9. The mobile unit will check his pre-routing of road-ways to the section and area involved and proceed as follows:
   a. At the fastest safe speed to the section and area.
   b. Look for aircraft and when spotted use the spot light or dimmer switch for identification.
   c. After recognition the mobile unit will follow the observers instructions until the subject is stopped.
   d. Approach the subject from the rear, if possible. Record license number, make, model and color of the vehicle.
   e. Attempt to stop vehicle with the blue flashing light. If unsuccessful, use spot light in rear view mirror. This should be done in a sweeping motion. Use siren, if available.
   f. When an assignment is given, all units not involved are to plan road-way routing to the section where the subject is located. This is essential in the event help is needed.
   g. When giving section and area use the phonetic alphabet as follows: A-Able; B-Boy; C-Charles; D-David (Example: Section 1 - area A-Able.)

AN ANALYSIS OF DEER SPOTLIGHTING IN VIRGINIA[1]

by

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ABSTRACT

We analyzed a 1969 questionnaire survey of law enforcement agents, four years of Commission records (1968-71), and conducted on-site interviews about 20 agents' deer spotlighting cases.

Two estimates suggest at least 600 and probably close to 9000 spotlighting incidents annually and that agents apprehend at least 2.9%.

Complaints occur at a rate of 3.9 per week from 1 October to 31 December. During this same period 86.3% of all spotlighting arrests are made. Only 0.44 deer were killed per case; a preference was shown for bucks. Rifles and shot guns were used equally and reflect general hunting use. Most vehicles used were late model sedans.

The average time of arrest was 11:37 p.m. The period from 8:55 to 2:19 contained 68% of all violations. In November, the peak month, occurs 45.5% of all biolations. From November 14 to 28, 30.8% of all spotlighting arrests are made. Spotlighting on Saturday is significantly higher than other days of the week.

Spotlighting occurred when the temperature averaged 27° F (60° max., 20° min.); arrests were made in rain or snow in only 10% of the cases.

Violators were residents (94.3%), not on strike or work layoff (7.14%). There was no correlation between spotlighting in a county and miles of light-surface roads, miles of all weather roads, ratio and square miles of rural to toal area, or legal deer kill.

Spotlighting occurred on public land in 14.3% of the cases, 85.7% on private land. The majority (90%) occurred from heavy-duty public roads. Most were traveling east on level (less than 5% slope) roads.

The even occurred 18.7 miles from the agent's house (13.5 miles, 1 s.d.; 60 max, 0.1 min). The nearest occupied house was 1.3 miles from the violation site (9 miles max., 100 yards min.). The average distance to theviolator's house was 34.3 (66.7 miles, 1 s.d; 450 maz., 0.1 min). Spotlighting occurred mostly in harvested corn fields surrounded by woods. The average field depth was 171 yards (148 yards, 1 s.d.). Violations would have been visible from the air in 95.7% of the cases.

The average age of the violator was 27. Women were present in 14.3% of the cases; children in 2.9%. The average group size was 2.8 (8 max, 1 min.). Everyday dress was worn in 61.4% of the cases. The violator was known by the agent in 31.4% of the cases. The violators were drinking or under the influence of alcohol in 32.9% of the cases.

Stakeouts were used to apprehend most violators. A chase ensued in 31.4% of the cases, 77.3% when a deer kill was involved.

Fines paid averaged $99.77 ($200 max., $31.75 min.). Convictions were obtained in 91.4% of the cases.

Needed research is suggested.

INTRODUCTION

Laws and regulations governing the taking of game, and their enforcement, have been traditionally used within wildlife management. A large potion of wildlife agencies' budgets are currently used for enforcement, and states have only an opinion about the effects of the enforcement on the success of the total management program. The enforcement program is a major factor in achieving the desired harvest, but in most cases it is currently operating at an unknown level of accuracy, or, if known, at a level that is

[1]The support of The National Rifle Association is gratefully acknowledged.

not comparable to that attained by biologists. The mathematical concept of significant figures states that the number of useful decimal points, in the final analysis, is the number in the least accurate observation. By analogy this suggests a current inbalance and points toward the need for more accurate enforcement data.

Several authors, among them Giles et al. (1971) McCormick (1968) and Morse (1969), have called attention to various aspects of wildlife law enforcement that need to be studied and evaluated. This paper is concerned with a major big game violation, spotlighting deer.

Of the many problems of enforcement, those involving big game appear to be the most conspicuous to the public. Illegal killing of big game may connote a lack of effectiveness and thus encourage other violations. It can also have an adverse effect on wildlife populations, and may prevent many management efforts from being successful. The loss of big game animals by illegal hunting also constitutes an important economic drain on a valuable natural resource.

