A. is located in central Louisiana partly in southern Grant Parish and partly in northwestern Rapides Parish. Approximately half of its 6,000 wooded acres lies in each of these parishes. The Red River serves as the southern boundary of the area.

As would be expected of an area lying adjacent to a major stream, the timber type is typical hardwood bottomland similar to that found on the alluvial flood plains of all the major streams in Louisiana. The principal species of trees encountered are Water Oak (*Quercus nigra*), Willow Oak (*Quercus phellos*),

Nuttall Oak (*Quercus nuttallii*), Hackberry (*Celtis laevigata*), Green Ash (*Fraxinus pennsylvanica*), Bitter Pecan (*Carya acquatica*) and Red Gum (*Liquidambar styraciflua*).

Throughout the entire area there are a number of slightly elevated ridges and a network of small intermittent bayous and sloughs. Two large permanent bayous also cross the area.

The area is cut almost exactly in the middle by a railroad. On each side of the railroad track there are jeep roads which provide access to practically all corners of the area. On the eastern side of the woodland there is extensive pasture land which is extremely irregular in shape. Numerous necks and arms of pasture extend into the timbered portions. Approximately 2,500 acres are utilized as pasture. Accessibility to all corners of the area could be said to be generally good. In wet years, however, transportation becomes quite a problem.

METHODS

Trapping procedures were relatively simple. A commercial grade of live trap was used. These traps are constructed of 1 inch mesh welded wire and have outside dimensions of 6½ inches x 6½ inches x 19 inches. This type of trap is quite adequate for trapping squirrels. These traps were placed on scaffolds made of saplings nailed to the trap tree parallel to the ground and at a height of about four feet. The entrance to the trap was always placed facing the tree, although it is probably just as effective either way. Where possible, the saplings were nailed between the trap trees and other trees that happened to be within five or six feet of the trap tree. Until 1959 all trap trees were picked because of size, species, and proximity to the jeep road. Having been so selected they were permanently marked with yellow tree marking paint denoting the trap station number. Pecans were used exclusively for bait. It is desirable to use cracked pecans which apparently radiate their scent better than uncracked ones. The importance of pre-baiting a trapping line cannot be stressed too much. There is a time lapse between the time that bait is put out and when the squirrels first start using the bait. One can avoid spending many unproductive hours by pre-baiting with an ample supply of pecans and not setting the traps until good usage of the bait is exhibited. There appears to be no period of conditioning to the presence of the trap, hence, it is unnecessary to position the trap at the time of the pre-baiting. Trapping was tried both ways on several occasions during this study and it appears that once the bait is found by the squirrel the individual can be caught almost immediately with complete indifference to a newly positioned trap.

All squirrels that were tagged during this three-year study were tagged with size number 1 tags made by the National Band and Tag Company. A special pair of tagging pliers made by the tag manufacturers was used in the application of the tags. Extreme caution was exercised in the application of the tags to the squirrels' ears so as not to cut off circulation. If the circulation is impaired or cut off the wound caused by the tag puncturing the ear becomes infected and the tag sloughs out of the ear. Tags were placed in the anterior leading edge of the ear and as near the head of the squirrel as possible to minimize tag loss. Tags not located in such a manner are apparently easily torn from the ear.

In removing a squirrel from a trap in preparation for tagging or reading of tag numbers, it was found that a cone shaped bag fashioned from ½-inch mesh fishing seine was ideal. The bag should be approximately 12 inches wide at the mouth and should be about 30 inches to 36 inches long. A drawstring around the mouth will hold the bag around the door of the trap. In removing the squirrel from the trap the tip of the bag should be held upward at about a 45-degree angle and the entire bag stretched taut so as to provide a straight passageway for the squirrel. Once the squirrel has entered the bag, he will race to the tip until he cannot move further forward. The squirrel can then be grasped firmly by the base of the tail and hind legs taking care to gather the netting about the hind quarters so as to maintain constant pressure forward in the bag. This keeps the animal wedged in the narrowing neck of the bag and renders him immobile. The squirrel can then be tagged, or numbers from already existing tags can then be read with ease.

