IWPF000081

DROUGHT IMPACT ON BLANDING'S TURTLE AND EPISTYLIS OCCURRENCE ON PAINTED TURTLES

LEE COUNTY NATURAL AREA GUARDIANS
319 SOUTH MASON, AMBOY, ILLINOIS 61310

WILLIAM E. ROGERS

AND

DEBRA A. OSMER

SEPTEMBER 1990 - JUNE 1991

Table of Contents

Drought Impact on Blanding's Turtle

Page 1.....Abstract

Page 2.....Introduction

Page 3.....Methodology

Page 4.....Results

Page 7.....Discussion

Page 15.....Summary

Pages 17 - 28.....Exhibits

Epistylis Occurrence on Painted Turtles

Page 29.....Abstract

Page 30.....Introduction

Page 32.....Methodology

Page 34.....Results

Page 36.....Discussion

Page 39.....Summary

Pages 40 - 64.....Exhibits

Page 65.....Bibliography

Page 67.....Acknowledgements

Page 68.....Financial Statement

DROUGHT IMPACT ON BLANDING'S TURTLE

ABSTRACT

The drought of 1988-89 drastically reduced water levels in the wetlands of southwestern Lee County, Illinois. The disappearance of normally permanent aquatic habitat prompted concern by the Lee County Natural Area Guardians (LeeNAG) that Blanding's turtle (*Emydoidea blandingi*) had as a species been adversely affected. Reports of a landowner familiar with the species seemed to support this concern. Subsequent investigations and observations made after the return of normal water levels failed to confirm the investigators' suspicions.

INTRODUCTION

With the exception of box turtles and southern tortoises, most North American turtles seem to prefer an aquatic environment during that time of year when they are active. In this respect, Blanding's turtle occupies a rather unique position among native chelonians. Where a range of suitable habitats exists, this species exercises considerable freedom of choice. It has been variously described in the literature as "essentially aquatic" (Conant, 1958), "semi-aquatic" (Johnson, 1977) and "essentially terrestrial" (Carr, 1952). These diverse impressions probably reflect the adaptable nature of a creature whose habits are influenced by a number of environmental factors such as the availability of water, the presence (or absence) of food, the time of year and the proximity of nesting grounds. It is likely that other factors play a part as well.

In the Lee County portion of the Green River Lowlands, an area of numerous ponds and wetlands, Blanding's turtle displays a marked affinity for water. Of the 31 individuals collected in the 1989-90 survey, only one was captured on land. The scarcity of water resulting from the 1988-89 drought probably stimulated compensatory responses in local

Emydoidea. The purpose of this report is to suggest what some of those responses might have been.

METHODOLOGY

The low water conditions described above were noted during a 1989-90 LeeNAG survey of Blanding's turtle in the Lee County study area. The drought was in progress when this survey was begun in September 1989. Baseline data on turtle numbers for the period immediately preceding the drought were lacking; therefore, conclusions were by necessity based on observations made during the drought, after the return of normal water levels and to a lesser degree on anecdotal information provided by a landowner. This landowner had followed closely a 1986 turtle study of his wetland and was able to distinguish Blanding's turtle from two other inhabitants, painted turtle *(Chrysemys picta)* and snapping turtle (*Chelydra serpentina*). Published reports on the natural history of *Emydoidea* were examined to gain insight into the turtle's habits. Relative 1986 and 1989-90 water levels were compared for six sites which had produced Blanding's turtles in the earlier survey. Control ponds located near dry ponds were trapped at the height of the drought in 1989 to determine whether 1986 survey specimens had emigrated. These data were then used to establish whether any inhabitants of the permanent sites

moved to revitalized wetlands following the return of normal precipitation in the spring of 1990.

Although not scientific in the strictest sense, these methods represent all that were available under the circumstances and the conclusions drawn from them are considered by the investigators to be broadly valid.

RESULTS

This section usually details the results of procedures outlined in "Methodology". Since the present study is in essence an after-the-fact survey, we will use this space to report on observations made during the drought and following the return of normal water levels.

As stated above, we have no baseline data on Blanding's turtle numbers and distribution for the period immediately preceding the drought. However, some background information is available from the summer of 1986, roughly two years before the onset of dry conditions. This information was gathered during a LeeNAG survey of the yellow mud turtle (*Kinosternon flavescens flavescens*), conducted in southwest Lee County. In the course of trapping for the latter species, a total of 13 Blanding's turtles were taken from six sites (numbers 2, 3, 11, 14, 16 and 24). Three sites were located in Amboy township, two in May township and one in East Grove township. In 1986, all six sites were fully-charged wetlands.

In 1989, LeeNAG secured a Nongame Checkoff grant to conduct a follow-up survey of Blanding's turtle in the same area. At the time this survey was begun in September, drought conditions had prevailed for some 16 months. The investigators found that four of the six 1986 Blanding's sites (numbers 3, 14, 16 and 24) were dry and the remaining two (numbers 2 and 11) were dramatically reduced in size. The latter two sites were trapped without success. Some water remained in ponds within .5 km of the four dry sites. Trapping was done in these ponds in an effort to capture turtles which may have emigrated. Of four sites sampled, three (numbers 6, 17 and 20) produced no Blanding's turtles. The fourth (site 1) yielded six specimens, none of which carried 1986 survey marks.

During the winter of 1989-90, a landowner reported to the investigators that he had found remains of what he believed to be Blanding's turtles on his property. The site in question is the Guanci/Spears wetland (comprising sites 3, 4 and 5), a 7.5 ha marsh which normally retains water even in relatively dry years. It is the largest site in the study area and produced one Blanding's turtle in the 1986 mud turtle survey. Dependent solely on run-off for its water supply, this marsh had evaporated rapidly throughout the spring of 1988 and by July of that year was completely dry. The owner stated that while repairing duck blinds on

the site in early fall he noticed "a couple dozen" carapaces in and around the dry marsh and that some of them appeared to be those of Blanding's turtles. The investigators decided to conduct a walk-over of the area at the earliest opportunity to confirm this report. The search was carried out on March 11, 1990. At that time, vegetation was sparse and ground visibility very good. Water was restricted to a few shallow pools of perhaps 50 m^2 or less scattered over the bed of the marsh. The investigators felt that even though 18 months had elapsed since the reported discovery of the carapaces, at least some of them, or parts thereof, should remain.

Two complete circuits were made of the wetland's perimeter, one near the former shoreline and another some 10 m in. The marsh bed itself was then transected at regular intervals and the shallow pools were waded. After searching the entire 7.5 ha in this manner, only three fragmentary carapaces of painted turtles were found. An inspection of the timber and sand ridges surrounding the site turned up nothing, nor were any Blanding's turtle remains seen during the ensuing trapping season. In conclusion, it could not be confirmed that a die-off of *Emydoidea* had occurred at the Guanci/Spears wetland.

Spring and summer of 1990 saw the return of normal precipitation to the local area. The desiccated wetlands

quickly refilled with water and judging from the lush vegetation and abundant fauna, it was difficult to believe that a drought had taken place. Eight of 13 sites trapped during this period produced a total of 25 Blanding's turtles. Of these eight sites, six (3, 4, 5, 14, 16 and 21) had been dry at the end of the 1989 trapping season on October 16. The Guanci/Spears wetland (sites 3, 4 and 5), without water for most of 1988 and 1989, yielded 16 healthy specimens in May and June of 1990. Only one of the 31 individuals captured throughout the survey carried a 1986 survey mark. Although this leaves 12 turtles from that survey unaccounted for, we see no reason to suspect that they succumbed to the drought. Rather, the sheer size of the sample, including 25 individuals from eight sites over a six-week period, suggests that Lowlands *Emydoidea* weathered the drought quite well.

DISCUSSION

The trouble with designing a study to document drought responses is that researchers seldom know when a drought is about to occur. Such a study would ideally be in place and functioning well in advance of the drought's onset so that a baseline of "normal" behavior could be established. Occasionally, a fortuitous turn of events will provide an opportunity when a drought takes place in the course of

long-term research being conducted for other purposes. One good example can be found in a South Carolina study carried out by J. Whitfield Gibbons and associates. This study, designed to monitor populations of five turtle species in Ellenton Bay, spanned the 15 year period from 1967 to 1982. Especially precise information was gathered between February 1975 and July 1982 (excepting April through October 1979) when the site, a 10 ha wet area, was surrounded by a continuous drift fence. When drought struck the region in 1980-81, the researchers were already armed with 13 years of data on reproduction and turtle movements in and out of the bay. Their conclusions appeared in an article entitled "Drought-Related Responses in Aquatic Turtle Populations" in Volume 17 of the Journal of Herpetology, 1983. (Copy attached.)

Since the South Carolina location is well south of its normal range, *Emydoidea blandingi* was not included in the species studied. However, the responses of those species which were studied - pond slider (*Pseudemys scripta*), cooter (*Pseudemys floridana*), chicken turtle (*Deirochelys reticularia*), mud turtle (*Kinosternon subrubrum*) and stinkpot (*Sternotherus odoratus*) - can probably be regarded as typical for most aquatic turtles faced with drought conditions.

Among the South Carolina turtles, the most frequently observed departures from normal behavior involved reproduction and emigration. Reproductive activity was "dramatically lower" (Gibbons and associates, 1983) in four of the five species. For 1981, egg laying was suspended in *P. floridana* and *S. odoratus* and sharply curtailed in *P. scripta* and *D. reticularia*. While the number of nesting *K. subrubrum* remained essentially the same, the percentage of females laying more than one clutch was lower. The phenomenon of decreased fecundity in lean times is well documented in many animal species. It apparently allows the resulting lower populations to make better use of diminished resources. Although it is unclear how the Ellenton Bay statistics apply to Blanding's turtle in northern Illinois, it seems reasonable to assume that fewer eggs were laid in 1988-89 than in previous years. In the absence of hard evidence to support this assumption, it can be reported that LeeNAG investigators found little evidence of nesting activity on the sand ridges surrounding the Guanci/Spears wetland in late summer and fall of 1989. These ridges are known to be used by the indigenous populations of painted and snapping turtles and probably serve *Emydoidea* as well. In contrast, vigorous nesting activity by the former two species was observed in these areas following the return of normal water levels in 1990. This temporary reproductive

decline in *C. picta* and *C. serpentina* may have been accompanied by a similar response in Blanding's turtle.

Emigration, the movement of individuals from one body of water to another, is practiced by many turtle species and for some is considered normal behavior even in times of plenty. When extenuating circumstances (such as drought) render a habitat unliveable, emigration can become a survival tactic. The propensity to emigrate varies from one species to another. Turtles that are strongly aquatic (e.g. some *Sternotherus* and *Trionyx* species) seem reluctant to abandon a shrinking habitat and will often burrow into the mud when no water remains. Those species which are adapted to terrestrial travel will emigrate freely. In the South Carolina study, two species (*P. floridana* and *P. scripta*) which frequent ephemeral aquatic environments emigrated in much higher numbers during the drought. The majority departed toward the nearest permanent body of water. The highly aquatic *D. reticularia* and *S. odoratus* showed little change in emigration rates from previous years and most probably escaped dehydration by aestivating in the mud. The fifth species, *K. subrubrum*, is well adapted to terrestriality and is presumed to have been little affected by the drought.

For present purposes, we will consider which of the responses noted above may have been manifested in Lee County *Emydoidea* during the 1988-89 drought.

REPRODUCTION - Blanding's turtle breeds between March and November, most commonly in March, April and May. Nesting takes place in June and July. Clutches range from six to eleven eggs and hatchlings emerge in August and September (Ernst and Barbour, 1972).

We will focus on the Guanci/Spears wetland, the largest site in the study area and the most prolific producer of Blanding's turtles in the 1989-90 survey. Judging from landowner reports, water supplies were severely depleted by late spring of 1988 and the marsh was completely dry by July. In 1989, the site held no water until late in the year. In effect, environmental conditions favoring normal reproduction were marginal in 1988 and extremely poor in 1989. The extent to which these factors influenced the breeding behavior of Guanci/Spears *Emydoidea* is uncertain. Individuals which emigrated to sites of permanent water may have nested successfully.

For added insight, we will turn again to the Ellenton Bay study. Reproductive adaptations to the 1981 drought differed widely in two of the five species observed. *S. odoratus*, a highly aquatic turtle, responded with a complete suspension of egg-laying, whereas *K. subrubrum*, which readily adapts to dry conditions, showed little change in reproductive output (Gibbons and associates, 1983). Ecologically, *Emydoidea* falls somewhere between these two

kinosternids, being neither highly aquatic nor highly terrestrial. It might be expected, then, that nesting by local Blanding's turtles may have been moderately suppressed by the 1988-89 drought.

Overall, reproductive success could have been more heavily impacted in the area of hatchling mortality than in either breeding or nesting. Young turtles emerging from the nest into drought conditions, with no nearby water available, are vulnerable to dehydration and predation. Smith (1961) reported that:

> *"A number of baby Blanding's turtles were found dead and desiccated on August 26 in sand hills in Whiteside County. These young turtles were presumably hatchlings that had been killed by the hot sun before they could find their way across several hundred feet of sand to water."*

EMIGRATION - Blanding's turtle feeds on land and in the water. While the species is now generally regarded as being primarily aquatic, it is apparently comfortable out of water and does not hesitate to travel on land. In his intensive study of *Emydoidea* in Lake and McHenry Counties, John Rowe noted that both sexes "occasionally made extensive overland movements to nesting sites or to reach other aquatic habitats in search of mates or food. Short term emigrations from water for basking and/or undetermined purposes were also observed." (Rowe, 1987.)