Although spotlighting is the most common term for the illegal act of hunting deer at night with the aid of lights, it is also known as headlighting, firelighting, nightlighting or jacking. It is one of the most difficult violations to apprehend and many factors enter into the problem of its control. Among them are the skill of the warden, the size of the area he has to patrol, the land use patterns throughout his area, his relationship with the community in which he works, the type of communities present in the area he patrols, the economic base of the area, and the secrecy and cunning of the violators. Perhaps with information about the operations of spotlighters, enforcement of the regulation may be made more efficient.

METHODS

The data in this study about spotlighting violators and violation characteristics were collected using a questionnaire designed to record the arresting agents' observations for each violation. Several assumptions were necessary to insure the reliability of this investigational technique. They are:

1. The number of spotlighting arrests made by the agent is directly proportional to the total extent of illegal spotlighting activity occurring.
2. The spotlighting arrests that are made are a random sample of the total number of spotlighting violators.
3. The agents are able to accurately recall the various facts concerning each spotlighting case.

The first assumption implies that more arrests should occur when the illegal activity is frequent than when it is infrequent. This assumption was supported by all agents interviewed. They based their support on past experience and observation, but the exact relationship between arrests and total illegal activity was not quantified.

The second assumption is that the characteristics of the violators arested by the agents are representative of all others engaged in the illegal activity. Although it may be argued that those arrested are the least cautious, and therefore not representative of the group, this does not seem to be correct. The agents work at times and locations that are not accurately known by the violators. Although a violator may know the agent is on patrol, he rarely knows where. Also, even though an agent may suspect a violation to occur, he usually does not know the time or location. Those who take precautions to determine the agent's location may succeed in avoiding apprehension on several outings, but with each trip there is still a probability of their being caught.

The third assumption was necessary due to the period covered by the interview. Cases from January 1969 to December 1971 were included in the questionnaire. The interviews were conducted from September 1971 to April 1972. Although the exact details surrounding many of the agent's arrests might be easily and understandably forgotten, this did not seem to be the case. Vistation of the violation site, field notes, and the violation records were useful aids in answering many of the questions.

The selection of agents to be interviewed for this study was based on an analysis of the 1968, 1969, and 1970 spotlighting arrests and convictions filed with the Virginia Commission of Game and Inland Fisheries in Richmond, Virginia. The selection was intentionally planned not to be a random sample of all agents, in order to efficiently utilize the limited time and funds available. A decision was reached to concentrate only on those agents familiar with the violation. The 20 agents selected represented 21.6% of all Virginia agents making a spotlighting arrest in 1969 and 1970, and accounted for 52.5% of all the spotlighting arrests made during the two year study period.

The data from the arrest tickets were processed separately for the years 1969 and 1970, and in addition, a cumulative total of all years was made. This included limited data from 1967 and 1968, and also complete data from 1969, 1970 and 1971 violations. A total of 549 arrests were recorded. The cumulative results are presented here.

The questionnaire administered to the 20 agents in Virginia was designed to supplement the basic arrest-ticket information regarding the characteristics of the spotlighting violation. The data obtained were tabulated by month, and provided information on a total of 70 cases. A spotlighting case was defined as a violation that resulted in the arrest of one or more persons. For example, three people in a car may be arrested for a spotlighting violation and this is considered as one case. It is possible to have several arrests as the result of one violation and one case. The survey covered 197 arrests made in 1969 and 1970, or approximately 40% of the total arrests made by all Virginia agents during the two years. The information was analyzed monthly in the complete report, but for this paper cumulative results are shown.

A standard questionnaire was developed and a computer program to perform detailed analyses of arrest ticket reports.

The Extent of Spotlighting in Virginia

Vilkitis presented in his Idaho study (1968) a formula to estimate the illegal kill of big game animals. The illegal kill, I, was related to the total arrests for big game violations for the field study period, m, in the same way as the total number of illegal kills created by the investigator, c, was related to the number of times the investigator was stopped by enforcement personnel, r. According to his estimate, enforcement agents were successful in apprehending 3.1% of the violators.

Using data from Virginia, 284 sportlighters were arrested in 1970. If this represents 3.1% of the actual violations, then 9,088 spotlighting incidents actually occurred.

Another approach to estimating the extent of spotlighting in Virginia was based on data supplied by Mr. Harry Gillam, of the Education Division, Virginia Commission of Game and Inland Fisheries. In a survey conducted of all Virginia's agents in the fall of 1969, the number of actual and casual complaints of spotlighting received by each agent was recorded. Of the 109 full time agents, 80 responded to this questionnaire. Although the terms, actual and casual, were vaguely defined, the large sample size and unique nature of the data prompted their use as an estimator of the extent of spotlighting. It must be made clear that these estimates are useful only as "ballpark" figures. They provide a basis for indicating the number of spotlighting violations, and are more likely to be of greater reliability than mere guesswork.

