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CONTROL METHODS FOR NUISANCE BEAVER IN THE SOUTHEASTERN UNITED STATES

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ABSTRACT: Strychnine alkaloid baits were consumed by both captive and wild beaver without any apparent hesitation. An approximate minimal acute lethal dose of sodium monofluoro-acetate to beaver of mixed ages and sex was 0.202 mg/kg. Trapping beaver on four study area watersheds in Alabama with No. 330 conibear traps for approximately two weeks in winter during two successive years essentially eliminated beaver. Older individuals were trapped the first year, maturing juveniles and the remaining few adults were trapped the second year, and there was very little reproduction between the trapping periods. Trapping, with its recreational appeal, and income and food potential seems the better and more prudent approach to control of nuisance beaver than others being considered.

Reliable records of population density and distribution of the beaver (Castor canadensis) in the southeastern United States are incomplete, but they were believed by early writers to have been present on every watershed in the region. Early pioneers that settled along the major river systems used the beaver as a major food item. During the mid-l800's the beaver was sought by organized hunting groups and their numbers decreased greatly (Howell, 1921). By 1879, representatives of Hudsons Bay Company were trapping in Alabama and beaver became extremely scarce by 1890 (Moore and Martin, 1949). Barkalow (1949) noted that only 41 beaver dams were located in Alabama in 1929 by Conservation Department Game Wardens attempting to inventory the beaver. By 1931 beaver were found only in isolated sections of the Amite and Comite Rivers of Louisiana (Arthur, 1931) and the last known beaver in Virginia was killed in 1911 (Blackwell, 1948). This pattern of over-harvest to near extirpation from approximately 1850 to 1930 was apparently a regionwide phenomenon, except in Virginia and West Virginia where it was reported to have occurred in the late 1700's or early l800's (Swank, 1949).

A Pittman-Robertson beaver restoration project was commenced in Alabama in June 1940, and by 1951 an estimated 765 beaver had been live-trapped and stocked in 48 counties within the state (Beshears, 1967). Beaver colonies were established at or near each of 72 release sites. The restoration program combined with protection from trapping provided a situation that enabled the beaver to expand its range and increase in numbers with only limited human interference. Apparently many of the beaver trappers, during the years that beaver were scarce and that trapping was illegal, had either lost interest or died, and few young men learned the skill. Once trapping was again permitted in a few locations, very little of it was done. Beaver damage complaints began to be heard as early as 1955, and damage associated with beaver and their activities prompted the removal of the beaver from the list of protected animals of Alabama in 1960.

Beaver damage problems increased in Alabama to the point that in 1967 a beaver symposium was devoted to reports from four states on the seriousness of the problems and was followed by discussions of how to cope with them (Anon., 1967). A report of a survey by the Alabama Forestry Commission conducted in 1973, indicated that beaver had caused $2,205,000 total damage to the forest resource of Alabama. Popular articles, reports of surveys, publications and observations of beaver ponds and dams throughout the region document the recovery and abundance of beaver in North and South Carolina, Georgia, Alabama, Mississippi, Maryland, Louisiana, Arkansas, Tennessee, Southeastern Oklahoma, and Northwestern Florida (Arner et al., 1969; Linscombe, 1974; Miller, 1976; Moore, 1967; Cook, 1976; Woodward, 1976; Larson, 1967). A regional map (Figure 1) shows the approximate range and distribution of beaver within most of the southeastern states. Where they were available, damage estimates based on acreages or dollar value or both were included on the map.

A questionnaire in which Alabama landowners could express their views on a series of issues concerning the beaver was published in four periodicals with total circulation of 32,553. Of 127 responses that were returned and in which landowners reported beaver present on their property, 102 indicated their desire to remove all or some of the beaver. Beaver

[1]A contribution of the Alabama Cooperative Wildlife Research Unit, Auburn University Agricultural Experiment Station, Game and Fish Division, Alabama Department of Conservation and Natural Resources, the U.S. Fish and Wildlife Service, and the Wildlife Management Institute, cooperating.

damage was categorized by 104 landowners in the following proportions: 70(67.3%) reported timber damage, 20(19.2%) reported pasture damage, 8(7.7%) reported row crop damage and 6 (5.8%) reported other types of damage. Damage to hardwood timber stands has been the single most important complaint of forest landowners. Stands or portions of stands are killed when their root systems remain inundated for extended periods as a result of flooding by beaver dams. This type of damage is particularly significant in the Gulf Coastal Plain region where relatively large acreages of flat terrain are flooded by comparatively low dams. A second type of timber damage occurs where the beaver cut trees, particularly small pine in plantations, or girdle hardwoods that have potential as veneer logs.

Alcoa Land and Timber Company financed two research projects that were conducted by the Alabama Cooperative Wildlife Research Unit of the Auburn University Agricultural Experiment Station to develop a bait or baits suitable for control of nuisance beaver. The first study determined acceptability of several candidate substances as possible baits (Williams, 1971). The second study (Cooper, 1970) evaluated natural foods that could be used as baits for beaver, the effectiveness of certain poisons, and methods and effective times for presentation. Cooper et al. (1972) noted the need for further research to find an operational toxicant that was effective and suitable for registration for use in beaver control.

Other approaches to beaver control have been or are currently under investigation. Among these is evaluation of the American alligator [Alligator mississippiensis (Daudin)] as a potential predator. A preliminary study was initiated by the author in three fishing lakes near the Auburn University campus. Each lake contained one or more active beaver colonies and was stocked during the summer of 1972 with an alligator at least seven feet in length. Observations were made to detect beaver and alligator interaction. On one occasion a large alligator was observed to come half out of the water in an attempt to catch a beaver swimming on the surface. On another occasion, this same alligator was observed to have chased two beaver out of the water and onto the shore during mid day in July. The alligators were not known to have controlled the beavers in these ponds. These studies were discontinued following reports from Florida of a human fatality and an increase in the number of reported alligator attacks on humans (Anon., 1975). Similar work with alligators is currently being pursued at Mississippi State University (Anon., 1972).

Two chemosteri1 ants are under evaluation as reproductive inhibitors in wild beaver populations in Mississippi (Arner, 1975). Two years of additional testing are scheduled before the effectiveness of this approach to controlling isolated nuisance beaver populations is fully evaluated.

As beaver damage complaints increased an effort was made to promote trapping with No. 330 conibear traps as a control measure for nuisance beaver populations. This was done through lecture, demonstration, and a publication (Hill, 1974). A motion picture is currently being produced in cooperation with the Auburn University Cooperative Extension Service. The intent of this effort is to stimulate and assist citizens to learn skills of beaver trapping and fur processing.