In the LeeNAG study area, six of the eight sites which produced Blanding's turtles in 1990 had been dry in 1989 (see "Results"). Of these six, five were located within .5 km of some permanent water. Four of the closer permanent water sites were trapped in 1989; only one yielded *Emydoidea*. None of the six individuals captured at that site carried 1986 survey marks and thus could not be identified as refugees from dried-out sites. The lack of captures at the other three permanent sites might be attributable to poor water conditions (low level - high temperature) which may have disrupted normal feeding activity. None of the aforementioned specimens collected and marked in 1989 were recaptured at nearby recharged sites in 1990.

Despite a shortage of supportive statistical data, the investigators believe that at least some Lee County *Emydoidea* emigrated during the drought. This consensus is an extrapolation based on the following facts:

1. Sites of known occupation by Blanding's turtles in 1986 were dry in 1989.
2. Other sites within a reasonable distance retained water throughout the drought.
3. Blanding's turtle is able and willing to travel overland.
4. In 1990, both water and Blanding's turtles had returned to the formerly dry sites.

In the final analysis, only two plausible possibilities can explain the absence of *Emydoidea* from their former habitats: they either emigrated or they aestivated. Given what we know of Blanding's turtle ecology, emigration seems the more likely possibility.

AESTIVATION - Some turtles avoid dehydration during dry weather by burrowing into mud and becoming more or less dormant. This reaction is typically seen in the more aquatic species. In the South Carolina study, *S. odoratus*, which seldom ventures onto land except to lay eggs, emigrated in low numbers and is presumed to have responded primarily by aestivating. Other species may aestivate on land. The spotted turtle, *Clemmys guttata* (Ward et al., 1976), *K. subrubrum* (Bennett et al., 1970) and *K. flavescens* (Cooper, 1977) have been reported to practice terrestrial aestivation (Rowe, 1987). Ross (1985) reportedly observed terrestrial aestivation in Blanding's turtle for up to five days. In the Lake/McHenry County study, *Emydoidea* travelling on land were seen to remain stationary in leaf litter for as long as six hours (Rowe, 1987). LeeNAG investigators could find no other references in the available literature to aestivation, either aquatic or terrestrial, in Blanding's turtle. The examples offered by Ross and Rowe did not persist long enough to be considered true aestivation. Considering the natural history of

Emydoidea blandingi and the lengthy duration of the drought, we believe that brief aestivation may have been practiced in occasional conjunction with, but not to the exclusion of, emigration.

SUMMARY

The history of Blanding's turtle in the swamps and marshes of the Green River drainage probably spans several thousand years. Over the millenia this species evolved strategies which enabled it to cope with the whims of nature. The effective operation of these strategies requires certain natural conditions, foremost among which is the availability of suitable habitat. From a practical standpoint, we must conclude that the ability of *Emydoidea blandingi* to tolerate environmental calamities such as drought has dimished in proportion to the shrinking of its range due to agriculture and other development. Emigration, for example, is a viable adaptation only if there are places to emigrate to. The turtles of southwest Lee County are fortunate in that their environment retains at least a semblance of its former vitality. In today's world, however, this situation is more often the exception than the rule.

The foregoing data suggest that *Emydoidea* can successfully withstand severe conditions if it has the tools for survival at its disposal. The preservation of remaining

habitat with good water, intact and undisturbed nesting grounds, safe travel corridors and the protection mandated by current laws can assure the continued existence of Blanding's turtle in the Green River Lowlands.

Journal of Herpetology, Vol. 17, No. 3, pp. 282-286, 1983
Copyright 1983 Society for the Study of Amphibians and Reptiles

Drought-Related Responses of Aquatic Turtle Populations

J. WHITFIELD GIBBONS, JUDITH L. GREENE, AND JUSTIN D. CONGDON

Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29801, USA

ABSTRACT.—A major drought in South Carolina provided opportunity to observe certain reproductive and emigration responses of freshwater turtle populations that have been studied for 15 years. Five species responded differentially to the drying of a major aquatic habitat. *Pseudemys scripta* and *P. floridana* emigrated in greater numbers, and fewer females laid eggs than in any previous year. *Sternotherus odoratus* and *Deirochelys reticularia* did not reproduce at the level of previous years but did not abandon the aquatic habitat. Reproduction and emigration of *Kinosternon subrubrum* were not appreciably different from other years. The differing responses of the species are discussed in terms of the ecological and evolutionary differences between them.

Sporadic drought conditions in regions of the southeastern United States may result in the total drying of many relatively permanent aquatic areas (i.e., that do not dry annually). Among the aquatic habitats most affected are Carolina bays (Sharitz and Gibbons, 1982) that receive no input from springs or streams so that water levels are strongly influenced by precipitation and evaporation. Certain biological phenomena (e.g., death of stranded fishes) can be reliably related to the drying of a habitat; however, documenting the influence of a drought on phenomena such as migration or reproductive output in most animal species requires long term data so that natural variability can be separated from the effects of drought. Such data are rarely collected because of the necessity of uninterrupted studies that include years having widely differing environmental conditions.

Long-term population studies associated with a Carolina bay in South Carolina permitted an evaluation of the responses of freshwater turtles to drought conditions during 1980 and 1981 that resulted in almost total drying of the aquatic habitat under study. The objective of this paper is to examine several drought-related phenomena associated with five species of aquatic turtles (*Pseudemys scripta, P. floridana, Deirochelys reticularia, Kinosternon subrubrum*, and *Sternotherus odoratus*).

PROCEDURES

Observations were made at Ellenton Bay, a Carolina bay on the Savannah River Plant (SRP) in the Upper Coastal Plain near Aiken, South Carolina. During the past 15 years, Ellenton Bay has fluctuated in size from a 10 ha aquatic area to a terrestrial habitat with a few remaining muddy areas and less than 500 m^2 of open water. Ellenton Bay turtle populations (Gibbons, 1970) have been studied with varying degrees of intensity since 1967. Of the individuals marked by notching or drilling shell marginals in 1967 and 1968 some of each of six species were recaptured in 1980 or 1981.

Terrestrial movement was monitored with drift fencing and pitfall traps (Gibbons and Semlitsch, 1982). Ellenton Bay was surrounded by a continuous drift fence (1240 m) from February 1975 to July 1982 with the exception of 10 April 1979 to 31 December 1979. Traps were checked daily during these periods and turtles were registered and measured before being released on the opposite side of the fence. A total of 6003 turtles of the 5 most common species were captured or recaptured.

In this paper, the term "emigration" indicates that a turtle (excluding gravid females) was leaving Ellenton Bay when it was last captured in a given year. To establish the frequency and direction of emigration, the shape of the bay was cor-

jected to a circle and divided into 30° sections. Emigrating turtles were assigned to the appropriate section for analysis.

Data obtained during the years when Ellenton Bay was enclosed by a drift fence allowed the identification of population responses in 1981 that differed from previous years. Numbers of turtles emigrating were recorded for the entire year in 1975, 1976, 1977, 1978, 1980, and 1981. Females with eggs were recorded for the same years with the exception of 1975. The x-ray technique (Gibbons and Greene, 1979) in conjunction with the drift fence was used to determine frequency and size of clutches. This approach has been successfully used in previous studies at Ellenton Bay (Gibbons et al., 1982), and elsewhere (Tinkle et al., 1981; Congdon et al., 1983a).

RESULTS

Ellenton Bay, the deepest Carolina bay on the SRP, reached its lowest water level in a decade in November 1981 (Fig. 1), a level comparable to that reached during the autumn of 1969 (Gibbons, 1970). Only a few small (<100 m²), shallow (<30 cm depth) pools remained of the normally more extensive (≈10 ha) and deeper (1–1.5 m) aquatic habitat.

Egg Laying.—The number of females laying eggs was dramatically lower for four species in 1981 than in any previous year for which records are available (Table 1). No individuals of *P. floridana* or *S. odoratus* nested at Ellenton Bay in 1981. In previous years, 3 to 12 *P. floridana* and 3 to 17 *S. odoratus* were known to lay eggs.

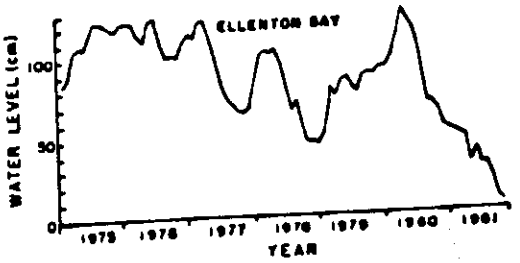


FIG. 1. Water level (cm) of Ellenton Bay from 1975 through 1981. The most notable changes in egg laying and emigration were observed during 1981, the year of most severe drought.

Only 3 *P. scripta* nested in 1981 compared to 10 to 35 in previous years. The fourth species, *D. reticularia*, normally nests at Ellenton Bay in late winter (Feb–March) and in early fall (Aug–Sep; Gibbons and Greene 1978). In late winter of previous years, 8 to 14 *D. reticularia* nested compared to 3 in the winter of 1981 and none in 1982. The number nesting in the autumn ranged from 8 to 17. In 1981, none nested during the fall. The number of *K. subrubrum* laying eggs in 1981 (N = 23) was comparable to other years (N = 19–54, $\bar{x}$ = 37). However, the percentage of *K. subrubrum* laying more than one clutch in 1981 was only 4% compared to 14% to 44% in other years (Gibbons et al., 1982).

Emigration.—Unusually high numbers of both species of *Pseudemys* abandoned Ellenton Bay during late spring and early summer of 1981, and as of July 1982 most had not returned. As few as 25 and as many as 70 *P. scripta* have been registered as non-returning emigrants in previous years (Table 1). In 1981, 293 *P. scripta* de-

TABLE 1. Numbers of individual turtles laying eggs and emigrating (excluding 1979) from Ellenton Bay in years preceding the drought (1975–1980) and during the drought (1981).

	Number with clutches			Number emigrating		
	Pre-drought			Pre-drought		
	$\bar{x}$	Range	Drought	$\bar{x}$	Range	Drought
Pseudemys scripta	22	10–38	3	46	25–70	293
Pseudemys floridana	9	3–12	0	9	3–19	40
Deirochelys reticularia	25	16–32	3	23	9–40	33
Kinosternon subrubrum	41	19–54	23	61	49–93	76
Sternotherus odoratus	9	3–17	0	8	4–14	10

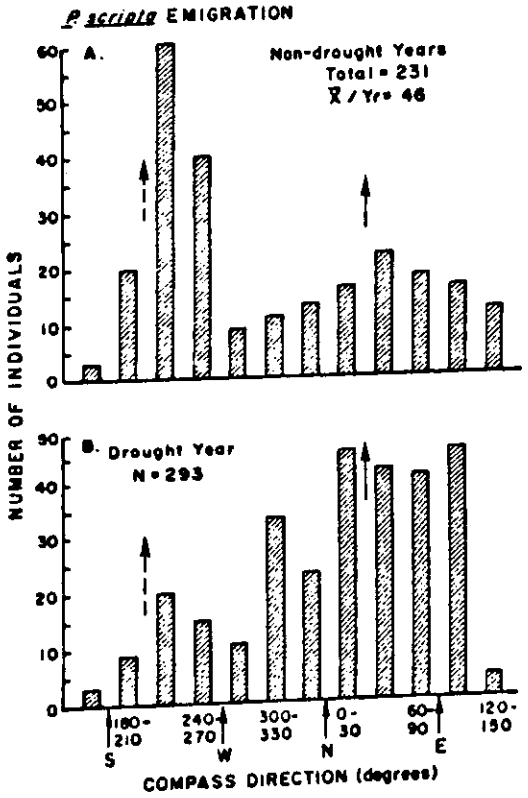


FIG. 2. Compass directions of *Pseudemys scripta* emigrants prior to and during the drought. Solid arrow indicates the direction of Bulldog Bay, the closest (400 m) permanent water. Dotted arrow indicates direction of Woods Bay, the closest (200 m) ephemeral body of water.

parted from the drying aquatic habitat (Table 1). Most (52%) emigrated in the direction (±60°) of the nearest remaining body of water in contrast to a mean of 32% that emigrated in that direction in previous, non-drought years (Fig. 2). Three to 19 *P. floridana* have been recorded emigrating in other years compared to 40 in 1981. Although the directional shift during 1981 compared to previous years was not as great as in *P. scripta*, the total number emigrating in 1981 (N = 40) was only slightly less than the total of the previous five years (N = 45).

Three species (*D. reticularia, K. subrubrum, S. odoratus*) did not emigrate in numbers greater than the maximum in previous years nor did they show any noticeable shift in the direction of emigration. However, for each species, the number emigrating during the drought year exceeded the mean number emigrating during the five previous years for which we have data. In 5 earlier years, 9 to 40 *D. reticularia* left Ellenton Bay and did not return (Table 1). In 1981, 33 emigrated. As few as 49 and as many as 93 *K. subrubrum* emigrated from Ellenton Bay in the years from 1975 to 1980 compared to 76 in 1981 (Table 1). *Sternotherus odoratus* is typically more aquatic and in non-drought years fewer individuals emigrated compared to the other species ($\bar{x}$ = 8; range 4–14). In 1981, 10 *S. odoratus* left Ellenton Bay and did not return (Table 1).

DISCUSSION

Five species of turtles studied in Ellenton Bay displayed three distinct patterns in reproduction and emigration in response to the drought conditions. We consider these patterns to represent different adaptive responses of the species and not to be artifacts of sampling design or collecting bias.

Two species (*P. scripta* and *P. floridana*) showed reduced reproductive output and substantially higher emigration rates in the drought year compared to previous years. Two other species (*S. odoratus* and *D. reticularia*) showed reduced reproductive output but no change in emigration patterns. The fifth species (*K. subrubrum*) did not show an appreciable change in reproductive output of the population with the exception of a lower proportion of multiple clutches in the drought year than in previous years. Neither the rate nor the direction of emigration of *K. subrubrum* was detectably different from previous years.