RESULTS OF TRAPPING

Trapping operations for the three-year period of study yielded a total of 413 tagged squirrels. In 1957, 99 squirrels were tagged; 103 were tagged in 1958; and 211 tagged in 1959.

Due to the fact that they were subjected to the greatest hunting and trapping pressure, the squirrels which were tagged in 1957 have given the most returns. It is suspected that the squirrels trapped in 1958 and 1959 would have given similar returns if trapping and managed hunts had continued for another two years. Unfortunately the lease on the Grant-Rapides Game Management Area expired and was not renewed.

As it has been previously stated the initial trapping was done in 1957. Trap lines were placed along jeep roads with the traps being set on the permanently marked, individually selected trap trees. The entire area was covered by trap lines as near as possible. Trapping was conducted in June, August, September and October.

Although 99 individuals were tagged in 1957, only 98 can be assumed to have been available for the hunter and subsequent trapping. One tagged animal was found dead in a trap. By the use of tag loss computations which will be explained later in this paper, we find that 96 squirrels have retained their identity. Of these 96 individuals, 15 or 15.6% were killed during the 1957 managed hunt. Nineteen (19.8%) of the 96 were retrapped in 1958. Three (3.1%) were killed on the 1958 managed hunt. One individual (1.04%) was retrapped in 1959 and 2 (2.1%) were killed during the 1959 managed hunt. By totaling the percentages we find that 41.6% of the squirrels tagged in 1957 have been accounted for. The fate of the remaining 58.4% is not known. (See Figure 1.)

The trapping operation of the summer of 1958 was conducted in much the same manner as was the 1957 program. Trapping was done during the months of June and July. Traps were set at the same stations that had been selected the previous year. A total of 103 squirrels were tagged during the 1958 season. One of these marked animals was found dead in a trap prior to the 1958 managed hunt leaving 102 animals available. By the application of tag loss computations to be discussed later we find that 2 squirrels can be assumed to have lost their identity leaving 100 marked animals available to the hunter. Fourteen of these squirrels (14%) were killed during the 1958 managed hunt. Fifteen (15%) of the 100 squirrels were retrapped one year later in 1959. Seven (7%) were killed during the 1959 managed hunts. The total of these categories is 36%, leaving 64% of the original 100 marked squirrels still unaccounted for. (See Figure 2.)

Trapping procedure was modified quite a bit for the 1959 trapping program. Since all trapping prior to 1959 was done on jeep roads, it was felt that there was a possibility of getting a biased return of tagged animals. The reasoning behind this is simple. Many hunters follow trails and roads while hunting to lessen the amount of noise made in stalking. It would seem logical that if enough individuals hunted the roads used for trap lines, the number of tagged squirrels killed would not represent a true percentage of the hunter kill. In several cases, hunters have hunted trap line roads and killed as many as three tagged animals on one hunt. The trapping operation for 1959 was designed to see if trap lines on jeep roads did give valid information or if they were giving biased data. For this reason the area was divided into two parts, each to be trapped in a different manner. Since a railroad track very conveniently ran almost through the middle of the area, it was decided to use jeep road trap lines on the north side of the railroad and a new system of random trapping on the south side of the railroad. The jeep road trapping was conducted the same as it had previously been done. The new system of random trapping consisted basically of putting trap stations approximately 110 yards apart on parallel compass lines running completely across the area. These lines were marked only with plastic surveyor's flagging which was taken down when the traps were moved so as to prevent a hunter from following the line. These lines were tended on horseback. Due to the fact that good trap sites probably would not fall exactly on line and exactly at a distance of 110 yards from the last station on line, it was decided to allow the trap to be placed anywhere within a radius of one chain (66 feet) from the trap site point on the line. This distance is more than ample to meet any unusual circumstance encountered. Trap lines laid out in this manner eliminate the possibility of hunters biasing the sample by hunting trap lines.

It will be shown later in this report that tag returns suggest that in actual practice the lines run off of the roads get more tagged animals killed than those run on jeep roads.