To promote utilization of beaver meat as a human protein source, a series of taste panel tests are being conducted to describe accurately the quality, nutritional, and other taste parameters of beaver meat.

The information that forms the basis for the remainder of this paper came from a research project on beaver control that was sponsored jointly by the Alabama Forestry Commission and the Game and Fish Division of the Alabama Department of Conservation. Some of the objectives of this study were (1) to evaluate, in pens, the acceptability of strychnine alkaloid baits, (2) to determine minimum acute lethal dosage of sodium monofluoro-acetate to beaver, and (3) to evaluate the economics of trapping as a population control technique for beaver.

Strychnine alkaloid

During a series of tests in pens, four beaver accepted strychnine alkaloid (12 mg/kg.) baits in the presence of other foods without any apparent hesitation. Three of these beaver died of strychnine poisoning within 10 hours. Storax baits (Cooper, et al., 1972) containing strychnine alkaloid were prepared for further field tests as follows: American storax (1200 grams or approximately 1 quart) gathered locally from Clarke County, Alabama

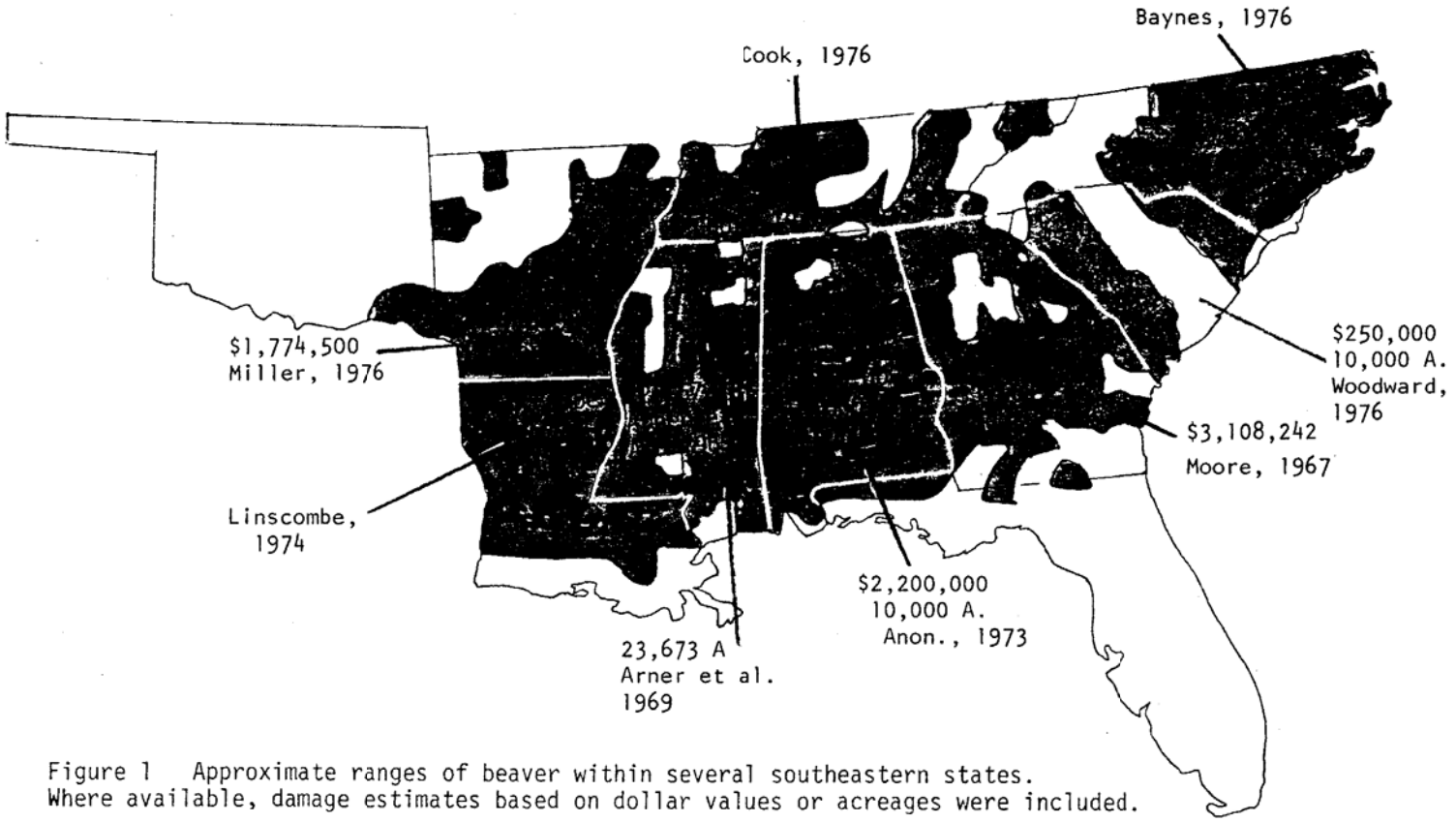

Figure 1 Approximate ranges of beaver within several southeastern states. Where available, damage estimates based on dollar values or acreages were included.

was placed in a wide mouth fruit jar and heated in a water bath. One cup (150 ml) of ethyl alcohol was stirred into the mixture as a thinner. One ounce of strychnine alkaloid (28.35 grams)was put into the mixture which was then stirred for approximately 20 minutes to insure that a homogeneous blend was obtained. This material was painted on sweetgum limbs 1 to 2 inches (2.5 to 5 cm) in diameter and approximately 2 feet (6m) in length. The amount of material prepared as above was sufficient to paint approximately 80 sticks, each of which contained an approximate dosage (351 mg at 12 mg/kg) sufficient to kill a 60 pound (27 kilogram) beaver.

Bait sticks prepared as described above were placed, one each at 12 locations where beaver feeding activity was observed around a large lake. The sticks were put on the shore within approximately three feet of the water's edge. When checked after 48 hours, sticks were missing or the bark had been peeled from them at 10 of the locations and two dead beaver were found. The stomach of one of these beaver contained storax covered sweet-gum bark; both animals were believed to have died from strychnine alkaloid poisoning.

It was concluded on the basis of these preliminary tests that beaver will take sweet-gum limbs painted with storax containing strychnine alkaloid and that this technique has sufficient potential in beaver control to warrant further field testing. Additional work is needed to determine the effectiveness of baits prepared in this manner and the possible hazards to other wildlife, particularly fish that may feed directly on the storax and vertebrates that may feed on dead beaver.