An average of 3.94 actual complaints were received per week by Virginia's agent during a 12-week period from October 1 to December 31. This period contained an average of 86.3% of all spotlighting arrests in the 3-year period from 1968-1970. There were 109 full-time agents working in Virginia and based on their report of an average of 3.94 complaints per week during the period, an estimated 5,153 maximum spotlighting complaints would occur (i.e. 109 agents X 12 weeks x 3.94 complaints/ week = 5,153).

Since an average of 86.3% of all spotlighting arrests occurred during the study period, it was assumed that this is proportional to the total amount of illegal activity occurring. That is, during the remaining 40 weeks of the year, 13.7% of the total spotlighting arrests were made. The actual number may be higher than the complaints received since all violations are not reported. Duplications in reporting, or reports of legitimate hunting as spotlighting would tend to lower the estimate. Applying these as-

sumptions, the estimated average number of spotlighting violations for 1968, 1969, and 1970, was 5,971. An average of 173 arrests were made during thses years for spotlighting. Based on this average and the estimate of 5,971, the agents succeeded in arresting at least 2.89% of the violation.

Reasons for Spotlighting

Based on data from a survey by the Education Division of the Virginia Commission of Game and Inland Fisheries it was reported that 39.9% of the agents felt that the number one reason for spotlighting was "hunting for kicks". According to 25.2% of the agents replying, they felt that the reason was to obtain deer for home consumption, while 16.2% of the agents felt that the violators could not resist when the "opportunity presented itself". Market hunting was believed to be the reason for spotlighting according to 8.9% of the agents, while 8.8% felt that the "frustration in not obtaining a deer legally" was the basis for spotlighting. The characteristics of the violation are likely to vary, depending upon the reason the particular violator has for spotlighting. Those spotlighters "hunting for kicks" are not as likely to take the same precautions to avoid arrest as market hunters. The characteristics of those violators spotlighting for home consumption are likely to be different from those that spotlight when the opportunity presents itself. In addition to these types, another reason for spotlighting was observed. Certain persons may have a grudge against an agent and participate in a spotlighting violation as a means of "getting back" at him.

Characteristics of the Violation

Deer were killed in 22 cases or 31.43% of the total cases reported. A total of 31 deer were killed or an average of 0.44 deer killed per case. The ages of the deer were generally reported in the 1- to 2.5- year age classes. The sex ratio of the deer killed was 100 males to 100 females. This tends to indicate a preference for bucks among spotlighters as the state's deer population sex ratio is about 30 males to 100 females.

The type of weapon used by the spotlighting violators were found to be rifles in 47.14% of the cases, shotguns in 47.14%, pistols in 2.86%, and bow and arrows in 2.86% of the cases. Of the rifles used, 72.73% were .30 caliber, 21.21% were .22 caliber, and 3.03% were .270 caliber. No response was obtained in describing the caliber in 1.43% of the cases involving rifles. Scopes were present on 21.21% of the rifles. Of the shotguns used 78.79% were 12 gauge, 6.06% were 20 gauge, and 6.06 were .410 caliber. No response was obtained describing the gauge in 9.09% of the cases. Single barrel shotguns were used in 17.14%, double barrels in 11.43%, pumps in 2.86%, and semi-automatics in 12.86% of the cases involving shotguns. None of the shotguns had sawed-off barrels. Of the pistols used, 50% were .22 caliber models, while the other 50% was not described. It seems that the type of weapon chosen to hunt deer illegally was probably the same weapon the violator hunted with during the legal season. Several agents stated that they believed the real spotlighting "pros" favored .22 caliber rifles due to their relative quietness when compared to shotguns and .30 caliber weapons.

The type of vehicle driven by spotlighting violators in 67.1% of the cases was described as a sedan. Pickup trucks were used in 22.9% of the cases, station wagons in 7.10% and jeeps in 2.9% of the cases. It was observed that 47.1% of the vehicles were models built prior to and including 1965, while 52.9% of the vehicles were models made after and including 1966. The most commonly used vehicles for spotlighting appeared to be a late model sedan. This indicates that the violators used what might be described as a family car, and since a large percentage of the vehicles were fairly new models, it suggests that the violators were spotlighting for reasons other than not being able to afford to buy meat at the market.

The type of spotlight used by the violators in 37.1% of the cases was the model that plugs into the vehicle cigarette lighter. This type provided a portable, low-cost, and one of the most powerful means of illumination available to violators. The vehicles headlights were used in 24.3% of the cases as spotlights, while sealed beam battery

packs were used in 17.1% of the cases. Hand-held flashlights were used by violators in 12.9% of the cases. In 7.1% of the cases the spotlight like the type used on many police cars was fixed to the vehicle.