During the course of the 1959 trapping operation a total of 211 squirrels were tagged. Seven of these animals were killed by predators before the managed hunts. It appears that raccoons were the culprits and once they learned the whereabouts of a trap, every squirrel caught in that trap was doomed. Of the 204 tagged squirrels assumed to have been alive at the end of the 1959 trapping operation, 100 were caught on the jeep run line and 104 were caught on the line tended on horseback. During the 1959 managed hunt there were 31 marked animals killed. By computing the number of individuals that have lost both tags and hence their identity we can adjust our totals of marked animals to compensate for those squirrels which can no longer be identified as a marked animal. Thus we can calculate that there were 98 squirrels on the jeep run trap line and 102 squirrels on the line run on horseback which are assumed to have retained their identity. This gives a grand total of 200 squirrels which have retained their identity. Eleven of the 31 marked squirrels which were killed on the managed hunt were tagged on the jeep road line. Since it is computed that there were 98 identifiable squirrels on the jeep road line it appears that 11.2% of the marked squirrels on that line were killed. On the line run on horseback a total of 102 marked animals are computed to have been available. Since 20 of the 31 marked squirrels killed on the managed hunts were tagged on the line that was run on horseback, 20.4% of the squirrels marked on the line tended on horseback are assumed to have been killed. By combining the kill from both lines and using the total computed number of marked squirrels (200) we find that 15.5% of the squirrels marked in 1959 were killed during the 1959 managed hunt. It is interesting to note that the total percentage of squirrels taken in 1959 is still surprisingly close to the previous year's percent of kill. By the examination of the records one might also conclude that squirrels tagged from jeep roads are less vulnerable than those tagged randomly through the woods. See Figure 3.

SEX RATIOS

Of the 99 squirrels tagged in 1957, 51 or 51.5 percent were males and 48 or 48.5 percent were females. A total of 103 animals were tagged in 1958, 42 (40.8 percent) were males and 61 (59.2 percent) were females. In 1959 the trapping effort produced 211 tagged squirrels; 107 or 50.7 percent were males and 104 or 49.3 percent were females. There appears to be an abnormally high percentage of females caught during the 1958 season. No attempt will be made to explain this situation. It was originally thought that perhaps the female was more susceptible to the trap at certain times of the year than was the male. A preliminary check of the trapping records of all three years' trapping showed no such pattern. It was attempted to plot curves of each year's trapping showing the number of males and females taken during each two-week period of the trapping season (1 June through 15 October). After assembling the data it was apparent that there is no correlation between time of the year and sex of the squirrels trapped insofar as the records of this study show. This should not be construed to be conclusive, however, since some of the samples involved were very small and thereby could have produced misleading results.

HOME RANGE

Although the trapping methods used in this study were designed primarily to tag squirrels for a study of the effects of hunting pressure, they do lend themselves to a limited home range study. From the outset of the study traps have been set at permanent stations on the jeep roads. Unfortunately it would take a detailed survey to prepare a map showing the distance relationships between these traps. In 1959 the trap stations used on the line run by horse were positioned at known distances apart (110 yards) on compass lines originating from a known point on a base line. The information that was obtained from this portion of the study gives us a limited knowledge of actual distances traveled for each of the times an individual was trapped. Each of these trap stations can be plotted to scale and the distance from one trap to another can

Fig. 1 - Diagram of Distribution of Tag Returns of Squirrels Trapped During the 1957 Trapping Season.

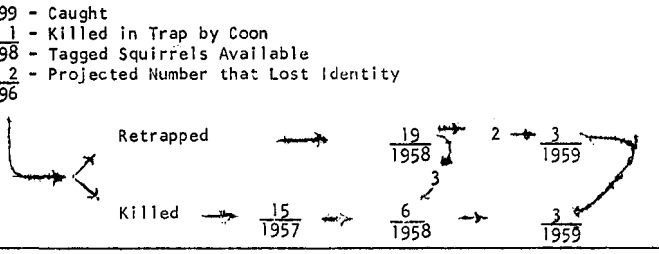


Fig. 2 - Diagram of Distribution of Tag Returns of Squirrels Trapped During the 1958 Trapping Season.