Compound 1080

Monofluoroacetic acid occurs naturally in several plants in Africa and Australia. Sodium monofluoroacetate (Compound 1080) a commercially produced product, is very soluble in water and relatively insoluble in organic solvents. Its mode of action as a toxicant is through inhibition of citrate and succinate metabolism within the Krebs cycle causing a reduction in the available energy to a point where cellular premeability barriers cease to function. Tissue and organ disorders result and death occurs due to cardiac failure, respiratory arrest following severe convulsions, or progressive depression of the central nervous system (Atzert, 1970. Its toxicity is essentially the same whether given orally, subcutaneously, intramuscularly, intravenously, or intraperitoneally (Quin and Clark, 1947).

In determining a lethal dosage of 1080 to beaver, penned individuals of mixed age and sex were injected intramuscularly at varying levels. Dosages were weighed and dissolved in distilled water so that each 0.10 cc of the stock solution contained the mg dosage level of 1080 for each kg of beaver. The beaver's weight in kg then converted directly to the number of 0.10 cc to be injected. Dosages used are shown in Table 1.

Table 1. Dosages of 1080 injected intramuscularly in 12 beaver of varied sex and age during tests under penned conditions.

Dosage in mg/kg	Death	Exhibited signs of poisoning	Survived
10.000	X	X	
10.000	X	X	
2.400	X	X	
0.700	X	X	
0.220	X	X	
0.202	X	X	
0.202	X	X	
0.185		X	X
0.150		X	X
0.100		X	X
0.033			X
0.033			X

Seven beaver died of 1080 poisoning at dosage levels greater than or equal to 0.202 mg/kg. All that received dosages of 0.100 mg/kg or more exhibited signs of 1080 poisoning.

The lethal dosage of 1080 to beaver is less than 0.202 mg/kg. An LD_{50} for beaver was not computed due to lack of a sufficient number of test animals, but it could normally be expected to be between 0.202 and 0.150 mg/kg.

The major signs of 1080 poisoning noted in the test beaver were their inability to maintain normal sitting posture. Those that were severely affected remained in a prone position, and were highly responsive to stimuli soon after signs of sickness were detected.

Compound 1080, like strychnine, is not registered for use as a beaver control agent, and therefore its use for this purpose is illegal. It has secondary and tertiary hazards to nontarget species, but these are somewhat reduced through dilution, excretion, and metabolic breakdown, prior to death if the minimal dosage levels are used (Atzert, 1971).

Economics of Trapping as a Beaver Population Control

Study Areas

In evaluating the economics of trapping as a control measure for nuisance beaver, four research areas were selected within Alabama that contained streams inhabited by beaver in established colonies as follows: a branch of Cowikee Creek near Spring Hill in northern Barbour County, Watoola Creek in southern Lee County, the South Fork of Sandy Creek near Camp Hill in Tallapoosa and Chambers Counties and Mill Creek near Coatopa in Sumter County (Figure 2).

Cowikee Creek: The stream portion of Cowikee Creek studied was approximately two miles in length, was bisected by a road, and had a series of 19 beaver dams most of which impounded water across the narrow flood plain (Figure 3). Most of the ponds had open water areas except for scattered stands of red alder (Alnus rubra) that occurred in some of the shallow areas. The slopes immediately above the flood plain were predominantly in pine (Pinus sp.). The sparseness of large trees in the flood plain indicated that beaver had been present on this watershed for at least 15 years. Tree species downstream from the pond area were predominantly Water Oak (Quercus nigra), and Sweet Bay (Magnolia virginiana).

Watoola Creek: A second study area in the Upper Coastal Plain soil type was selected along a total of approximately 11 miles of Watoola Creek (Figure 4). This watershed had two forks and a total of 50 beaver dams that spanned the flood plain in addition to other small dams. There were 11 large open water areas comprising approximately 155 acres. The wooded portions of the flood plain in this watershed contained a preponderance of Water Oak and Sweet Bay in addition to Black Willow (Salix nigra), Sweet Gum (Liquidambar styracif1ua), and River Birch (Betula nigra).

Sandy Creek: A research area consisting of a five mile section of stream on the headwaters of the South Fork of Sandy Creek is situated in the Piedmont soil region of Alabama (Figure 5). There were 22 major dams spanning the main stream in addition to adjacent smaller dams and six major open-water ponds. There were age variations in the beaver impoundments on this watershed, as indicated by open water ponds, those with standing dead timber and those with root systems of the timber only recently inundated. Roads cross the stream at four locations providing vehicle access to within approximately one-half mile of all sections of the stream. The portion of the stream studied is bordered along approximately three-fourths mile of its length by open pasture or row crop fields. The hardwood overstory species along portions of the stream that were not inundated were essentially those found in the Watoola Creek area in addition to pine and a variety of oaks.

Mill Creek: The fourth study area comprising two miles of the headwaters of Mill Creek is located in a region of sandy and heavy clay hills containing occasional calcareous outcroppings that form a low bluff on the west side of the Tombigbee River (Figure 6). The study area consisted of a series of 15 ponds that spanned the flood plain of this stream north of Hester Circle Road. Additionally, there were several small sub- or side dams of lesser significance. Beaver had been present on this watershed for several years as evidenced by a proportionally large number of open water ponds. Ponds 2 and 3 just upstream from Hester Circle Road contained small stands of Red Alder in the upper shallow areas. At the edge of the flood plain the major trees in addition to pine species, were Sweet Gum and Black Willow.