A large number of female *Pseudemys* of both species departed during the spring and summer of 1981, and most left after June, a time when most egg laying would have been completed (Gibbons et al., 1982). None of those emigrating in 1981 had oviductal eggs. The increase in emigration of *Pseudemys* is unquestionably a drought-related phenomenon. More than 50% of

293 individuals of *P. scripta* and 70% of the 40 *P. floridana* that left the Ellenton Bay habitat traveled toward the nearest body of water, a beaver pond about 400 meters away. Limited aquatic trapping (27 captures) after June 1981 yielded 11 individual *P. scripta* that had been registered at Ellenton Bay earlier that year, thus confirming that the beaver pond was the destination for some of the departing animals.

Differential behavioral and reproductive patterns of the five species can be related to the ecological and evolutionary differences between them. *Kinosternon subrubrum* is the most terrestrial of the five species and laid eggs as in previous years. Not only do these individuals hibernate on land but they also feed on land (Scott, 1976) and spend much of their life cycle in the terrestrial environment (Bennett, 1972). Consequently, the gradual drying of the aquatic environment would be expected to have less impact on such an animal than it would on more aquatic turtles.

Sternotherus odoratus, at the opposite extreme, is the most aquatic of the five species. *Sternotherus* seldom venture onto land except for egg-laying and are ordinarily found in permanent aquatic habitats. Therefore, they might be expected to respond to drought conditions by tracking the remaining water and then, when no water remains, burrowing into the mud. Their dependence on the aquatic environment is reflected in their apparent reluctance or inability to emigrate and the virtual cessation of reproduction under the drought conditions.

Deirochelys is a biological enigma in a variety of ways, including fall and winter oviposition (Gibbons and Greene, 1978; Congdon et al., 1983*b*); most populations in this region of South Carolina are associated with fluctuating, non-permanent bodies of water although this species is more aquatic than *Kinosternon*. The reduction in available resources and habitat resulting from a reduced aquatic area could lead to lower egg production. *Deirochelys* presumably burrow to escape drought conditions rather than resorting to emigration.

The two species of *Pseudemys* represent highly aquatic animals which are well-adapted to temporary bodies of water as indicated by this study and others (Cagle, 1946; Moll and Legler, 1971). Thus, the response of such long-lived animals which can survive brief overland movements is to escape the adverse conditions by moving to another habitat. Whether a new habitat is located by a mechanism for seeing polarized light reflecting from a surface of a body of water or some other means is unresolved at this time. However, these two species maintain their ubiquity and abundance through an ability to capitalize on aquatic environments which are productive but ephemeral.

Without the data collected over several years, the effects of drought on the turtle populations and the differential responses of the species could not have been distinguished from annual variation during non-drought years. This research supports the contention that long-term studies are necessary to reveal certain ecological phenomena in natural populations of animals (Tinkle, 1979).

Acknowledgments.—We thank the numerous individuals who have assisted in installing, maintaining, and checking drift fences with pitfall traps in these studies. Support for the research was provided by Contract DE-AC09-76SR00819 between the U.S. Department of Energy and the University of Georgia and by NSF Grant No. 79-04756 to J. W. Gibbons.

Literature Cited

Bennett, D. H. 1972. Notes on the terrestrial wintering of mud turtles (*Kinosternon subrubrum*). Herpetologica 28:245–247.

Congdon, J. D., D. W. Tinkle, G. L. Breitenbach, and R. C. VanLoben Sels. *In press.* Nesting ecology and hatching success in the turtle, *Emydoidea blandingi*. Herpetologica.

———, J. W. Gibbons, and J. L. Greene. *In press.* Parental investment in the chicken turtle (*Deirochelys reticularia*). Ecology 64.

Cagle, F. R. 1944. Home range, homing behavior, and migration in turtles. Misc. Publ., Mus. of Zool., Univ. of Mich. (61):1–37.

Gibbons, J. W. 1970. Terrestrial activity and the

population dynamics of aquatic turtles. Am. Midl. Natural. 83:404–414.

———, AND J. L. GREENE. 1978. Selected aspects of the ecology of the chicken turtle, *Deirochelys reticularia* (Latreille) (Reptilia, Testudines, Emydidae). J. Herpetol. 12:237–241.

———, AND ———. 1979. X-ray photography: A technique to determine reproductive patterns of freshwater turtles. Herpetologica 35:86–89.

———, ———, AND K. PATTERSON. 1982. Variation in Reproductive Characteristics of Aquatic Turtles. Copeia 1982:776–784.

———, AND R. D. SEMLITSCH. *In press.* Terrestrial drift fences with pitfall traps: an effective sampling technique for animal populations. Brimleyana.

MOLL, E. O., AND J. M. LEGLER. 1971. The life history of a neotropical slider turtle, *Pseudemys scripta* (Schoepff) in Panama. Bull. Los Angeles Co. Mus. Nat. Hist. (Sci.) (11):1–102.

SCOTT, A. F. 1976. Aquatic and terrestrial movements of farm pond populations of the Eastern mud turtles (*Kinosternon subrubrum*) in East-central Alabama. Unpubl. Ph.D. dissertation Auburn Univ. 175 pp.

SHARITZ, R. R., AND J. W. GIBBONS. 1982. The ecology of southeastern shrub bogs (pocosins and Carolina bays: A community profile U.S. Fish and Wildlife Service Omce of Biological Services, FWS/OBS-82/04. 103 pp

TINKLE, D. W. 1979. Longterm field studies. BioScience 29:717.

———, J. D. CONGDON, AND P. C. ROSEN. 1981. Nesting frequency and success: implications for the demography of painted turtles. Ecology 62:1426–1432.

Accepted: 28 February 1983.

EPISTYLIS OCCURRENCE ON PAINTED TURTLES

ABSTRACT

In September 1989, while conducting a survey of Blanding's turtle (*Emydoidea blandingi*) in the Green River Lowlands, members of the Lee County Natural Area Guardians (LeeNAG) noticed that a high percentage of captured painted turtles (*Chrysemys picta*) carried a velvety, brownish growth on their plastrons. An affected specimen was delivered to the Jake Wolf Memorial Fish Hatchery where the growths were identified as colonies of a stalked protozoan belonging to the genus *Epistylis*. LeeNAG secured a Nongame Checkoff grant to examine this apparent parasitism in greater detail. Live trapping of *C. picta* in 1990-91 revealed a sharp reduction in the incidence of *Epistylis*, leading to speculation that the 1989 outbreak may have been a drought-related phenomenon.

INTRODUCTION

Protozoa are single-celled organisms with an extremely lengthy tenure on earth. Identifiable protozoan remains have been found in rocks estimated to be 400 million years old. These highly successful creatures exhibit a wide variety of different forms. Generally speaking, protozoa are either free-living or dependent on a host. Most species ingest particulate or dissolved organic matter (or other microorganisms) as food, but some contain chlorophyll and are able to produce their own nourishment through a process similar to photosynthesis.

The *Epistylis* species found on Lowlands *C. picta* was attached to the plastron by dichotomously branched, non-contractile stalks. While bearing a strong resemblance to parasitism, this association was probably not truly parasitic, since the turtles seemed to suffer no ill effects from their infestations. Captured specimens carrying large colonies of *Epistylis*, sometimes nearly covering the plastron, appeared otherwise healthy and active. These individuals had obviously been engaged in a quest for food when they entered the traps, and in physical condition and behavior did not differ noticeably from trapmates which were free of the protozoan.

The genus *Chrysemys* includes one species, *C. picta*, and four subspecies in the eastern United States. Two

subspecies, midland painted turtle (*Chrysemys picta marginata)* and western painted turtle (*Chrysemys picta belli*), are found in the Lee County study area. A third unclassified subspecies also occurs here and represents an intergrade between *marginata* and *belli*. Apart from a greater maximum size in western painted turtle, the three subspecies are virtually identical morphologically and are distinguishable only by markings on the plastron and carapace. All three were present in the LeeNAG survey sample.

Painted turtles are primarily aquatic and seem to prefer impoundments such as ponds and marshes over running streams. Breeding takes place mainly in the spring, followed by nesting in June and July. Survey team members observed egg-laying by two females late on the afternoon of July 1, 1990. Another female was found covering a fresh nest in mid-afternoon of June 8, 1991. Nestlings emerge late summer to early fall or, not uncommonly, the following spring. A newly hatched individual weighing 4 g was picked up by investigator Debra Osmer on a sand ridge near the Guanci/Spears wetland in early May 1990. This turtle had presumably over-wintered in the nest.

Painted turtles prey on crustaceans, mollusks, insects and fish. They also eat plant material and are not averse

to scavenging. In the LeeNAG study, traps were baited with chicken liver.

Most of the survey sites are ponds and marshes, remnants of two extensive wetlands which once covered a large portion of southern Lee County. Although the majority of these sites are natural impoundments, some have been deepened by dredging and berming. Many of the shallower sites dried up during the drought of 1988-89. The remainder, mainly deepened ponds and those fed by field tiles, suffered some loss of water and a resulting degradation in water quality. Decaying organic material may have fueled an explosive proliferation of aquatic bacteria upon which the *Epistylis* protozoan feeds.

METHODOLOGY

When the first *Epistylis*-infested painted turtles were captured in September 1989, LeeNAG began to search for information concerning the relationship between these two species. It soon became apparent that little was known on the subject in Illinois. On the chance that the phenomenon was localized in our study area, it was decided to expand the trapping area to determine whether *Epistylis* could be found on *C. picta* in other parts of Lee County. An announcement was posted in the newsletter of the Lee County Soil and Water Conservation District (LeeNAG's parent

organization) stating the purpose of the survey and asking that interested landowners/operators get in touch with the district office. Respondents were then contacted and formal trapping permission was obtained.

Trapping was carried out in September and October 1990 and April and May 1991 with traps borrowed from the Department of Conservation's Natural Heritage Division. An original plan to trap two sites in each Lee County township was abandoned after it was discovered that little suitable habitat for *C. picta* remained in the more highly-developed northern townships. Sampling was expanded into eastern and western townships not previously trapped. In addition, follow-up trapping was done at those sites which had shown heavy concentrations of *Epistylis* in 1989 to see if levels of the protozoan had risen, fallen or remained the same. Captured turtles, including Blanding's and snapping turtles (*Chelydra serpentina*), were examined for the presence of *Epistylis* and released. Air and water temperatures, information regarding the site type (natural pond, oxbow, etc.) and data on captured specimens were recorded on survey sheets.

Two painted turtles with living colonies of *Epistylis* on the plastron were taken to the Jake Wolf Memorial Fish Hatchery at Manito where the identification was made by aquaculture coordinator Rodney Horner. Hatchery staff

intended to culture the *Epistylis* for further study; however, the colonies died before a proper culture medium could be obtained.

RESULTS

The results of the *Epistylis* survey rest on rather scanty evidence. Although the investigators met with modest success in September and October 1990, trapping in April and May 1991 produced very few turtles. This may have been due in part to a cool spring season and abundant supplies of food and water. In all, 54 trap-days yielded only 25 painted turtles. Our efforts were far better rewarded in 1989-90, when somewhat more intensive trapping produced 207 specimens of *C. picta* during roughly the same period. The vast majority of these were captured in the spring of 1990 when the turtles were just returning to normal activity following two years of drought. By April 1991, after a year of regular precipitation, area wetlands were brim full and restocked with standard turtle fare. Several sites were seen to contain large masses of frog eggs and tadpoles, crayfish, gastropods and thick beds of aquatic vegetation. Although numerous painted turtles were seen basking at some sites, they seemed reluctant to enter the traps. As it were, the trappers had lost the advantage bestowed by slim pickings. Quite possibly, the turtles were difficult to bait because they were easily finding all the natural

sustenance they needed. A case in point is the Hilliard site. Here, in a man-made pond with adjoining wetland, painted turtles were seen basking on every visit. A fish kill had taken place over the winter, providing the turtles with a windfall of dead bluegills and bass. Several of these were found lying on the bottom in shallow water, shredded in a manner which suggested scavenging. No turtles were captured in 14 trap-days. Well-provisioned with carrion and natural prey, *C. picta* could afford to be very cautious about approaching traps.

On the basis of the captures that were made, it appears likely that *Epistylis*, rampant in parts of the study area in the fall of 1989 and spring of 1990, was definitely on the wane by early fall of 1990 and non-existent as large colonies on painted turtles by the spring of 1991. At Fifty Turtlehead Pond, the site of the heaviest infestations, every one of 14 painted turtles taken in April and May 1990 was affected to some degree by *Epistylis*. Of six specimens trapped at the site in September of that year, one carried a small amount of visible *Epistylis*. This turtle was the only individual captured during the present survey to be affected by the protozoan. Overall, trapping of 14 sites in ten townships produced 28 turtles from eight sites in five townships. The count includes 25 painted turtles, two Blanding's turtles and one snapping turtle.

DISCUSSION

The association of *Epistylis* with *C. picta* had not been seen by local DOC biologists or fisheries pathologist Rod Horner prior to its discovery during the LeeNAG Blanding's turtle survey of 1989-90. A 1986 survey of the yellow mud turtle (*Kinosternon flavescens flavescens*), conducted jointly by the Department of Conservation and the Natural Area Guardians, collected 74 painted turtles from the same area. None were reported to harbor colonies of protozoa. The rise of *Epistylis* during the worst drought in five decades, coupled with its decline as precipitation returned to normal, seems to suggest that the outbreak was drought related.