Time of Violation

Based on the 549 violations, the mean time of arrest for spotlighting was 11:37 p.m. with a standard deviation of 2.71 hours. The period from 8:55 p.m. to 2:19 a.m. contained 68% of all spotlighting arrests. As was stated earlier, it was assumed that the number of arrests is an indication of the number of violations actually occurring. On the validity of this assumption, it appears that during the 5½ hour period from 8:55 p.m. to 2:19 a.m., 68% of all spotlighting violations occur. The months of September, October, November and December contain 85.24% of all spotlighting arrests. The peak in the number of arrests occurs in the month of November with 250 violations or 45.53% of the total. From November 14 to November 28, which includes the week prior to the deer season, 30.8% of all arrests were made. A possible examination of this seasonal tendency is that hunting is primarily a fall sport and the shooting interest is more prevalent at this time of the year. Although frustration of not being able to obtain game legally may be a factor influencing spotlighters, many others may spotlight just for some excitement or a chance to do some shooting. It is notable that the month of April contains the fewest number of violations. Tradionationally, this is the month in which the fishing season usually begins, and it is possible that the interest in shooting is temporarily overshadowed by fishing and more people afield.

The possibility exists that the data collected might be subject to a systematic bias on the part of the agent. This might occur if the agent only patrolled from September to December for spotlighting violations. The seasonal occurrence of spotlighting, however, was supported by several factors, and suggests that the possibilitities of bias were minimal. The agents stated that spotlighting was a fall activity, although violations do occur throughout the year. Their patrols were conducted intensely during the fall because they believed that this is when most of the illegal activity occurred. It was believed that the agents would adjust their patrols according to the number and time of spotlighting violations in their area based on observations, complaints, reports and experience. Since spotlighting arrests are made in other than fall months, this tends to indicate that violations occur year-a-round, but in the opinion of most agents, such incidents are few.

The day of the week for each arrest was recorded and totaled for the 1969 and 1970 data. In 1969, 192 spotlighting arrests were made, and of these, 60 were on Saturdays representing 31.2% of the total violations, while 84 arrests, or 43.7% of the total for the year were made on Saturdays and Sundays. Assuming that spotlighting violations, on a yearly basis, are as likely to occur on any day of the week, the expected number of violations for any day of the week is 27.4, i.e. (192 violations per year/7 days per week). The expected number of violations for any day of the year is 0.075 or (27.4/365 days). This assumption was tested using the t distribution with a 0.05 level of significance. It was found that the number of spotlighting violations occurring on Thursdays, Fridays and Saturdays are significantly different from the assumed expected value. On Thursdays and Fridays, fewer violations were recorded than were expected, while a significantly greater number of violations occurred on Saturdays. According to these data, spotlighting violations are not distributed evenly throughout the week. The number of arrests on Saturdays were significantly greater than those on the other days of the week. Data for 1970 spotlighting arrests show that violations on Saturdays account for 40.15% of the total of 284 arrests. If violations are more frequent on Saturdays than on Wednesdays, the agent's chance of making an arrest should be higher when more violations occur. Patrols on Saturdays are likely to be more effective than on other days, but this does not mean weekday patrols are ineffective. The maximum efficiency and effectiveness of the agents can be obtained when patrols are conducted at times when violations are most likely to occur and we now have data on such occurrence.

The earlier discussion on the possibility of a systematic bias entering into the data would also apply to the observations made as to the day of the week of the violation, but this was believed to be minimal. It was stated by several agents that violations were more common on weekends due to those hunting for "kicks", however, those hunting for home consumption were likely to do so at any time or day. The agents also adjusted their spotlighting patrols based on information observations, and complaints from their areas.

The estimated average temperature at the time of the arrest for spotlighting was 37 degrees F, and a maximum of 60 degrees and a minimum of 20 degrees was reported. A standard deviation of 8.84 degrees was determined, thus 68% of the violations occurred at temperatures between 28 degrees and 46 degrees. It was raining at the time of the arrest in 7.1% of the cases, and snow was present in only 2.9% of the cases. The sky conditions were described as clear in 47.1% of the cases, clear with moonlight in 20.0%, and fog or clouds in 27.1%.