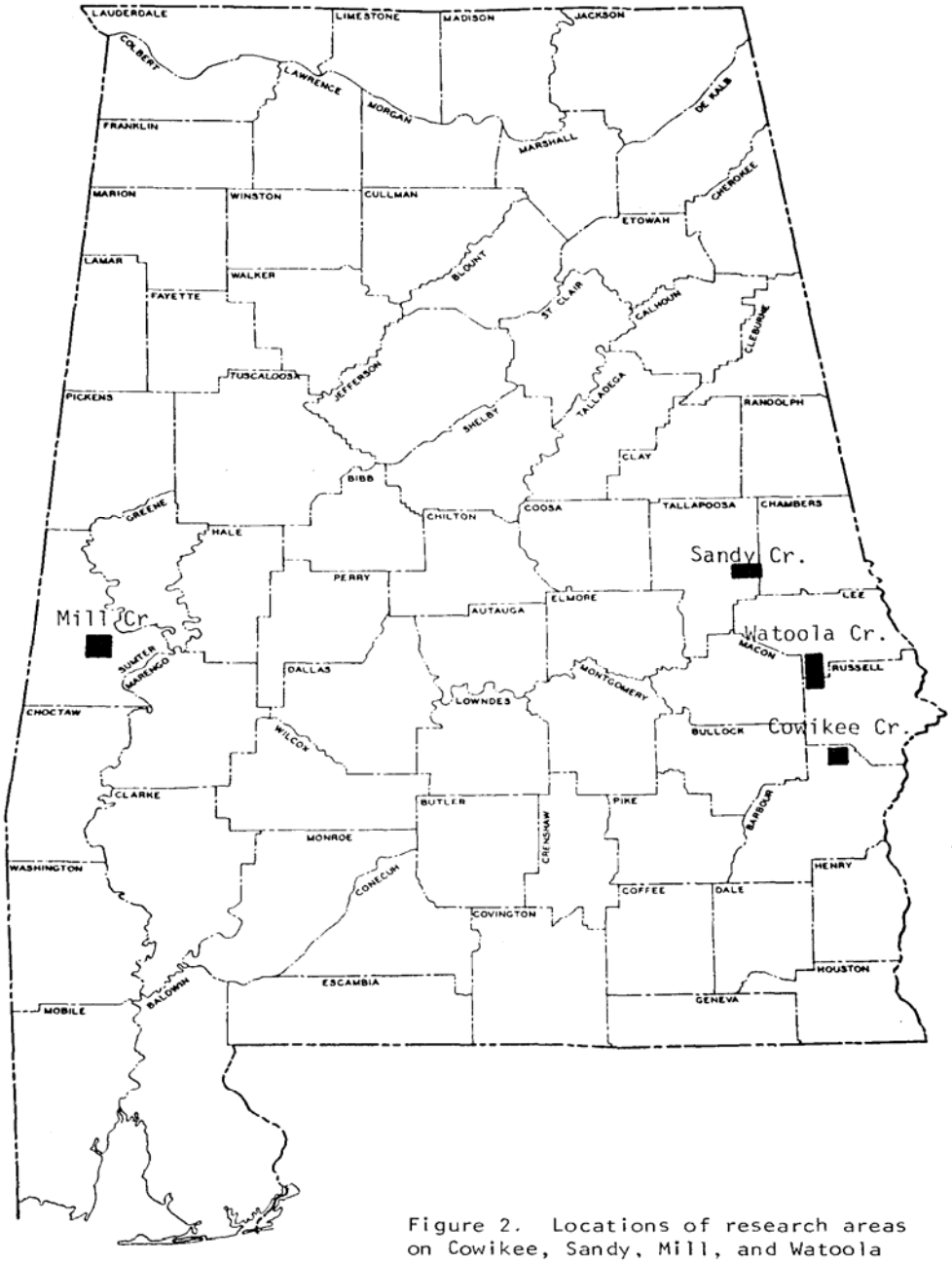

Figure 2. Locations of research areas on Cowikee, Sandy, Mill, and Watoola Creeks that were studied in evaluating the economic practicality of trapping to control beaver.

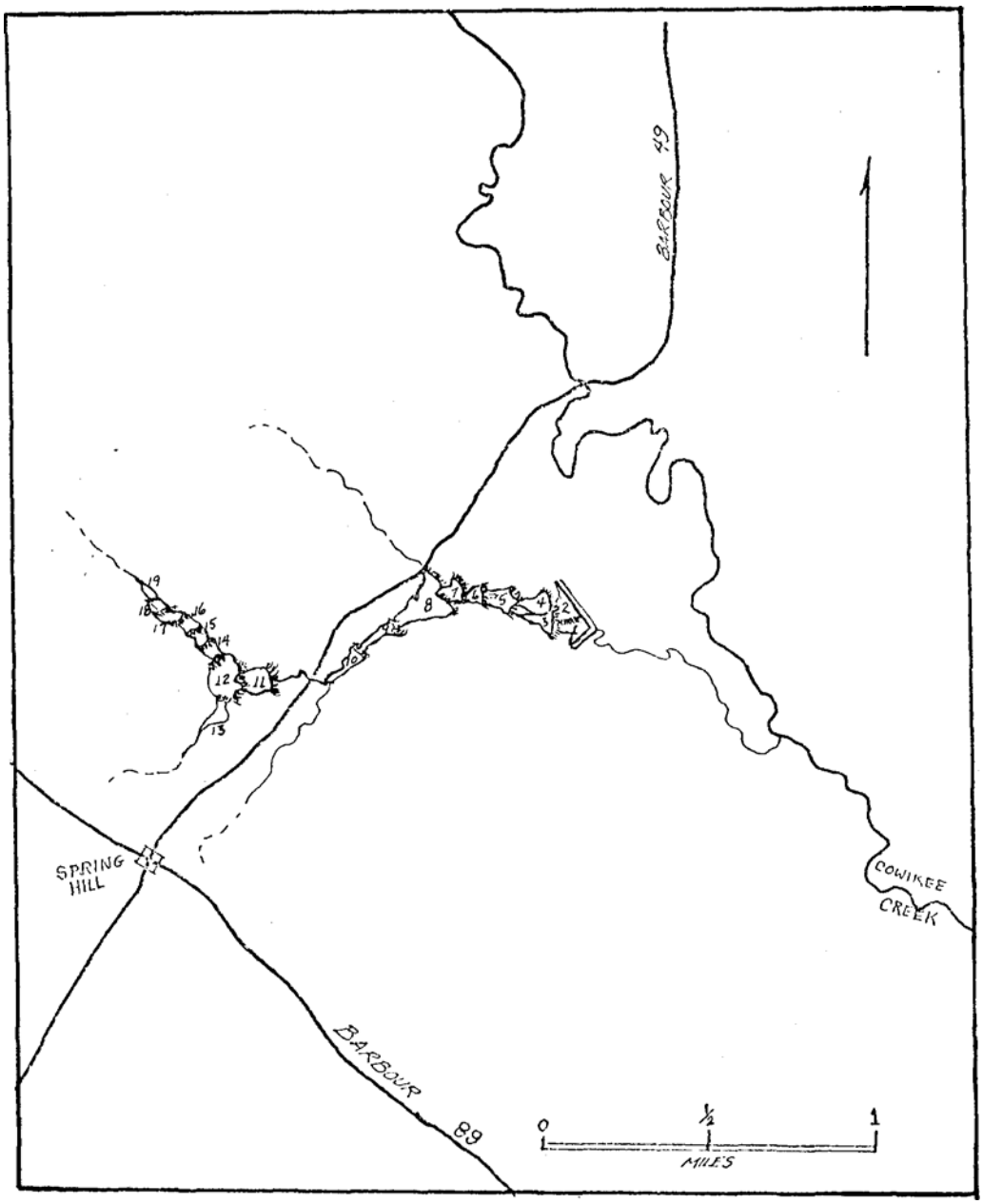

Figure 3. Cowikee Creek Research Area located near Spring Hill in Barbour County, Alabama that was studied in evaluating the economic practicality of trapping to control beaver. The portion of stream studied contained 19 beaver dams and impoundments.