Epistylis may always have existed in the wetlands of Lee County, living on *C. picta* in colonies small enough to escape notice. As a predator of bacteria, its populations are controlled by the relative abundance of its prey. The drought of 1988-89 reduced water levels in area wetlands, resulting in the death of phytoplankton and aquatic microfauna. The increased availability of decomposing organic matter and the rise in water temperature may have created a situation that was conducive to the proliferation of bacteria and the organisms which feed on them. As wetland volumes decreased, *Epistylis* concentrations became higher. Still, it is unclear exactly why large, visible

colonies began to appear on painted turtles. Perhaps this is a natural development when *Epistylis* densities reach a certain level. At any rate, the turtles showed no apparent distress. Since these protozoa feed on bacteria, this is not a case of true parasitism, but rather one of commensalism. That is, the host animal neither loses nor gains from the association. The turtle may merely represent a convenient substrate for *Epistylis*, a mode of transportation by which the protozoan hitches a ride around its habitat.

Also unclear is why *Epistylis* selects *C. picta* as a substrate over either *E. blandingi* or *C. serpentina*. Horner feels that the *Epistylis*/painted turtle relationship might be one of long standing and that the other two chelonians are somehow better able to resist the protozoan. Only one of 33 Blanding's turtles examined during the surveys of 1989-90 and 1990-91 showed any sign of *Epistylis*, and this was barely detectable. Of ten snapping turtles, none were infected.

Epistylis also demonstrated selectivity in its choice of the plastron over other body zones for the location of colonies. Research by survey members turned up only two references to *Epistylis* on painted turtles. In those cases, *E. chrysemydis* and *E. niagarae* were reported to have been found on *C. p. belli*. *Chrysemydis* had selected the

carapace; the location of *niagarae* was not specified. Even in the worst infestations seen by LeeNAG investigators, *Epistylis* almost never invaded the carapace. After the plastron, the second most common site of infection was soft tissue, especially in the sockets of the hind legs. On one severely coated specimen of *C. picta* trapped in 1989, the right side of the head, including the eye, was nearly covered. Even this turtle did not seem to be particularly bothered. Small colonies were also occasionally found on the bridge between the carapace and plastron.

The *Epistylis* found on Lowlands painted turtles has not been positively identified beyond the genus. In view of its apparent preference for the plastron, one might be tempted to regard it as a new species. It may be more likely, however, that we are dealing with a known species, possibly *chrysemydis*, which has for unknown reasons evolved a penchant for the plastron in this area.

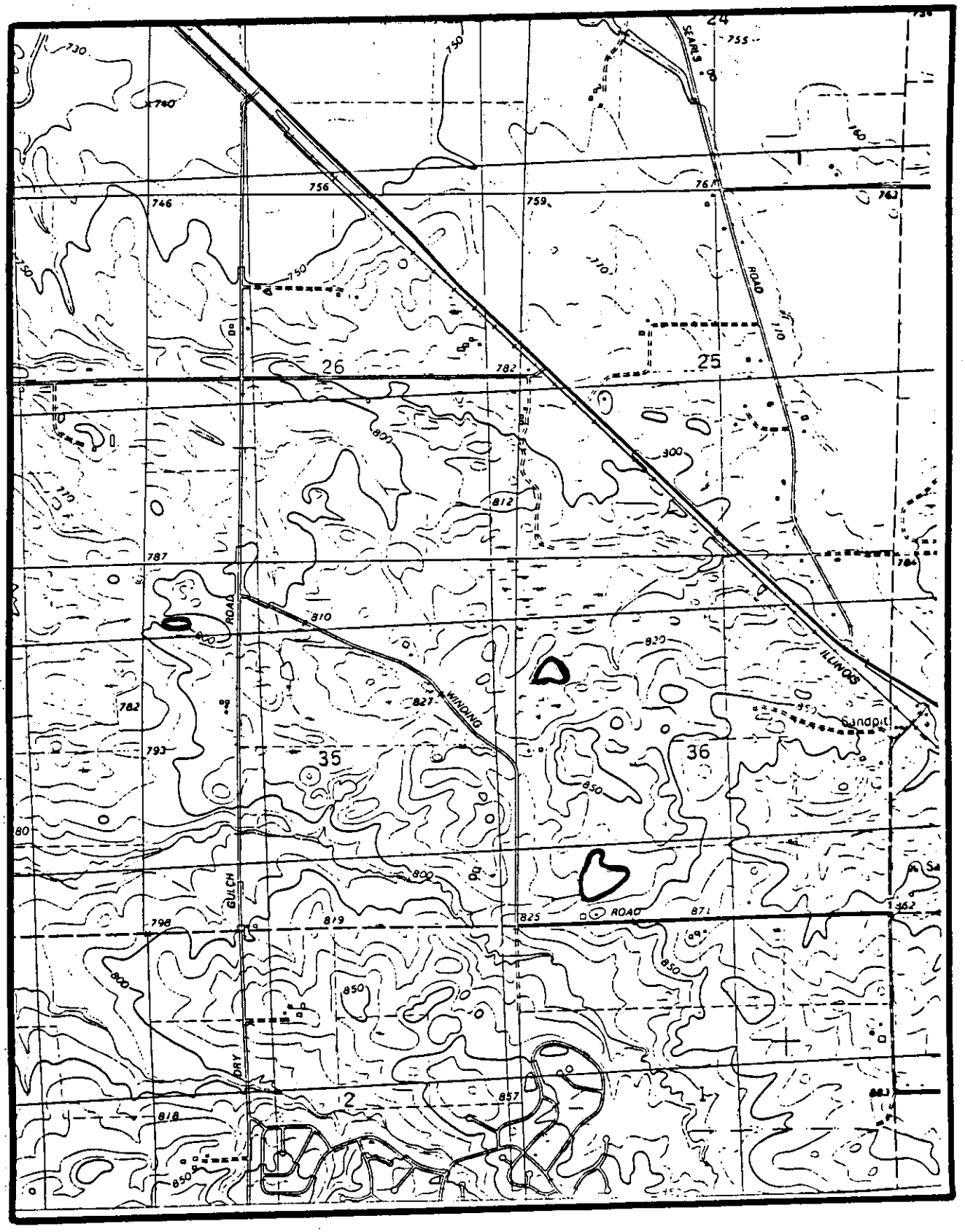
Throughout the 1989-90 survey, the incidence of *Epistylis* seemed to have been centered geographically in Amboy Township, with the highest rates and heaviest individual infestations reported from Sections 35 and 36. Occurrences decreased in frequency and severity away from this center. As might be expected, the outbreak persisted the longest where it had been most prevalent. The last case was seen in Fifty Turtlehead Pond, Section 36. It is

interesting to note that the rash of *Epistylis* was almost site-specific. Turtles in some ponds remained entirely free of visible colonies while those in neighboring sites were heavily infected. Every one of 14 specimens recovered from Fifty Turtlehead Pond in the spring of 1990 hosted *Epistylis*. At the same time, less than 1/2 km away in Zellhoffer Ponds 1 and 2, all 28 *C. picta* collected were clean.

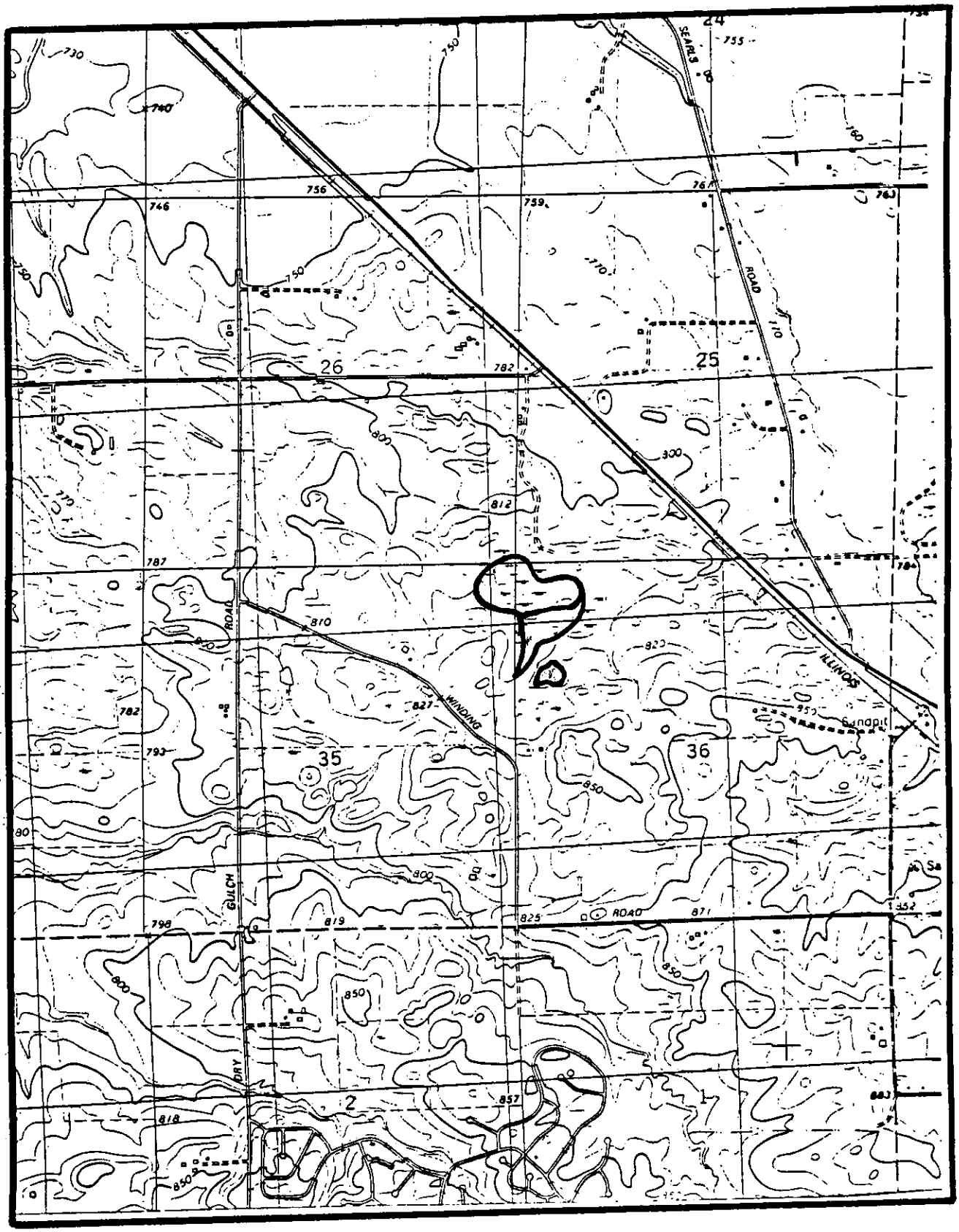
SUMMARY

From the evidence, it appears that the *Epistylis* epidemic among study area painted turtles was probably triggered by the 1988-89 drought. No *Epistylis* was seen in 74 *C. picta* captured in 1986, a year of normal precipitation. At the height of the drought in 1989, the protozoan was much in evidence, with an estimated 40 percent of 207 individuals infected. When wetlands refilled in 1990, *Epistylis* all but disappeared. No cases were found in 1991. LeeNAG believes that a combination of factors including low water levels, high temperatures, plentiful forage for bacteria and abundant turtle hosts contributed to the outbreak. There have probably been similar *Epistylis* population explosions in the past when conditions were right. The physical well-being of *C. picta* is apparently unaffected by even large colonies of the protozoan.

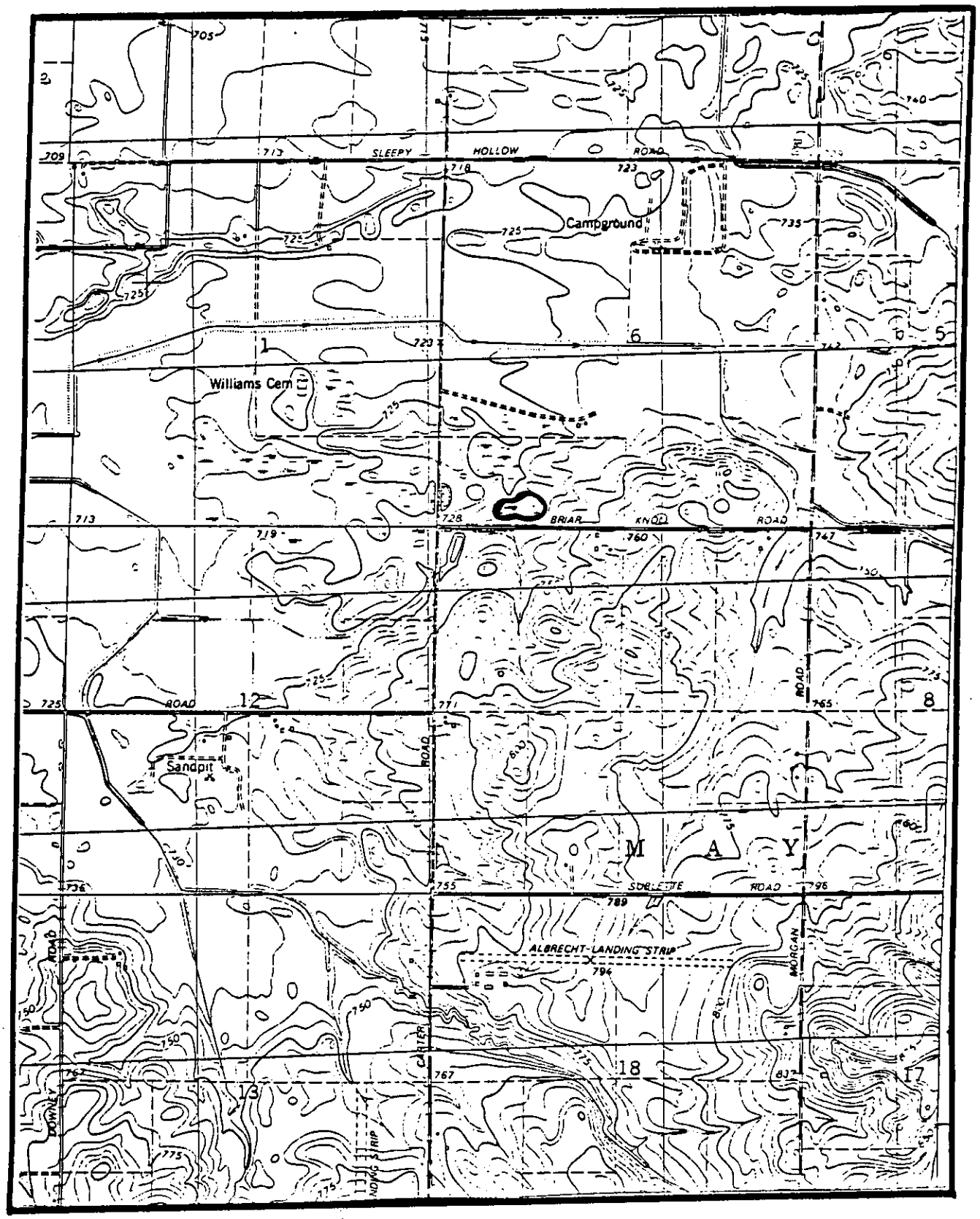
Epistylis Sites - 1989
Fredenhagen Long Pond
Guanci 50 Turtlehead
Spears South