The occurrence and distribution of deer at night has been investigated by several researchers. Progulske and Duerre (1965) worked on a study involving the factors influencing the spotlighing counts of deer. Cloud cover, temperature, precipitation, dew and relative humidity were recorded for each observation over a 3-month period, and these five factors gave an R^2 value of 0.85, indicating that 85% of the variation in deer counts could be accounted for through five weather factors and their interactions. Dasmann and Taber (1956), Cronemiller and Bartholomew (1950), Harper (1962) and others have reported that the activity of various cervids is greater on cool, cloudy days than on sunny, clear days. Anderson (1959) stated that deer were influenced significantly in their standing and bedding habits at night by moonlight, temperature, and humidity. The weather data from the spotlighting arrests indicate that a large portion of the violations occurred at times when the activity of the deer was believed to be high. From the standpoint of protecting the deer, it would appear that patrols on cool, clear nights without moonlight would be the type of conditions in which the most deer would be visible to the violators.

The violators were on strike or a work layoff in 7.14% of the cases, and 2.86% of the violators were in military service. The violators were residents of Virginia in 94.29% of the cases. Practically all of the non-resident violators were arrested in the month of November when the number of non-resident hunters reaches its peak in the state. Since only a small percentage of the violators were unemployed at the time of the arrest, strikes or work-layoffs probably do not significantly contribute to an increase in the number of spotlighting violations.

Location of the Violation

An attempt was made to isolate several factors that may have influenced the extent of spotlighting in different localities. Nine counties in Virginia in which required data were readily available were selected. It was theorized that the mileage of light surface roads might be related to the number of spotlighting arrests in a county.

This type of road is usually found in areas that are not well traveled, and it was believed that the number of access roads available to the spotlighter might be related to the number of violations and arrests. The correlation coefficient (r) was 0.092, indicating that there is almost no correlation between the two factors.

A correlation test was conducted using the miles of all weather roads and the number of spotlighting arrests. The r value was 0.1680, and was also not a significant factor in explaining the extent of spotlighting violations.

The relationship was tested between the number of spotlighting arrests and the ratio of the square miles of rural area in a county to the total square miles. The hypothesis was that the greater the percentage of rural area in a county, the greater would be the number of spotlighting arrests. The calculated r value was 0.4001, and this was not significant.

Another correlation was conducted using the number of spotlighting arrests and the legal deer kill. The value of r was 0.2558, and this indicates no significant correlation between these two factors.

Another assumption tested was that the higher the preseason deer population, the higher would be the known illegal kill. The value or r obtained was 0.0618, indicating almost no correlation. The preseason deer population was based on estimates for 1969 provided by wildlife biologists, and the known illegal deer kills represent those from all types of violations.

All of these correlation tests failed to reveal significant relationships in describing the extent and locations of spotlighting. Since limited data were available for approximately 8% of Virginia'a counties, further testing should be conducted as more data are collected before specific conclusions can be made on a statewide basis.

The spotlighting violation occurred on public land in 14.3% of the cases and on private land in 85.7% of the cases. The roads were public in 90.0% of the cases, private in 5.7%, and military in 4.3%. Violations occurred in non-restricted areas in 47.1% of the cases, and in restricted areas in 52.9%. Of the cases in restricted areas, 35.7% were on private-posted lands, 8.6% were close to private homes, 5.7% were in military areas, and 2.9% were in state game areas. Since the majority of spotlighting was done from public roads, it appeared that the violators probably were not hunting on their own lands, as a farmer taking deer for his own use would not have to use a public road.

The average distance from the violation site to the agent's house was 18.7 miles, and a standard deviation of 13.5 miles was determined. A maximum of 60 miles and a minimum of 0.1 miles was observed for the distance between the violation site and the agent's house. The nearest occupied house was an average of 1.3 miles from the violation site, and a maximum of 9 miles and a minimum of 100 yards was observed. A standard deviation of 1.71 miles was determined for the distance from the violation site to the nearest occupied house. The average distance from the violator's house to the violation site was 34.3 miles, with a maximum of 450 miles and a minimum of 0.1 mile reported. The standard deviation was 66.7 miles.

The violators were traveling on heavy duty roads in 41.4% of the cases, on medium duty roads in 25.7%, on light duty roads in 5.7%, and on unimproved dirt roads in 27.2% of the cases while spotlighting. The violators were observed to be traveling north in 16.18% of the cases, east in 32.35%, southeast in 1.4%, south in 20.6%, southwest in 1.47%, west in 25.00% and northwest in 2.94%. Slightly more violators were observed traveling east, while spotlighting, than in any other direction. The slope of the road at the violation site was described as 0 to 5% for 94.2% of the cases, and 6 to 14% in 5.8% of the cases. Most of the violations appear to be committed from fairly level roads, and this is probably related to the presence of fields usually on level to moderately sloping land.