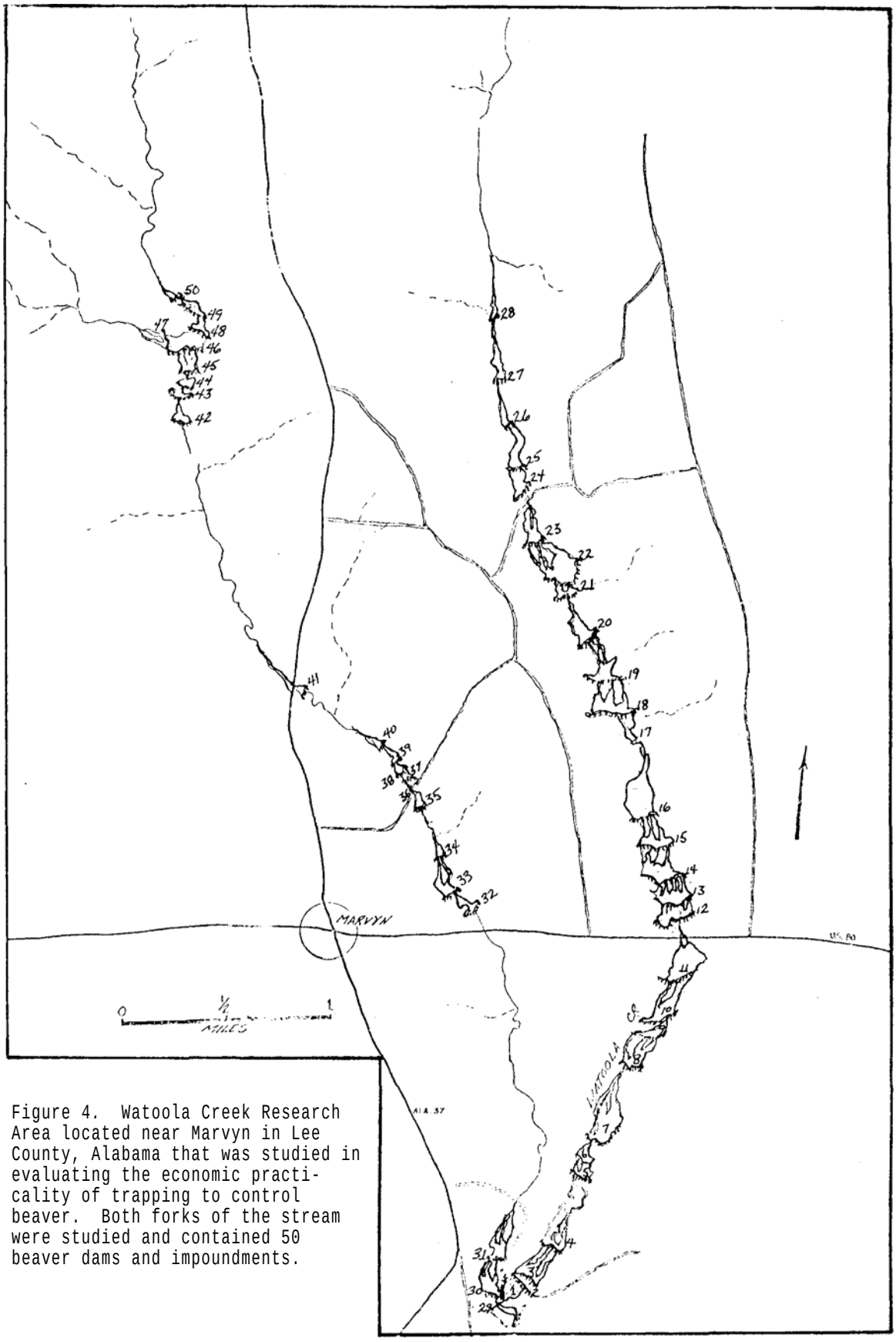

Figure 4. Watoola Creek Research Area located near Marvyn in Lee County, Alabama that was studied in evaluating the economic practicality of trapping to control beaver. Both forks of the stream were studied and contained 50 beaver dams and impoundments.