Epistylis Sites - 1990
Guanci Indian Ridge
Guanci 50 Turtlehead
Guanci Birdsong



Epistylis Sites - 1990
Kant Road Pond

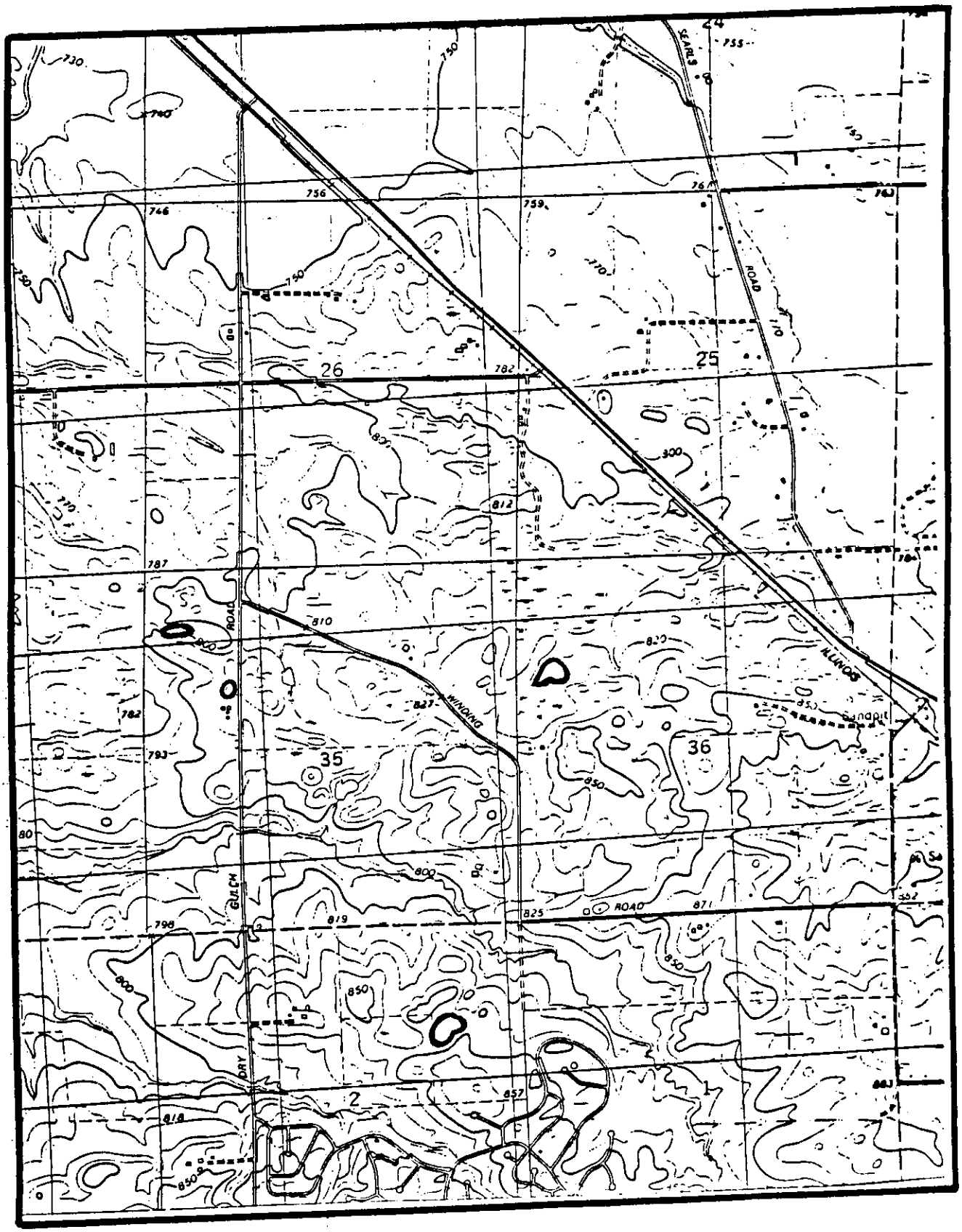


Site #06 50 Turtlehead

Site #10 Long Pond

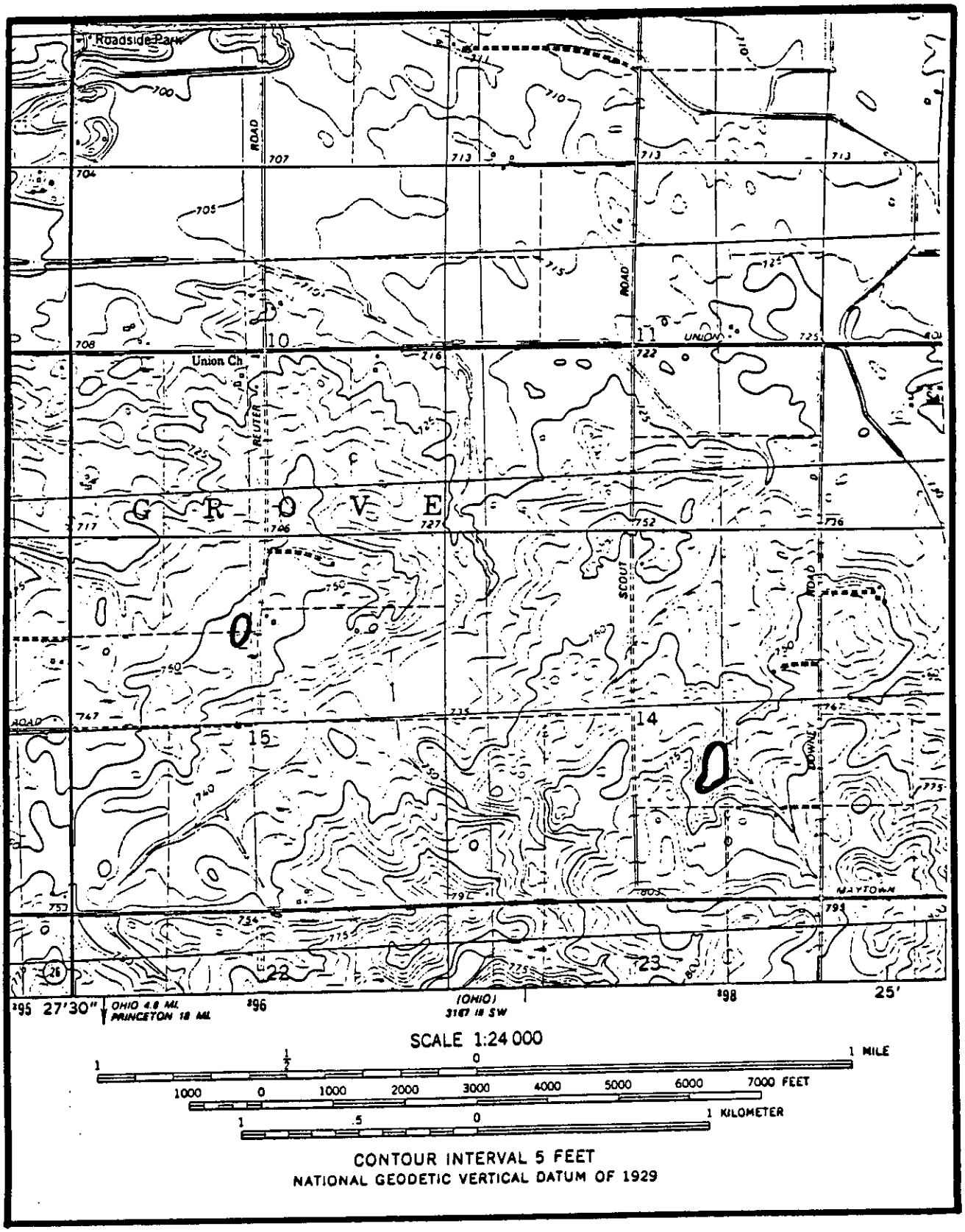
Site #23 Basking Pond

Site #31 Prairie Pond

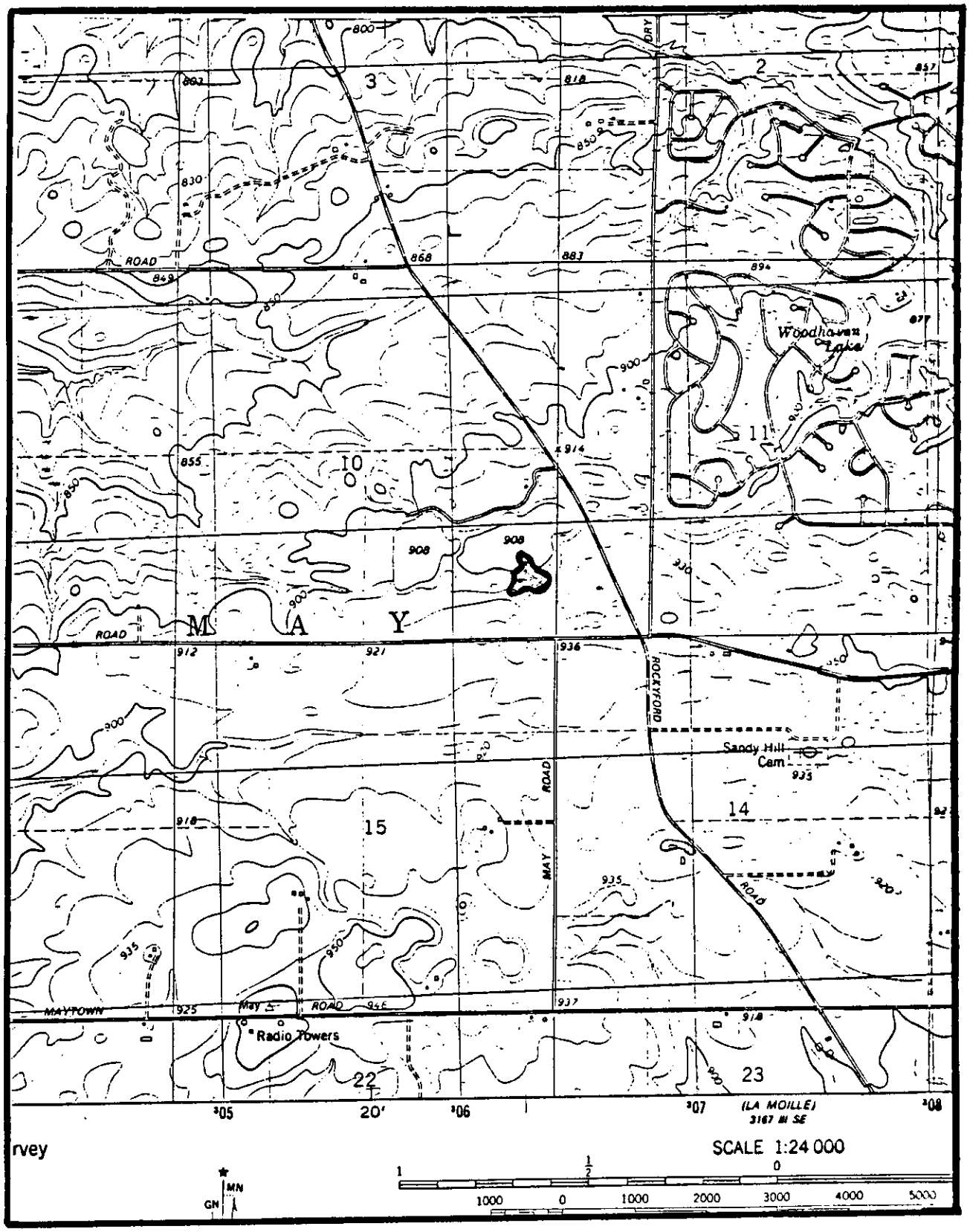


Site #16 Mud Turtle

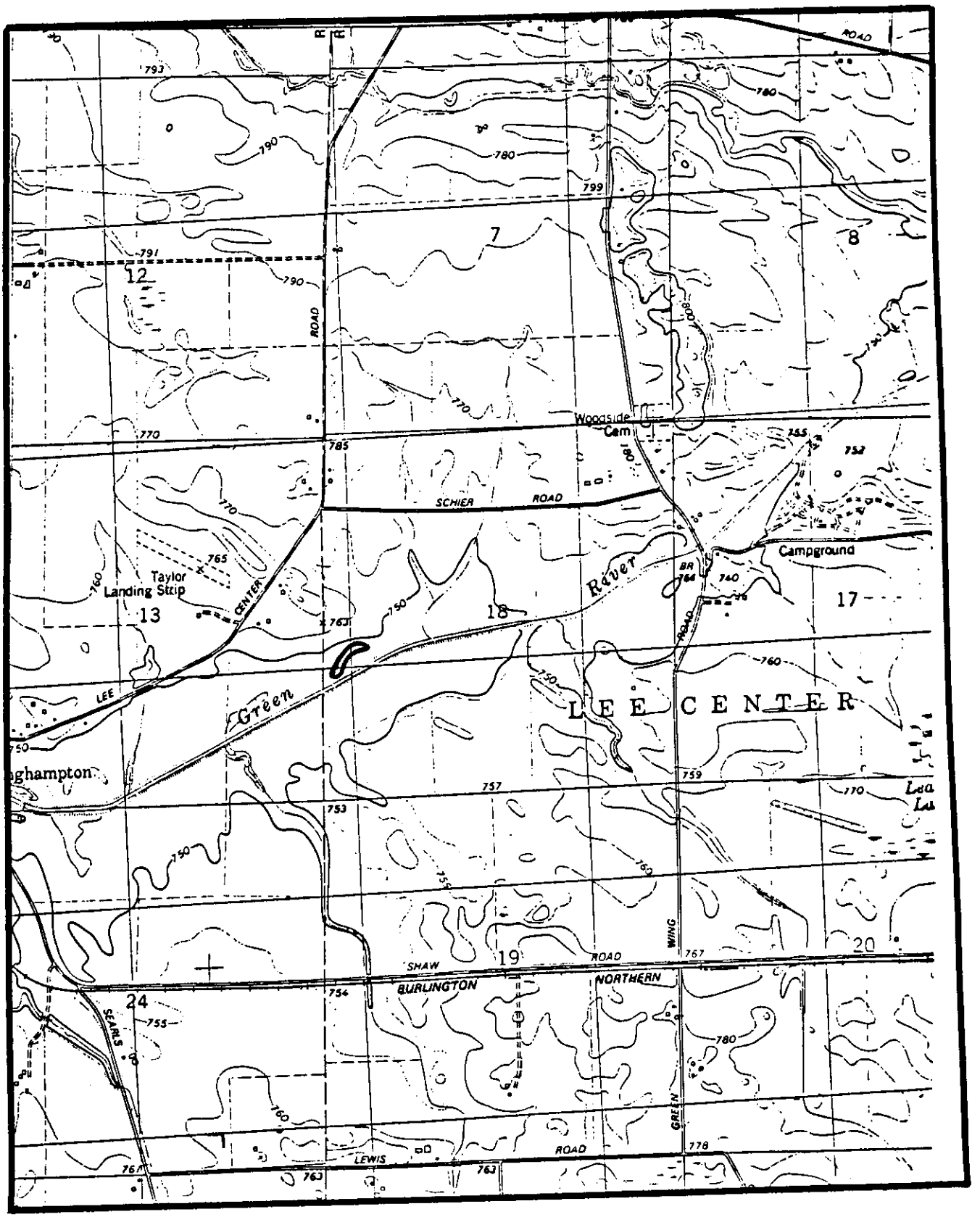
Site #26 Cliff's Pond



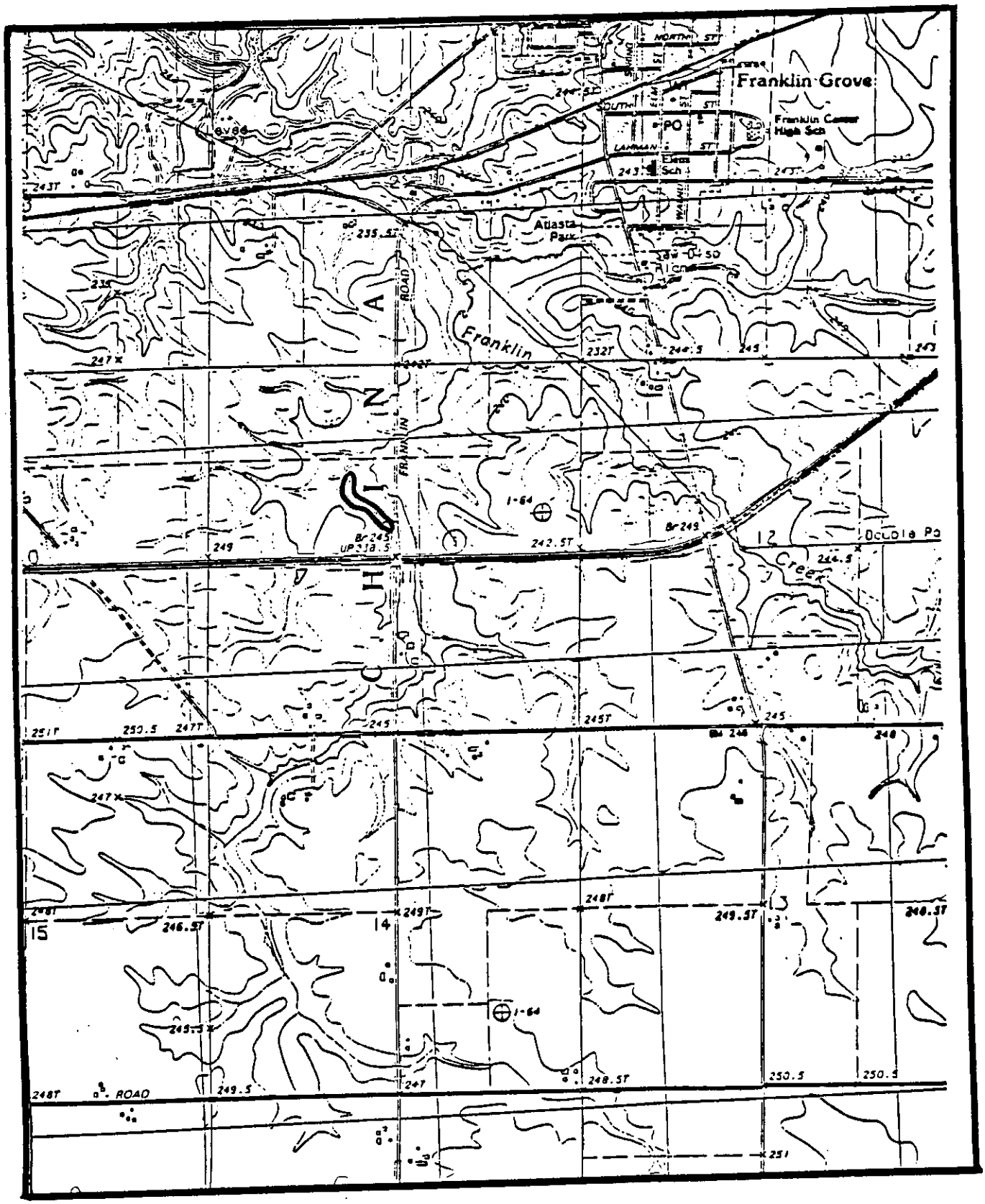
Site #25 Racetrack



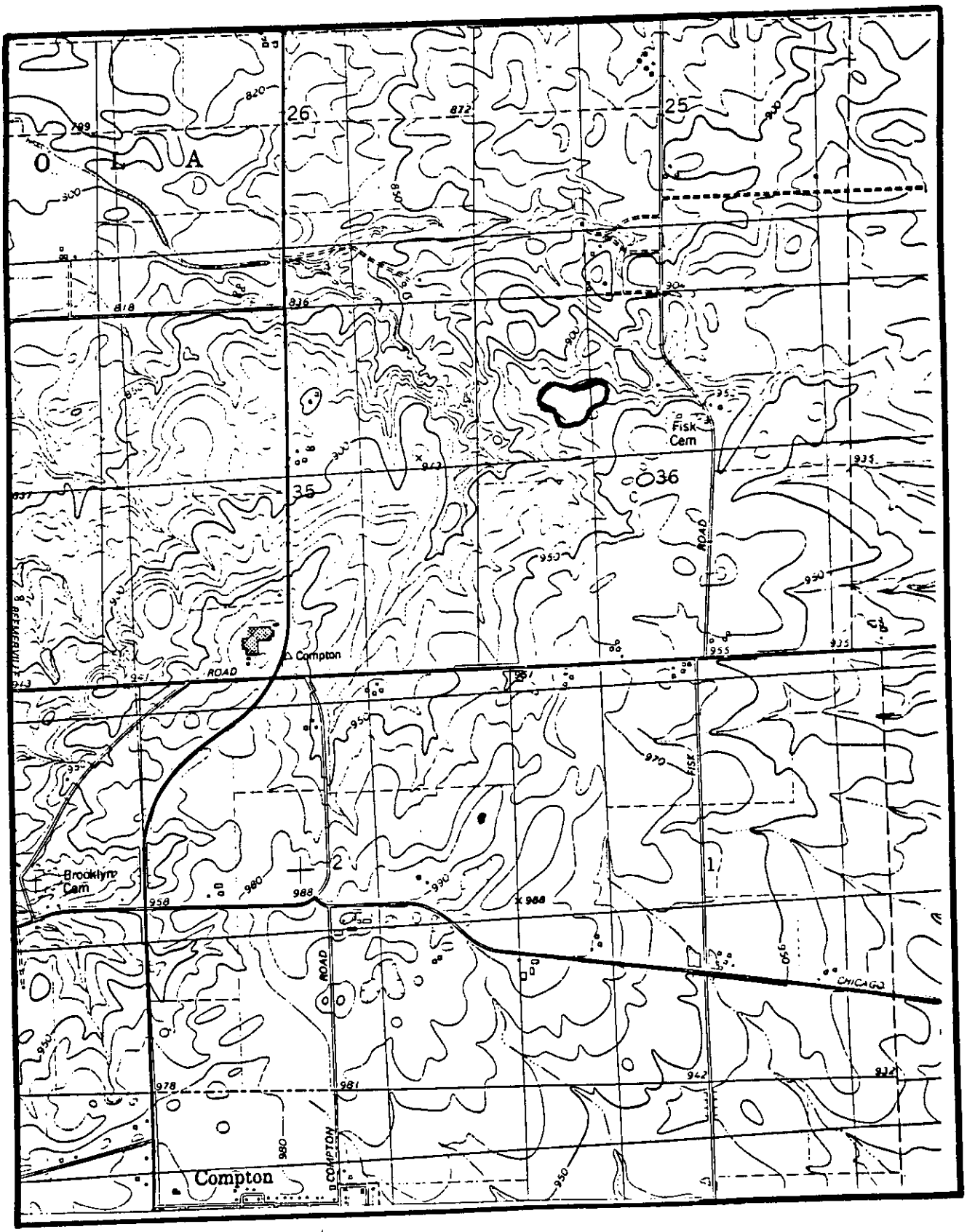
Site #27 Oxbow



Site #28 Ramsdell Creek

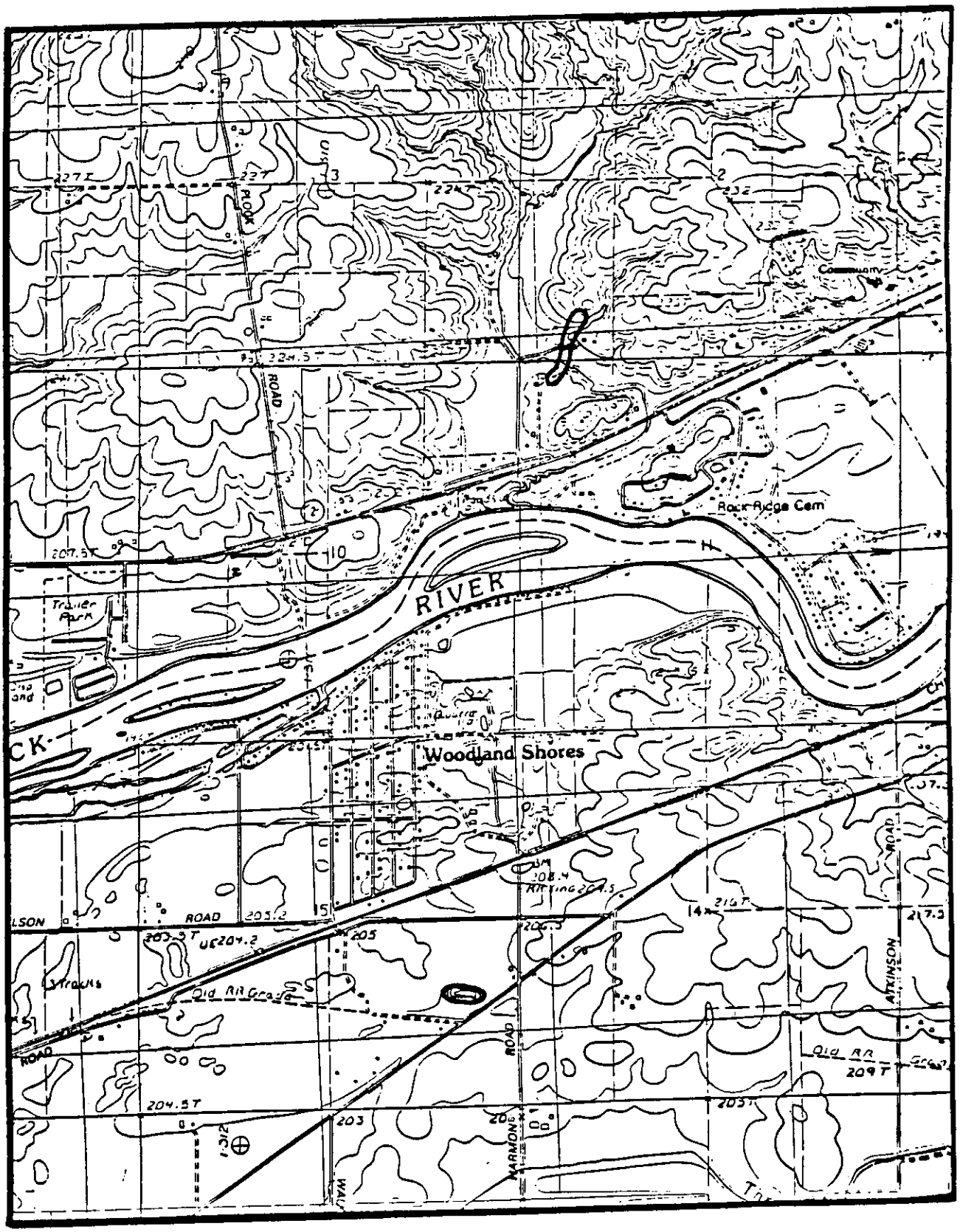


Site #29 Hornung

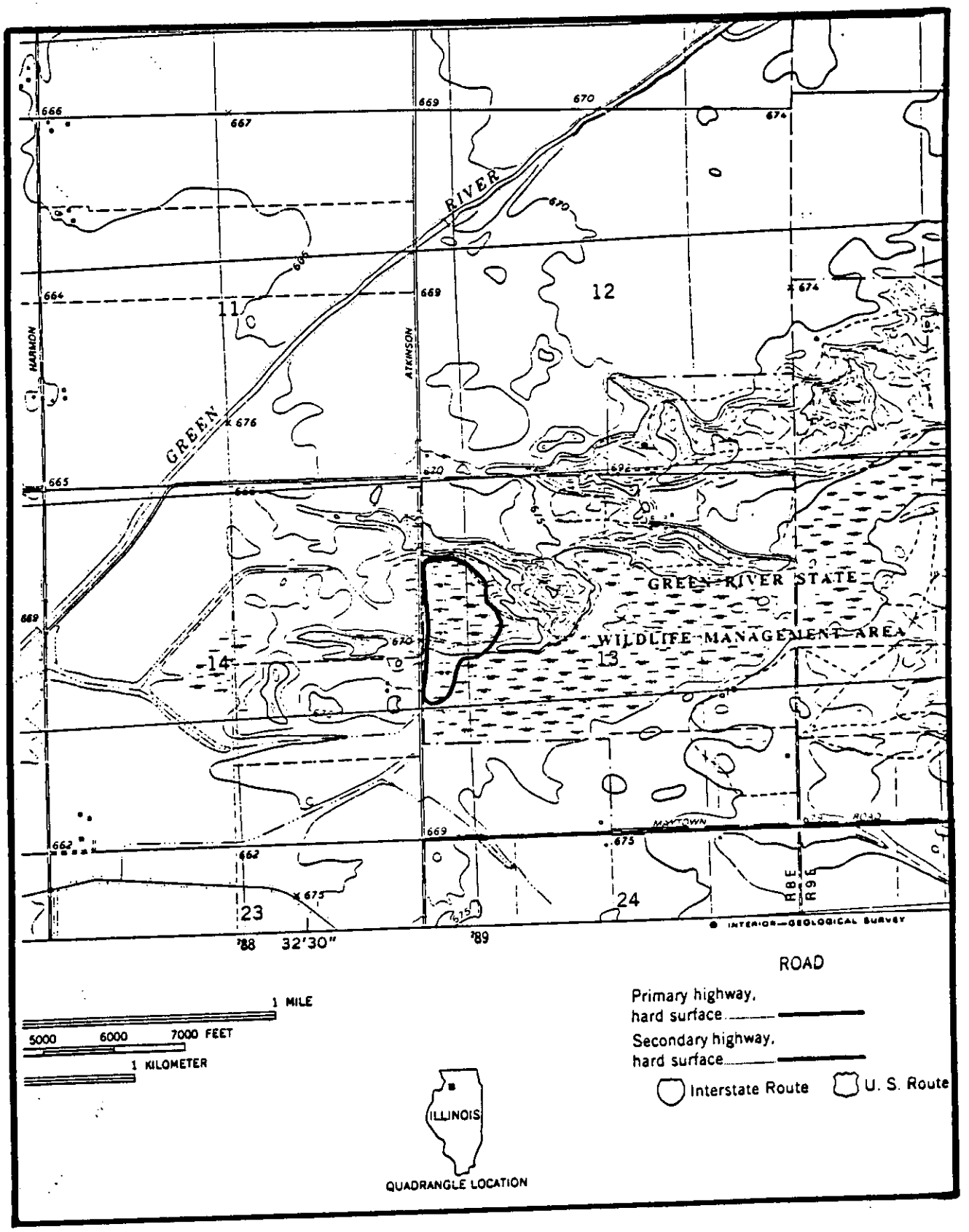


Site #30 Hilliard

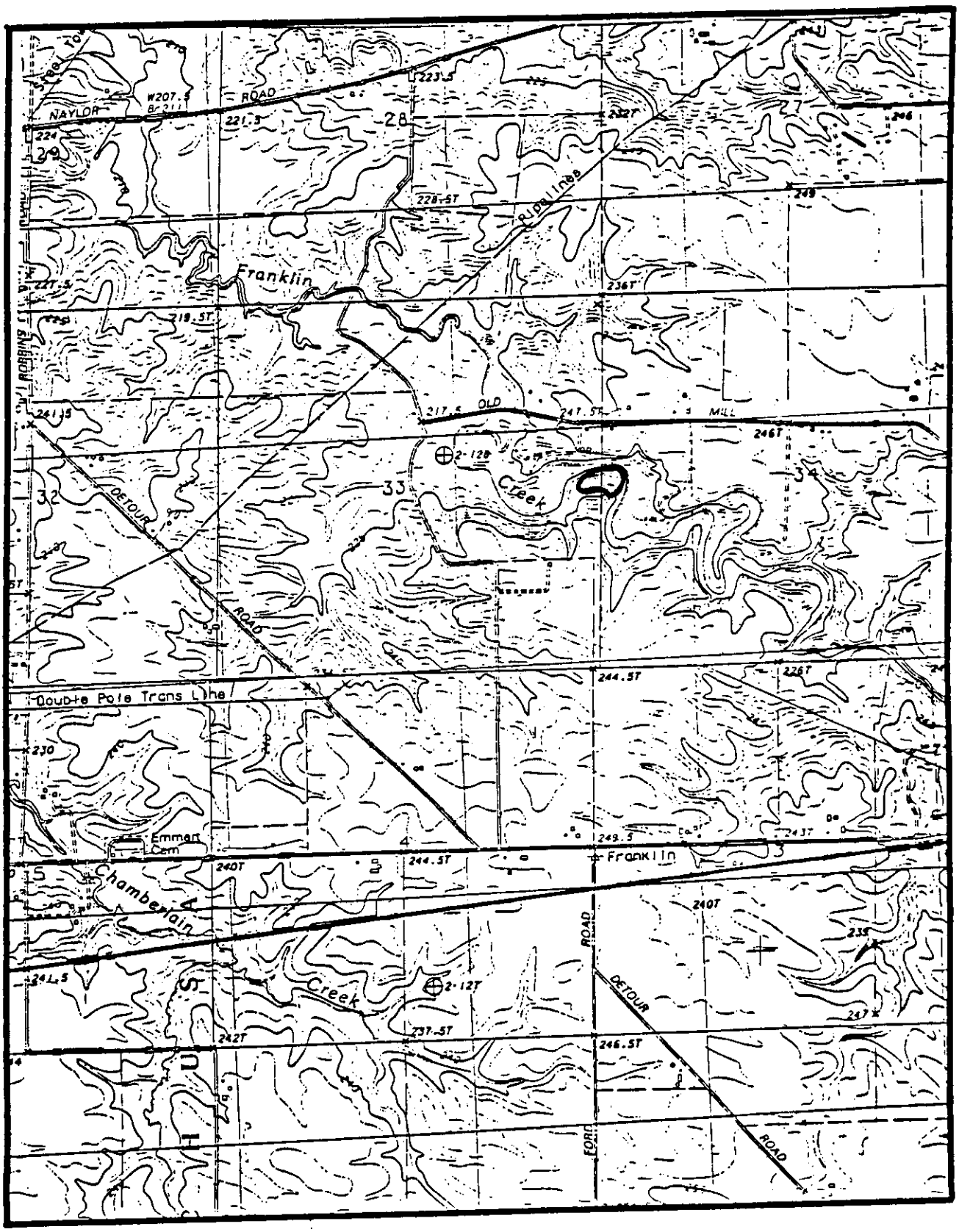
Site #33 Grosbeak



Site #32 Yellow Head



Site #34 Hackberry



EPISTYLIS SURVEY DATA SHEET

SITE: Fifty Turtlehead Pond TWSP: Amboy DATE: 9-22-90

TYPE OF SITE: Deepened Pond AIR TEMP: 23 C WATER TEMP: 18 C

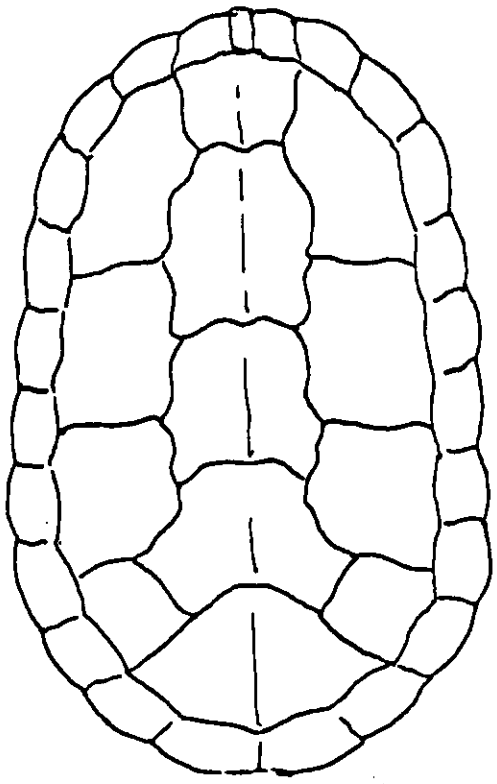