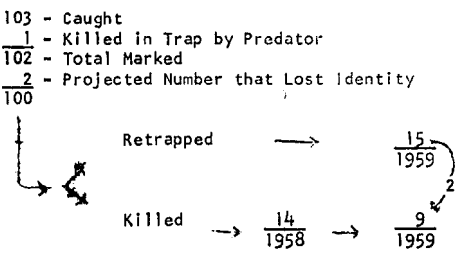
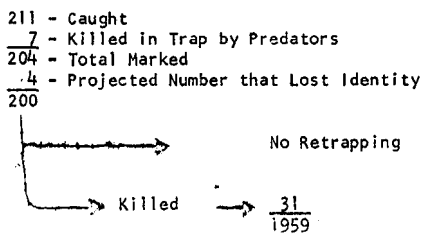


Fig. 3 - Diagram of Distribution of Tag Returns of Squirrels Trapped During the 1959 Trapping Season.



be quickly measured. In a vast majority of the cases however the animal was caught in the same trap.

All data that is used in compiling information on home ranges is naturally taken from records of animals that have been recaptured after the initial tagging. It is surprising to learn that only 38.0% (157) of all of the squirrels tagged during the three-year study (413) were retrapped one or more times. As would be suspected the squirrels tagged in 1957 as a group show more recaptures than do the squirrels tagged in other years due to the fact they were exposed to the trap for three seasons. See Table I.

It is interesting to observe that an individual squirrel is often caught in the same trap several times. A survey of the trapping records for 1957 and 1958 shows that 86 squirrels were trapped a total of 291 times. We find that 191 of these recaptures or 65.6% were made in the same respective traps. Does this imply that at the time of the year during which trapping is conducted that squirrels have a small radius of travel or does it imply that the animals quickly acquire the "trap habit"? To further augment the theory that squirrels do not have a wide radius of travel during the summer months is the data taken from the 1959 horse run trap line. We find that 36 squirrels were recaptured a total of 54 times. Since the traps on the horse line were placed at a known distance apart we can determine an average distance traveled from the point of initial capture. The 54 recaptures involved a total movement of 1,980 yards giving an average movement of 36.7 yards per recapture. The trapping records also reveal that 83.3% of the captures involving 36 squirrels were made in the same respective traps. In no case was an individual squirrel captured at traps more than 220 yards apart.

POPULATION CALCULATIONS

One of the more interesting applications of data recorded during this study is its use in the determination of an approximate total population number. It must be assumed that all squirrels tagged during 1959 and not recorded as having been killed by a predator during trapping operations were alive at the time of the hunt. It must also be assumed that any tag loss that did occur happened immediately after tagging.

There is a distinct possibility that a small number of the tagged animals may have lost their identity by the loss of both tags. Out of the 31 tagged squirrels recovered, 10 had lost either a left tag or a right tag. Specifically 3 individuals had lost right ear tags and 7 animals had lost left ear tags. By using these figures it is possible to arrive at an approximate number of squirrels that lost both tags and hence their identity. To arrive at such a figure we must also consider that 204 known marked individuals are assumed to have been available for the gun. Of 31 marked animals, 3 or 9.7% lost right ear tags and 7 or 22.6% lost left ear tags. By taking 9.7% of 204 (total squirrels tagged in 1959) we should have the projected number of marked animals that lost right ear tags. This is calculated to be 19.8 squirrels. If 22.6% of 31 marked squirrels lost left ear tags, would it then not be logical to assume that likewise 22.6% of 19.8 squirrels (projected number of squirrels having lost right ear tags) would lose left ear tags also? By using these figures we find that 4.5 squirrels of the 204 tagged squirrels have lost their identity. This can be used as a correction factor that is applied to the known number of marked animals assumed to be alive at the time of the managed hunt. Using this factor we find that 200 squirrels are retaining at least one ear tag. Records show that a total of 1,901 squirrels were killed on the 1959 managed hunt. Using this information a simple proportion is set up.