The spotlighting violation occurred in a field in 94.2% of the cases, and in a forest in 5.8% of the cases. The types of fields in which spotlighting occurred are corn, 35.90% of the cases, orchard grass, 23.42%, bluegrass-clover 15.62%, abandoned, 7.82%, wheat, 6.26%, soybeans 4.70%, apples 4.70%, and pastures 1.58%. The crops in the fields had been harvested in 56.0% of the cases. The largest portion of spotlighting violations appear to occur in harvested corn fields.

The average depth of the field in which violations occurred, that is, the distance from the road across the field to the woodlot was 171 yards. The maximum field depth recorded was 800 yards, and a standard deviation of 148 yards was determined. The average dbh of the trees surrounding the field was 7.9 inches, with a standard deviation of 3.3 inches. The trees surrounding the field were yellow pines in 21.3% of the cases. A mixture of oak-pine was present in 60.7%, oak-hickory in 14.7% and red oak-basswood-ash in 3.3% of the cases. The oak-pine mixture is the most common type found bordering fields where spotlighting occurred, and it is also one of the most common types of forest found in Virginia.

The violations would have been visible from the air in 95.7% of the total cases. This would indicate that the utilization of aircraft in close cooperation with ground units

would be a possibility for future patrols. Several states are currently using aircraft in their spotlighting patrol work and have reported favorable results.

Characteristics of the Violators and Sex of the Violators

The age of the arrested violator was recorded on 505 of the 549 arrests tickets. The average age was 27.00 years with a standard deviation of 9.54. The interval from age 18 to 37 contained 68% of all spotlighting violators.

In the intensive study, the average age of those arrested was 29 years, while the average age of those present but not arrested in any case was 28 years. The oldest person arrested in any case was 60 years, and the youngest in any case was 15 years. The average age of arrested spotlighters was considerably older than the average criminal. The largest arrest rates for criminal offenses were between the ages of 18 and 20 years (Sutherland and Cressey 1970).

Women were present in 14.3% of the cases intensively studied and arrested in 8.6% of the cases. Children were present in 2.9% of the cases, but were not arrested.

The average number of persons arrested in a spotlighting case was 2.81 from a group of 3.09 persons. The maximum number reported arrested for any case was eight, and the minimum was one. A standard deviation of 1.57 was determined for the average number of persons arrested, and a standard deviation of 1.56 was found for the average group size.

It was observed that the violators were dressed in everyday, street-type clothes in 61.4% of the cases, in hunting clothes in 35.7% and in camouflaged outfits in 1.4% of the cases. The large percentage in everyday clothes may indicate that the violators were not seriously engaged in hunting for meat, but would tend to support the idea that they were looking for excitement or spotlighting for "kicks".

The spotlighting violators were personally known by the arresting agent in 31.4% of the cases, while in 64.3% of the cases the agent did not know the violator. The violator had previously been arrested by the agent in 4.3% of the cases, although the arrest may not have been for a spotlighting violation. The spotlighting violators were charged with additional violations of the game laws in 40.0% of the cases. The violators were drinking or under the influence of alcohol in 32.9% of the cases.

The rather large percentage of arrested violators known by the agents reinforces the need for secrecy in the scheduling and location of spotlighting patrols. Many violators go through elaborate steps to determine the location of the agent, such as riding by his home to observe his patrol car, calling his house reporting a violation in one end of the agent's area, while the violator spotlights in the opposite end, throwing firecrackers along a road to imitate gunshots and flush an agent out of a stakeout, and sometimes utilizing two-way radios, with the lead car using spotlight, and having no weapons present. The location of a deer is reported to the second car following at a distance containing the weapon. If the agent stops the first car, he cannot make a case since no weapon is present. Another factor in working patrols is the percentage of violators drinking or under the influence of alcohol.

The spotlighting violation appears to be a group activity in many cases, and the consumption of alcohol may be a part of the complex group behavior. The group may be spontaneously formed or it may be planned. The relationship between the consumption of alcohol, the reason for spotlighting and whether it was an individual or group activity could not be determined from the existing data. It was speculated however, that those hunting for "kicks" would be drinking. The market hunter, or one hunting for home consumption, would be less likely to consume alcoholic beverages, but group participation in these cases would be variable. The market hunter would want few persons to know of his activities, whereas the spotlighter seeking excitement would probably brag of his adventure, and another person participating and witnessing the act would make his bragging more credible. In any case, the possibility of personal harm to an agent working alone under circumstances involving alcohol, firearms, and the threat of heavy fines should not be underestimated, and for this reason, patrols should be made by two agents if possible.

Methods of Apprehension

In the 70 cases intensively studied, 197 persons were arrested for an average of 2.81 arrests per case. Of those present at the time of the violation 92.4% were arrested. The remaining 7.6% were children. An average of 1.44 agents were involved in each case and a standard deviation of 1.02 was determined. The maximum number of agents involved in any case was six; several agents made cases while working alone.