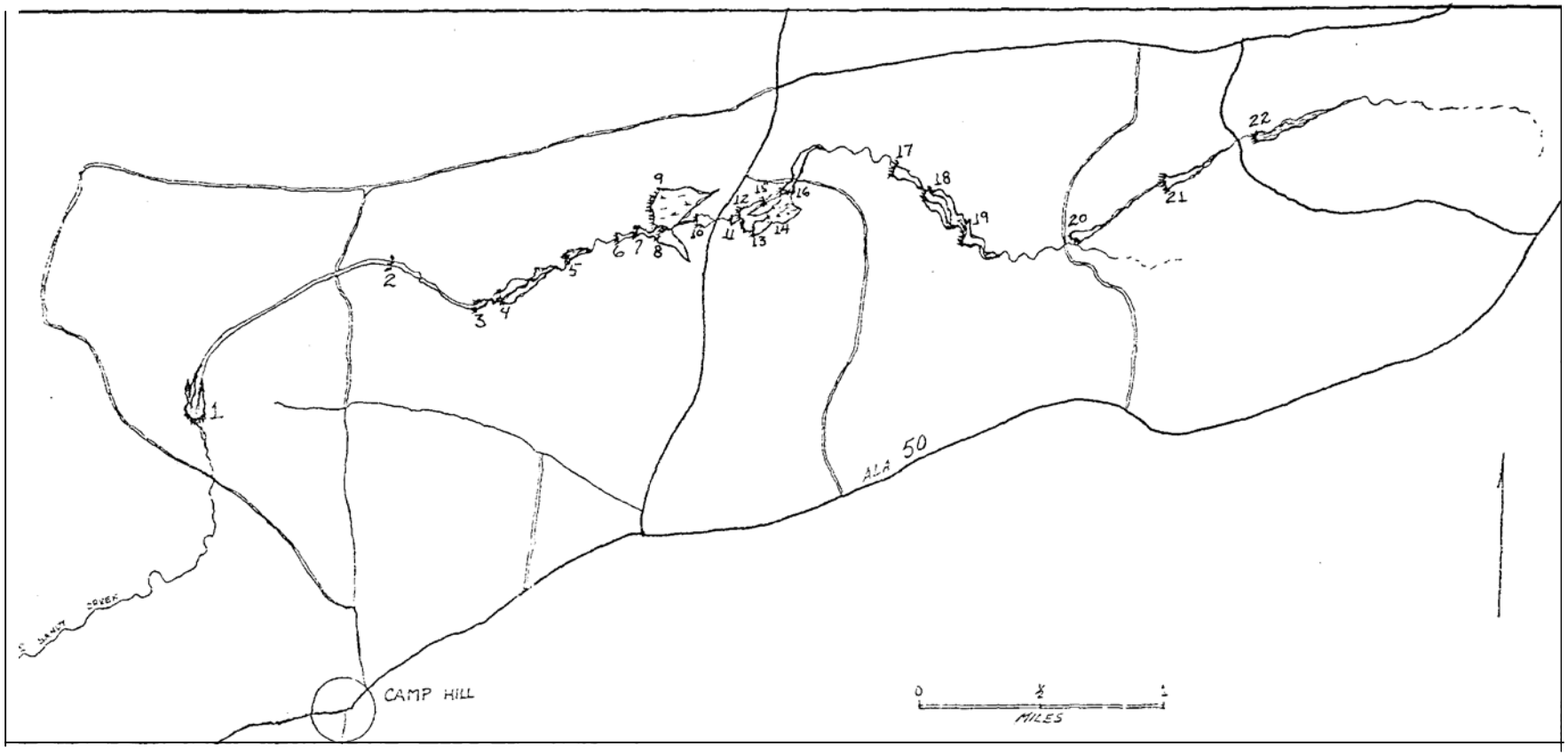

Figure 5. Sandy Creek Research Area located near Camp Hillin Tallapoosa County, Alabama that was studied in evaluating the economic practicality of trapping to control beaver. The portion of stream studied contained 22 beaver dams and impoundments.

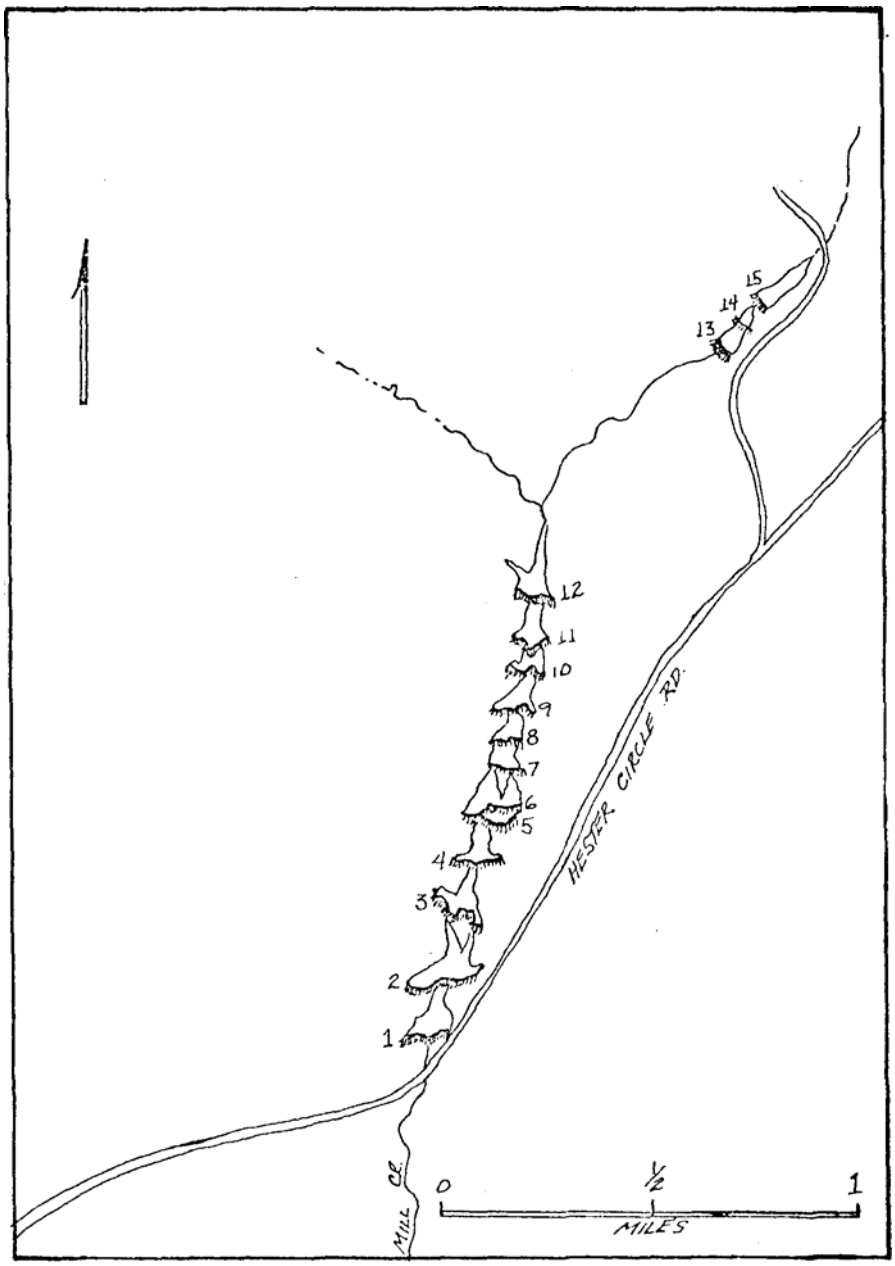

Figure 6. Mill Creek Research Area located near Coatopa in Sumter County, Alabama, that was studied in evaluating the economic practicality of trapping to control beaver. The portion of the stream studied contained 15 beaver dams and impoundments.

Methods

Each stream was trapped by professional trappers, a refuge manager, or research technicians for at least 10 days using techniques described by Hill (1974) during months that the fur is normally prime, and under favorable water conditions. Records were kept of the income from fur and other products of the trapping effort as well as the expenses incurred. The dams or ponds were numbered consecutively beginning with the first dam on the downstream portion of the watershed.

Results

Cowikee Creek: An experienced nonresident trapper trapped this watershed using conibear traps on four dams downstream from the road. During five trips between February 19 through 23, 1973 he caught 14 beaver and one otter, for which he received #315.00, or $49.70 per day, after deductions of $2.80 per day for expenses.

During the 1974 trapping season, a biologist with the Alabama Department of Conservation and Natural Resources trapped the Cowikee Creek area intermittently with 12 conibear traps a total of 291 trap nights over a period of approximately 31 days. This individual had no previous trapping experience and was assisted in setting the first seven traps. The traps were checked 11 times at an average interval of 2.8 days. He caught 14 beaver, 4 river otter, 4 raccoons, and 2 muskrats valued at $286.00. This was approximately $9.22 per day for the 31-day period, or $23.83 per visit to the study area. Expenses were estimated at $3.50 per visit, leaving a profit of $20.33 per trip.