NO. TRAPS: 4 TRAPPERS: Rogers, Osmer, LeVin

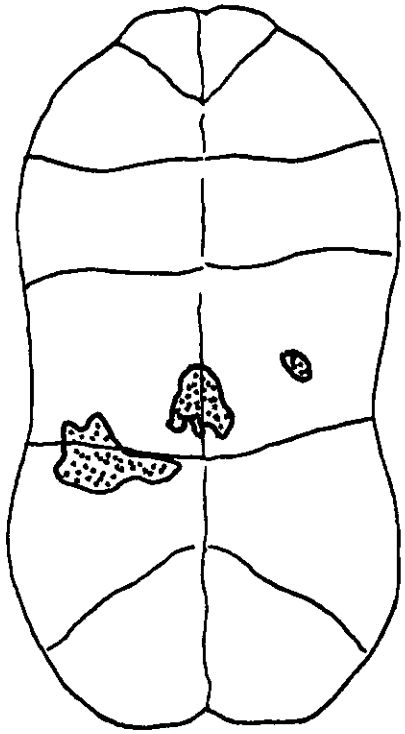
SPECIES CAPTURED: Chrysemys picta NO. 6

NO.

NO.

EPISTYLIS: One of the six individuals showed small colonies of Epistylis on the abdominal and femoral scutes of the plastron.





SITE ROSTER

SITE #	SITE NAME	TWP	SEC	OWNER
06	50 Turtlehead	Amboy	25	J. Guanci
10	Long Pond	Amboy	35	W. Fredenhagen
16	Mud Turtle	East Grove	15	G. Swickheimer
23	Basking Pond	Amboy	35	W. Fredenhagen
25	Racetrack	May	10	Bank Trust #1114
26	Cliff's Pond	East Grove	14	C. Albrecht
27	Oxbow	Lee Center	18	R. White
28	Ramsdell Creek	China	11	D. Ramsdell
29	Hornung	Viola	36	J. Hornung
30	Hilliard	Nelson	15	A. Hilliard
31	Prairie Pond	May	2	D. Bonnell
32	Yellow Head	Hamilton	13	State of Illinois
33	Grosbeak	Palmyra	2	D. Hose
34	Hackberry	Nachusa	33	State of Illinois

Trap Results

Site #	Site Name	Species	#	Epistylis
06	50 Turtlehead	C. picta	6	1
10	Long Pond	0	0	0
16	Mud Turtle	0	0	0
23	Basking Pond	E. blandingi	2	0
25	Racetrack	C. picta	6	0
26	Cliff's Pond	0	0	0
27	Oxbow	C. picta	5	0
28	Ramsdell Creek	C. serpentina	1	0
29	Hornung	0	0	0
30	Hilliard	0	0	0
31	Prairie Pond	C. picta	1	0
32	Yellow Head	0	0	0
33	Grosbeak	0	0	0
34	Hackberry	C. picta	7	0
14	14	3	28	1

FOR IMMEDIATE RELEASE
August 17, 1990

From: Lee County Soil & Water Conservation District
319 S. Mason
Amboy, Il. 61310
(815) 857-3623
Hazel Reuter

Subject: Illinois Department of Conservation Grant

The Lee County Soil & Water Conservation District is pleased to announce that William E. Rogers and Debra A. Osmer of the Natural Area Guardians have received their second Illinois Department of Conservation Nongame Checkoff Grant to study the increasingly rare Blanding's turtle in Lee County.

The 1990-91 grant will also survey all reptilian species for a previously undiscovered protozoan parasite which was first documented by Rogers in 1989. The Illinois Nongame Grant program is funded by citizen donations This grant is one of 22 grants funded for 1990-91 in the state.