Stakeouts were used to make 52.86% of the spotlighting cases. Routine patrols resulted in 15.71% of the cases, and a tip was received in 28.57% of the cases. For those cases in which a tip was received, a stakeout was usually set up to apprehend the violators. On those nights in which an agent made an arrest for spotlighting, an average of 5 hours was spent prior to the arrest for all methods of patrol. For example, an agent would start work on a spotlighting patrol at, say, 6:30 p.m., and would work until 11:30 p.m. before an arrest was made. The time spent on patrol prior to an arrest varied with the method of patrol used. If the agent received a tip on a violation, the time spent prior to an arrest was less than if the agent was on a routine patrol of an area. A stakeout, the concealing of the agent's vehicle in an area frequently by deer, for the purpose of apprehending a violator, was found to be the method of patrol used to apprehend most cases. The agents estimated that 10.2% of all stakeouts resulted in a case, while a maximum of 25% and a minimum of 3% were reported. Thus an average of one patrol out of ten was successful in apprehending a violator.

A chase was necessary to apprehend the violator in 22 cases, or 31.43%. Of the 22 cases in which deer were killed, 17 cases, or 77.3% involved a chase. For the 48 cases in which deer were no killed, only five cases involved a chase. The average speed attained by the agents in pursuit of the violator was 68 MPH, and the maximum speed was stated as 90 MPH. It appeared that if a violator had killed a deer, he was more likely to attempt to ellude the agent when approached, than was a violator who did not kill a deer.

Fines

The amount of fines paid by 409 arrested violators averaged $99.79. The standard deviation of $60.84 suggests a large variation in the amount of fines levied by judges. The range of fines was from $31.75 to $200.00 for a single violation. Several violators received jail sentences, but in all cases, these were suspended.

Of the total of 70 cases intensively investigated with the agents, convictions were obtained in 64 cases, or a rate of 91.4%, while in 7 cases, or 10.0%, the fines were suspended.

The Decision to Spotlight

To explain the causes of criminal behavior, an adequate theory must explain the distribution of crime and provide the basis for deriving predictive statements. Also as part of that theory there must be a statement that identifies, at least by implication, the process by which persons come to exhibit criminal behavior. Several theories have been advanced to explain crime causation, and the one currently held to be among the most widely accepted is Sutherland's 1924 theory of "differential association" (Sutherland and Cressey 1970). There are nine basic points to this theory which are discussed in numerous sociological and criminological books and journals. The applicability of this theory in order to explain the causes of spotlighting behavior offers useful insight into a complex sociological phenomenon. In addition to Sutherland's theory, an analysis of the act of spotlighting based on the assumption that the violation results after a decision made by the violator can offer insight into the possible motives for the violation. The act of spotlighting is in most cases, planned by the violator prior to the violation itself. Included in this planning would be various inputs and desired outputs which would be processed by the individual prior to the violation.

In the field of decision theory there are three types of decision problems generally recognized and are designated:

1. decision making under certainty
2. decision making under risk
3. decision making under uncertainty

Decisions made under certainty are those for which the decision maker has complete information about the state of nature and therefore knows which state of nature is true. Decisions made under uncertainty are those for which the decision maker does not know the likelihood of occurrence of the various possible states of nature. Decisions made under risk are those for which the probability of each can be calculated or assigned (Buffington 1972).

In decisions made under risk, the decision maker does not know the true state of nature, rather has partial information which can be expressed in terms of probabilities applicable to all of the possible states of nature. The probability associated with each possible state of nature may be derived either objectively or subjectively (Morris 1964). The violation of the spotlighting law appears to be a decision made under risk.

An analysis of this decision must include the inputs, processes, outputs and feedback characteristic of a systems approach.

Numerous inputs enter into the decision to spotlight, and these would include the desired benefits such as a deer kill, food for a family, money from the sale of deer, chance for excitement, or a change to beat the agents. The chance of being apprehended, the probability of high fines and penalties if convicted, and the likelihood of significant social stigma that may be attached to the violator are risks. Other inputs might include the abundance of deer in the area, a knowledge of the agents' patrol activities, the techniques of spotlighting, and an association with other individuals involved in spotlighting. The individual's cultural, educational, and economic status would probably have an influence on the weight assigned or risks associated with those inputs that are considered prior to the violation.