The Cowikee Creek study area was reconnoitered on foot during early January 1975 to determine what additional trapping would be necessary to complete the removal of beaver. There was no evidence of recent beaver activity. The dams had washed out, and there were no sign of recent feeding activity or tracks. The presence of dried grasses in the ponds indicated that they had been dry the previous summer.

Watoola Creek: This study area was comparatively large and contained approximately 11 miles of stream, and therefore it took three years to adequately trap all portions of it twice. During the 1972-73 trapping season, two professional trappers trapped the lower portion of this study area from February 17 through 23 and caught 18 beaver and 4 river otter which they sold for $400.00. Their expenses for this portion of their trap line were estimated at $4.00 per day, providing a net profit of $62.66 per trip to the study area.

During the 1973-74 trapping season one of the professional trappers mentioned above, using conibear traps, caught 60 beaver on this study area during 18 trips between December 9 and January 10. He trapped 8 beaver from the area trapped the previous year and 52 from a new portion of the watershed. He received $540.00 for these pelts, or $30.00 per trip. In addition he caught approximately $180.00 worth of river otter, bobcat, and raccoon fur which, less approximately $4.00 per day expenses for this portion of his trap line, netted a total $36.00 per trip for his efforts.

Five other beaver were trapped by a technical assistant from another section of the watershed during eight visits (264 trap nights) between March 4 and March 20. Decreased movement activity associated with warm weather rendered trapping during this spring period relatively unproductive.

Except for two ponds north of Highway 80 on the west fork that had not been trapped, the study leader and a technical assistant worked on previously trapped portions of the watershed during the 1974-75 trapping season. A total of 16 trips were made to the study area between November 18 through December 31, 1974. Traps would have been checked more frequently except for high water conditions that reduced the total trap night count to 312, even though as many as 35 traps were in use some nights. The total catch of 13 beaver, 3 river otter and 7 muskrats was valued at $202.00, or $12.62 per trip. Expenses for this part-time trapping effort were estimated at approximately $2.50 per trip providing a net profit of approximately $10.12 per trip.

The beaver pond complex on the headwaters of the West Fork of Watoola Creek was trapped by an unknown party during the 1973-74 trapping season. The trap stakes found during the next year indicated that leghold traps had been used most frequently. Their catch was estimated to be less than 10 beaver.

The streams on this study area were checked for evidence of beaver in late 1975. The first pond north of Highway 80 on the West Fork contained evidence of some repair work on the dam. The other ponds on the West Fork were dried up and contained vegetation indicative of a dry condition during the previous growing season.

During the spring 1975 trapping it was noted that the five dams north of the unimproved road on the headwaters of the East Fork had been dynamited and drained and that the adjoining lands have been converted to pasture. This area had been partially trapped during the previous winter. The few beaver that survived the first trapping apparently moved downstream to the first dam south of the road. Repair work on the dam was noted when it was checked in late 1975. The remainder of the dams from that point south to the junction of the forks were in disrepair. Many of these dams were more than 15 years old, and had well established rooted vegetation. The main stream had divided and spread over the wide flood plain and these dams, although essentially intact, were in poor repair.

It was estimated that less than 10 beaver remained on this watershed at the end of the study, and a limited amount of trapping during the 1975-76 season would probably have removed these.

Sandy Creek: Prior to the 1972-73 trapping season a local resident shot and killed eight beaver from a bridge that crosses a channelized portion of the stream on the lower portion of the study area. During the trapping season, three students with no previous trapping experience and one student with limited experience trapped part of this watershed. This trapping was unrelated to the present study and was conducted from November 28 through December 22, using No. 3 and 4 double endspring leghold traps. Traps were checked daily except during a two day period when they were covered by high water. Nine beaver were taken during approximately 311 trap nights. In addition, three raccoons were caught: the total value of the catch was $102.00 or approximately $4.25 per day during the trapping period. Expenses were estimated at approximately $3.00 per day. This endeavor, involving the use of leghold traps by inexperienced trappers, was unprofitable, netting only $1.25 per day.

During the 1973-74 trapping season, a research technician with previous experience took 20 additional beaver in conibear traps during an estimated 504 trap nights from February 12 through March 12. The area was visited 11 times at an average interval of 2.5 days to check traps. The value of this fur was $208.00, or approximately $19.00 per trip to the study area. Expenses amounted to approximately $2.00 per trip leaving a profit of approximately $17.00 per trip.

During the 1974-75 seasons a research technician and the project leader trapped this area from November 4 through 15, a total of 146 trap nights. During seven visits to the area five beaver were caught and were valued at $37.30, or $3.33 per visit after expenses of approximately $2.00. The combined take of beaver from shooting and previous years trapping undoubtedly reduced the profit from the trapping effort in 1974-75.

This watershed was walked out during January 1975 and the dams except dam No. 1 had been washed out by high water. The only beaver sign seen was of limited feeding activity at dam No. 1 and a small scent mound midway between dams No. 5 and 6.

Mill Creek: This watershed was trapped by two technicians from January 28 through February 8, 1974 with 15 conibear traps. The traps were checked daily during the 12-day period, and 12 beaver were caught during the 180 trap nights. This fur was valued at $89.52 or $7.52 per day for the trapping period. Expenses for the Mill Creek portion of their total trap line was approximately $1.50 per day, leaving a profit of approximately $6.00 per day.

During the 1974-75 trapping season, the project leader and one technician trapped this area from January 6 through 16, using 23 conibear traps and two leghold traps with drowning devices, a total of 160 trap nights. Traps were checked daily except during two periods of high water. After January 17, these traps were checked four times by a student trapper before they were removed. High water conditions rendered many of the traps inoperative during a substantial portion of the second part of the trapping period. The total catch consisted of 10 beaver, 3 raccoons, and one river otter, valued at $125.40, or $7.77 per trip. Expenses for this portion of the trap line were estimated at approximately $1.50 per day, leaving an estimated profit of $6.27 per day.

The Mill Creek watershed was checked in the fall of 1975 for signs of beaver activity. There was a slight amount of repair work done on dam No.12. Beaver (perhaps as many as two) were known to have inhabited a bank den in the narrow stream portion approximately 200 meters above dam No. 12 when trapping was terminated in February. Otherwise this watershed had been trapped sufficiently to remove the beaver that were maintaining the open water areas along most of the flood plain. The ponds were mostly devoid of standing water.

The mean income and number of beaver caught per trip for the first and second year of trapping was $29.91 and 2.32 beaver, and $14.25 and 1.07 beaver, respectively. One factor, in addition to decrease in market value of fur, that influenced the price received for beaver the second year was the age and corresponding size of beaver caught the second year. For example, the mean age of beaver of both sexes taken from the Cowikee and Sandy Creek study areas the first year of trapping was 6.18 and 6.66 years, respectively, whereas the mean age of 28 beaver taken a year later was 3.28.