$200 =$ Corrected number of known marked squirrels
$31 =$ Total number of marked squirrels killed in 1959
$1901 =$ Total number of squirrels killed in 1959

$$\frac{31}{1901} = \frac{200}{X}$$

$$31X = 200\ (1901) = 380200$$

$$X = \frac{380200}{31} = 12{,}265$$

$12{,}265 =$ Computed approximate population in 1959.

TABLE I

SQUIRREL TRAPPING DATA FROM GRANT-RAPIDES GAME MANAGEMENT AREA FOR 1957, 1958, 1959 SHOWING FREQUENCY OF RETRAPPING BY SEX AND YEAR

Year	*Total Tagged by Year*	*Total Tagged by Sex by Year*			*Number of Times Individual Retrapped*												
					0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1957	99	♂	51	Number of Individuals	20	17	5	1	1	3	1	2	0	0	0	0	1
				% of Total (99) Tagged in '57	20.2	17.1	5.0	1.0	1.0	3.0	1.0	2.0	0.0	0.0	0.0	0.0	1.0
		♀	48	Number of Individuals	30	6	7	1	4	0	0	0	0	0	0	0	0
				% of Total (99) Tagged in '57	30.3	6.1	7.1	1.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	103	♂	42	Number of Individuals	25	6	5	2	3	0	0	1	0	0	0	0	0
				% of Total (103) Tagged in '58	24.3	5.8	4.8	1.9	2.9	0.9	0.0	1.0	0.0	0.0	0.0	0.0	0.0
		♀	61	Number of Individuals	40	6	9	2	2	1	0	0	0	0	0	0	0
				% of Total (103) Tagged in '58	38.8	5.8	8.7	1.9	1.9	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
1959	211	♂	107	Number of Individuals	78	22	4	0	2	0	1	0	0	0	0	0	0
				% of Total (211) Tagged in '59	36.9	10.4	1.8	0.0	0.9	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
		♀	104	Number of Individuals	63	30	7	4	0	0	0	0	0	0	0	0	0
				% of Total (211) Tagged in '59	29.8	14.2	3.3	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTALS	413		413		256	87	37	10	12	4	2	4	0	0	0	0	1
				% of Total No. of Tagged Squirrels	62.0	21.1	9.0	2.4	2.9	1.0	0.5	1.0	0.0	0.0	0.0	0.0	0.2

Using the same principle and substituting data from the 1957 hunt we obtain the following:

$96 =$ Corrected number of known marked squirrels
$15 =$ Total number of marked squirrels killed
$2445 =$ Total number of squirrels killed in 1957

$$\frac{15}{2445} = \frac{96}{X}$$

$$15X = 96\ (2445) = 234720$$

$$X = \frac{234720}{15} = 15{,}648$$

$15{,}648 =$ Computed approximate population in 1957.

The use of the 1958 data applied to the same principle gives us the following:

$100 =$ Corrected number of known marked squirrels
$14 =$ Total number of marked squirrels killed.
$1059 =$ Total number of squirrels killed in 1958

$$\frac{14}{1059} = \frac{100}{X}$$

$$14X = 105900$$

$$X = \frac{105900}{14} = 7564$$ computed approximate population in 1958.

These computations should not be interpreted as exact numbers of total populations but rather as general population trends. This method when used with consideration of its limitations could provide valuable basic management information for application to squirrel populations.

SUMMARY

A three-year program of squirrel trapping and tagging was conducted on Grant-Rapides Game Management Area. A total of 413 squirrels were tagged and released. In 1957, 15 squirrels which were tagged during the 1957 trapping season were killed. During the managed hunt in 1958 14 tagged squirrels which were marked in 1958 were killed. A total of 31 of the squirrels tagged in 1959 were killed that same year. Thus from these returns it appears that hunters annually take approximately 15% of the squirrels on Grant-Rapides Game Management Area.

In addition to gaining some insight on the effects of hunting pressure, limited information concerning home range, sex ratios, and the rate of tag loss were also obtained. Using information gathered during this study, an attempt to calculate population numbers has been made.