The individual's decision would be based on processing these inputs and comparing the benefits of spotlighting and the risks of apprehension. In several cases the spotlighting occurs when a deer runs in front of a vehicle and the individual sees the chance for an easy kill. Under these circumstances the decision must still be made to fire the weapon at the deer. In this type of case, the individual's decision is often rapidly determined and a limited number of inputs are likely to be considered. In other types of spotlighting cases, the decision must also be made as to when and where to spotlight. The choice of where to spotlight would probably be based on the individual's knowledge of an area, the abundance of deer, and any knowledge of the agents' patrol tactics in the area. The time of the violation is likely to be based on arrangements made with other individuals', the desired benefits from spotlighting, and knowledge of the agents' activities.

The outputs of the decision to spotlight would be the individual's success in obtaining his desired benefits.

The feedback present in a systems analysis is positive, negative or neutral. Positive feedback would occur if the violator was apprehended and the value assigned to the risk of spotlighting increased. Negative feedback would occur if the violator was not apprehended and the value assigned to the risk of spotlighting decreased. A neutral feedback would occur when no change in the inputs or processes was observed due to the apprehension or lack of it. Investigation of this area of wildlife law enforcement has been lacking and it is recommended that further research be conducted to determine the probabilities and relationships of the inputs, processes, outputs and feedbacks, as they apply to the decision to violate the law. It seems likely that Sutherland's concept of criminal behavior can be accomodated with the above analysis and the techniques and concepts of the systems approach found useful in extending his perception and developing solutions.

Conclusions

Approximately 9000 spotlighting violations occurred in Virginia per year. Another estimate, based on the complaints of spotlighting received by agents, was approximately 6000 violations per year. Correlation tests utilizing the number of spotlighting arrests and several factors such as the legal deer kill, miles of road, etc., failed to establish any significant relationships.

Spotlighting data obtained from other states indicated that the characteristics of the spotlighting violation were similar to the characteristics observed in Virginia. The most common reasons given for spotlighting included hunting for excitement, for meat for home consumption, and market hunting.

The largest percentage of arrests were made on Saturdays between the hours of 10:00 p.m. and 11:00 p.m.. Patrols by the agents would appear to be most productive, in terms of apprehending violators and protecting deer, if conducted between the hours of 8:00 p.m. and midnight. The month of November contains the most arrests for spotlighting, with a peak around the legal deer season. Spotlighting violations appear to increase in frequency starting in October, and decrease in frequency after January. Spotlighting patrols should be conducted, accordingly, at these times. Most of the violators appeared to spotlight during clear weather conditions, however several cases were made when it was raining.

Nearly all spotlighting occurred in private fields and from public roads. Corn fields surrounded by a mixture of oaks and pines were the most commonly used areas. This description could apply to numerous areas within an agent's territory, but it was also observed that many violators traveled on heavy duty roads in an easterly direction. The violation occurred an average of approximately 1 mile from an occupied house, and 19 miles from the agent's home. The agents should be especially alert for late model sedans carrying three males in their late twenties.

Patrols using airplanes in conjunction with supporting ground crews would appear to be successful in locating spotlighting violators. This method of patrol is currently in use in several states, and the possibilities for application in Virginia should be considered. Currently, stakeouts result in the most arrests for spotlighting. The data presented on the characteristics of the spotlighting violation should serve as guidelines for the location and time of spotlighting patrols.

This study attempted to describe a particular game law violation with the intent of providing information that would be useful in its control. From this study, it was evident that further research in the field of wildlife law enforcement is necessary. The following law enforcement research is recommended:

1. Continue spotlighting data collection to indicate trends in violator and violation characteristics.
2. Determine the relationship between the motivation for spotlighting and the characteristics of the violator.
3. Study further the sociological and criminological aspects of game law violations.
4. Develop computer simulations of big game violations as an aid for enforcement training.
5. Develop airplane patrols for big game enforcement work.
6. Determine the relationship between game violation complaints received by agents and the number of arrests made for the violation.
7. Determine the relationship between the number of arrests for a particular game violation and the actual number of violations occurring.
8. Develop a computer program that classifies, stores and provides immediate retrieval of all fish and game arrest records.

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A PROPOSAL FOR A REGIONAL LAW ENFORCEMENT RESEARCH PROGRAM

by

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ABSTRACT

Despite the fact that approximately one third of the state wildlife agency personnel and funding is invested in law enforcement, scientific law enforcement studies are comparatively few. A regional program of law enforcement research, to be located at Virginia Tech in Blacksburg, Virginia, can coordinate projects, allow publication of results in many forms, avoid duplication of research projects, and answer more questions for less money in a joint effort than can individual states. The success and benefits of this program relies on funding by all states, since all states will benefit from this research. The program will enhance ideas and open communication between researchers and wildlife law enforcement agencies. With this proposed system of jointly funded research, states can save money in the long run, make great interactive advances, and achieve regional leadership in a new, vital, essential dimension of modern wildlife resource management.