Table 2 contains a summation of the catches, dams, and estimated beaver left on each of the study areas.

Table 2. The number of ponds, beaver taken, beaver taken per mile of stream, and estimated number of beaver remaining on four areas studied from 1972 through 1975.

Study areas	Ponds	Beaver taken	Beaver taken per pond	Approx. No. of beaver per mile of stream	No. beaver estimated remaining
Cowikee Creek	19	28	1.47	14.0	0
Watoola Creek	50	101	2.02	10.0	10
Sandy Creek	22	42	1.90	8.4	2
Mill Creek	15	22	1.46	11.0	2

DISCUSSION

The conclusion that may be drawn from the trapping experience on these four watersheds is that if a trapper works an area for about two weeks, he generally catches most of the adults and a few beaver three years old and younger. If he continues to trap, the catch will, during the next two weeks, contain proportionally more young at greater intervals between catches. If he pulls his traps and moves to a more productive area after two weeks, he can generally return the following year and expect a reasonably good catch per unit of effort. Although the second year of trapping is usually less profitable that the first year, there are some advantages in that trappers usually have landowner permission in advance, know the access routes, know beaver movement patterns and thus most of the best trap sites. Generally he can accomplish the additional trapping needed to remove beaver from a small watershed while running a larger trap line. During the interim period there will have been a great reduction in reproduction due to the removal of most of the adult females during the first year of trapping. The second year of trapping will usually remove the maturing juveniles and the few adults missed during the first year. This technique was effective, and on the four streams studied, was generally profitable from a trappers standpoint. This approach is recommended for controlling beaver on small watersheds.

Beaver trapping is a profitable endeavor that has good recreational appeal. Based on questionnaire responses from 32 part-time beaver trappers in 1973 and 20 in 1974 their average per-day profit was $27.30 and $21.42 respectively. The income they earned was generally proportional to their trapping effort.

When consideration is given to the recreational aspects of trapping, the income potential, and the edible meat of the beaver, it would appear that population control can best be accomplished on small watersheds through trapper harvest. This approach provides for the wise use of nuisance populations as a natural resource and seems a better choice for control than some of the less prudent measures being contemplated.

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LITERATURE CITED

ANONYMOUS. 1967. Proc. First Alabama Beaver Symposium, Game and Fish Div., Ala. Dept. of Conserv. & Ala. Forest Product Assoc. Montgomery, Ala. pp. 51.

_____. 1972. Bayou Gators. Miss. Game and Fish Sept-Oct. 35(5): 10-11, pp. 20.

_____. 1973. A survey of damage to the forest resource caused by beaver in Alabama. Ala. Forestry Comm. Montgomery, Ala. 8 pp. typewritten.

_____1975. Florida 'gators snapping back. Florida Times Union. July 18, 1975.

ARNER, D.H. 1975. Annual Report, Dept. of Wildlife and Fisheries, MAFES Research High lights, Dec. Miss. State, Miss. 38(12):4-8. pp. 8.

_____., J. BAKER, D. WESLEY, and B. HERRING. 1969. An inventory and study of beaver impounded water in Mississippi. Proc. 23rd Annu. Conf. S.E. Assoc. Game and Fish Commissioners. 23:110-128. pp. 686.

ARTHUR, S.C. 1931. The fur animals of Louisiana. Bull. No. 18, La. Dept. of Conserv., New Orleans, pp. 444.

ATZERT, S.P. 1971. A review of sodium monofluoroacetate (Compound 1080) its properties, toxicology, and use in predator and rodent control. Spec. Sci. Rep. Wildlife No. 146, U.S. Fish and Wildlife Serv., Dept. Interior, pp. 34.

BARKAL0W, F.S. JR. 1949. A game inventory of Alabama. P-R Projects, Game, Fish and Seafoods Div., Ala. Dept. of Conserv. pp.140.

BAYNES, A.S. 1976. Personal communication.

BESHEARS, W.W. 1967. Status of the beaver in Alabama. In Proc. First Alabama Beaver Symposium, Game and Fish Div. Ala. Dept. of Conserv. 2-6, pp. 51.

BLACKWELL, W.P. 1948. Beaver distribution in Virginia. Paper presented to Va. Acad. Sci. Mar. 7, 1948.

COOK, G.W. 1976. Personal communication, Tennessee map of beaver density - January 1974.

COOPER, W.L. 1970. Preliminary investigations of certain beaver control methods in Alabama. Master of Science thesis, Auburn University, Auburn, Alabama. 85 pp. (typewritten)

_____ ., R.K. WILLIAMS and D.W. SPEAKE. 1972. The use of sweetgum and storax as possible attractants for beaver. Proc. 26th Annu. Conf. S.E. Assoc. Game and Fish Commissioners 26:209-211.

HILL, E.P. 1974. Trapping beaver and processing their fur. Ala. Coop. Wildl. Res. Unit, Zoo.-Ent. Dept. Series No. 1, Agric. Exp. Sta. Auburn Univ. pp. 10.

H0WELL, A.H. 1921. A biological survey of Alabama. U.S.D.A. Bur. Biol. Sur. North American Fauna No. 45, U.S. Gov. Printing Office, Washington, D.C. 88 pp.

LARSON, J.S. 1967. Beaver research in Appalachian, Maryland. Atlantic Naturalist, Jan.-Mar. 22(1) :5-12.

LINSCOMBE, G. 1974. The beaver is back. Louisiana Conservationist, Nov.-Dec. 26(11-12): 18-21. pp. 31.

MILLER, J.E. 1976. Personal communication with map of 1975 beaver damage total estimate in Arkansas. Cooperative Extension Serv. Univ. of Arkansas, Little Rock.

MOORE, G.C. and E.C. MARTIN. 1949. Status of beaver in Alabama. Ala. Dept. of Conserv. pp. 30.

MOORE, L. 1967. 1967 beaver damage survey. Georgia For. Comm. pp. 27

QUIN, J.I. and R. CLARK. 1947. Studies on the action of potassium monofluoroacetate (CH_2FC00K),(Drehapetalum cumosum (Hook) Engl.) toxin on animals. Ondersport J. Vet. Sci. 22:77-90.

SWANK, W.G. 1949. Beaver ecology and management in West Virginia. Bull. No. 1, Div. of Game, Conserv. Comm. of West Va. pp. 65

WILLIAMS, R.K. 1971. Investigations of bait substances suitable for control of nuisance beaver. Master of Science thesis, Auburn Univ. Auburn, Alabama. 77 pp. (typewritten)

WOODWARD, D.K. 1976. Personal communication with current map of beaver distribution in South Carolina.