The Rural Lending Leader

1-800-688-FARM

Farm Credit Services
37 S. East Avenue, P.O. Box 205
Amboy, Illinois 61310-0205
Ed Martin, Senior Loan Officer 815-857-3866

CALENDAR

MAR.	15 TO APRIL 26		STATE COST SHARE SIGN-UP
MAR.	19	7:00 PM	USDA SERVICE CENTER
MAR.	26		BRANDYWINE, DIXON
APR.	3	7:00 PM	LONG BRANCH, AMBOY
APR.	3	NOON	PHOENIX ROOM, DIXON
APR.	3	8:00 PM	USDA SERVICE CENTER
APR.	8 TO 12		SEEDLINGS ARRIVE
APR.	10	9:00 AM	USDA SERVICE CENTER
APR.	28 THRU MAY 5		SOIL STEWARDSHIP WEEK
MAY	1	8:30 PM	USDA SERVICE CENTER

HAHNAMAN-ALBRECHT, INC.
"Serving you at six Locations"

Harmon- 359-7314 Eldena- 288-1200
Deer Grove- 438-2852 Woosung- 284-6999
Mt. Carroll-244-3020 Stockton-947-3311

HAHNAMAN-ALBRECHT
offers:

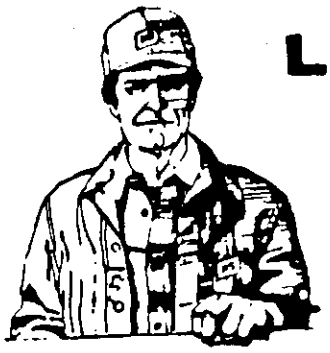
Grain Storage
Grain Drying
On Farm Grain Pick-up
Variety of Marketing Contracts
CCC Approved Storage
Liquid and Dry Fertilizer
Liquid and Dry Lime
BP-Feed- Eldena Location Only
Herbicides-Insecticides
Custom Application

"Service From Planting to Profits"

The Natural Area Guardians held the annual joint meeting with the Lee Co. Historical Society on Feb. 13th. An interesting program was provide by Larry Jones. Larry has many beautiful slides of birds we may see around our feeders as well as birds from Texas and California.

The Mar. 19th meeting will feature a representative from Ducks Unlimited as the speaker. Ducks Unlimited are very busy trying to save and establish duck habitat. Most know the duck population is declining.

Turtle surveying will soon be in full swing as the weather warms up! Two ponds or bodies of water are sought in each township. These waters will be live trapped seeking to find a parasite called Epistylis which affects Painted Turtles. All turtles are returned to their original habitat after examination. If any landowner wishes to participate call the office - 815/857-3623. The survey is carried out with funding from the Illinois Wildlife Conservation checkoff.



LEE FS, INC.

LEE CENTER...857-3535
or 1-800-426-7752
AMBOY.....857-3538
or 1-800-624-7734

GRAIN-FERTILIZER-SEED-PETROLEUM-TIRES

WITH A SPECIALIST FOR YOUR EVERY NEED....

A RESTING PLACE, A BREATHING SPACE...

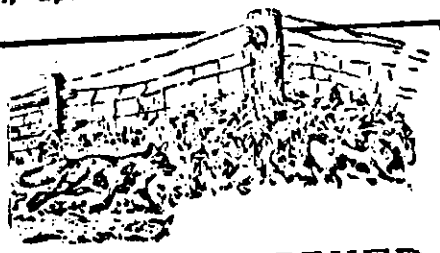
A world of magic still survives along these old fencerows,
a myriad of creatures live where the tractor never mows.

Prairie remnants hug the wire, a tangled, rusty maze,
while berries and brown thrashers share the sultry August haze.

The tip of an old hedgepost provides a lookout for a crow,
and bluebirds make a happy home in the hollowed space below.

A travel lane for creatures who shun the furrowed field,
for without this precious shelter, their fate is surely sealed.

Foxes and shrews and butterflies all need this old fencerow,
Oh, spare this narrow strip of land, this relic from long ago.
....D-90



GRANT RECEIVED

We are pleased to announce that another Wildlife Conservation Checkoff grant has been received by the LeeNAG's, written by Wm. E. Rogers.

This is a second grant to study Blanding's turtles and to survey all reptilian species for a protozoan parasite documented in our 1989 study.

The Illinois Mongase Grant program is funded by citizens donations. This is one of 22 grants funded for 1990-91.

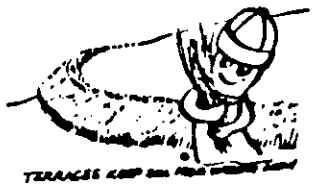
Your district directors and staff attending the 1990 Summer Conference received valuable information to better serve our cooperators. Our District received a medallion for continued excellence in planning and carrying out district activities from the Goodyear Company.

Two staffers, RC Edmondson and Secretary Reuter received certificates for 10 years of service.

A resolution to register the Natural Area Guardian name for exclusive use by soil and water conservation districts was passed.

A record number of directors from throughout the state attended the meeting. goal of 300 has been set for next year.

Association of Illinois Soil and Water Districts executive board members were elected. Rudy Rice was elected to a second two-year term as president. Others elected include Lee Bunting Vice Pres., Charles Curry, Treasurer and Stan Hovell, Secretary.



GRAIN ELEVATORS

ATHERTON GRAIN CO., INC., 104 S. MAIN ST.----------WALNUT----379-2177
MAHNAHAN ALBRECHT INC., P.O. BOX 131----------HARMON----288-7330

The Farm Lending Leader

See us now for the rates and terms you want for

Farm Real Estate Loans
Farm Operating Loans
Equipment Loans

Farm Credit Services
37 S. East Street, Amboy, IL 61310
Phone toll-free 1-800-688-FARM
Ed Martin Senior Loan Officer

CALENDAR

Sept. 5.....Reg. SWCD Board Mtg.
Sept. 13.....MILUC Meeting
Sept. 19.... Grass Carp Order Deadline
Oct. 3.....Reg. SWCD Board Mtg.
Oct. 4.....District Employee Training
Oct. 4.....Last Day to Order Fish
Oct. 12.....Fish Delivery
Oct. 13.....AUTUMN ON THE PRAIRIE
Nachusa Grasslands 1 to 5 pm

CONSOLIDATED GRAIN & BARGE CO., PO BOX 308.....FRANKLIN GROVE..800/447-4335

NATURAL AREA GUARDIANS

DO SOMETHING WILD - remember Illinois' non-game wildlife on your Illinois tax form! All you do is mark line 16a on Illinois form 1040, enter the amount (minimum $1) you wish to contribute from your tax refund and the non-game wildlife benefit. The program first appeared in 1984, since that time Illinoisans have donated $1.325 million to this fund.

The funds are used for studies, surveys, equipment, educational materials, etc. to benefit non-game species. The non-game species make up 95% of the wildlife.

The Lee County Natural Area Guardians have been the recipient of several of the small projects program. As part of the program NAG will be live trapping turtles throughout Lee County in the spring of 1991. We will be looking for a parasite called Epistylis which affects painted turtles. Landowners who wish to participate in this important survey are asked to return the attached permission slip or call the SWCD office (815/857-3623). Your cooperation is greatly appreciated.

I WOULD LIKE TO PARTICIPATE IN THE LEE CO. TURTLE SURVEY.

NAME_____

ADDRESS_____

TWP_____SECTION_____

CONSERVATION INFORMATION DAY

Come in Feb. 11, 1991 between 9:00 AM and 12:00 AM and chat with the experts!

February 11 will bring four area conservation specialists from the Ill. Department of Conservation to the USDA Service Center in Amboy.

Throughout the year many people come in or call the office with a flood of questions concerning wildlife habitat establishment, tree planting, groundhog and beaver control, pond stocking, algae control and many other inquires.

Are you having problems with trespassers, law breakers or changing laws concerning hunting? Come in and talk with Conservation Police Officer Mark Wallzynski.

Want your pond checked for fish and weed control? Ken Clodfelter will be here to answer your questions.

Want to improve your wildlife habitat? Scott Schaeffer will be here to assist your needs and furnish wildlife seeding if available.

There have been a number of farmstead windbreaks established in Lee County due to the expertise of Geo. Poe District Forester. Do you have a tree problem or question concerning forestry needs?

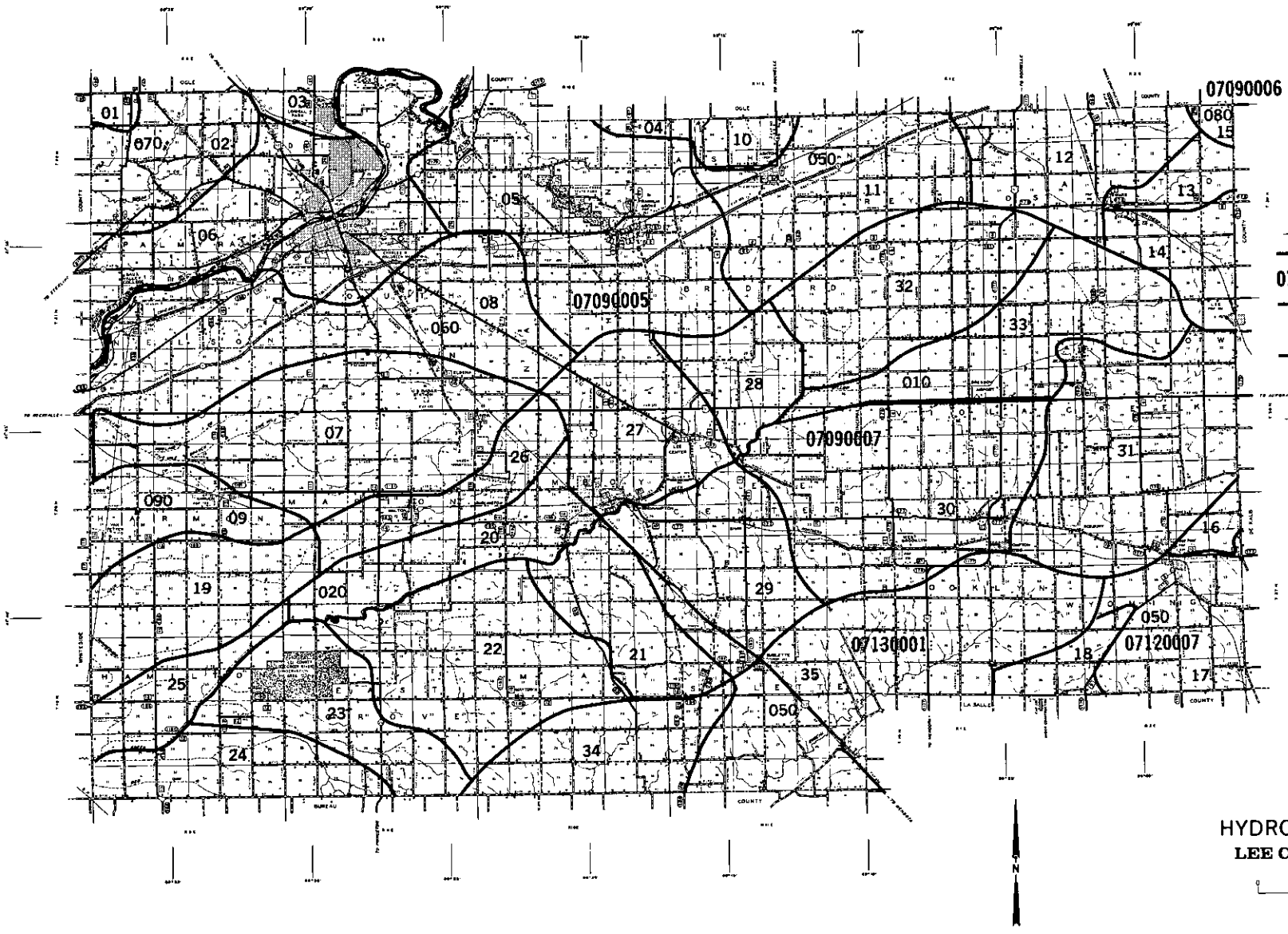
LEFFELMAN & ASSOCIATES INC.
tri-county insurance services
INSURING FARMS - CONTRACTORS
AGRI-BUSINESS
SUBLETTE • AMBOY • LA MOILLE

OUR 94th YEAR
Providing Service and Loans
to our
Agricultural Community

H. F. GEHANT BANKING CO.
WEST BROOKLYN, ILLINOIS 61378
PHONE (815) 626-3121
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



VICINITY MAP

LEGEND

- Hydrologic River Basin Boundary
- 07120007 Hydrologic River Basin Number
- Watershed Boundary
- 070 Watershed Number
- Subwatershed Boundary
- 07 Subwatershed Number

HYDROLOGIC UNIT MAP

LEE COUNTY, ILLINOIS

0 1 2 3 4 5 MILES

0 1 2 3 4 5 KILOMETERS

SOURCE: 1982 Illinois General Highway Map And Information From SCS Field Personnel. Polyconic Projection.

DECEMBER 1985 4-R-39572

USDA-SCS NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX.-1990

BIBLIOGRAPHY

Behler, John L. and F. Wayne King
1979 "The Audubon Society Field Guide to North American Reptiles and Amphibians." Alfred A. Knopf, Inc.

Bennett, D. H., J. W. Gibbons and J. C. Franson
1970 "Terrestrial Activity in Aquatic Turtles." Ecology 51:738-740.

Carr, Archie
1952 "Handbook of Turtles - The Turtles of the United States, Canada and Baja California." Cornell University Press.

Conant, Roger
1958 "A Field Guide to Reptiles and Amphibians." Peterson Field Guide Series.

Cooper, J. A.
1977 "Vest-Pocket Turtle." Natural History 86:52-57.

Ernst, Carl H. and Roger W. Barbour
1972 "Turtles of the United States." University Press of Kentucky.

Gibbons, J. Whitfield, Judith L. Greene and Justin D. Congdon
1983 "Drought-Related Responses of Aquatic Turtle Populations." Journal of Herpetology, Volume 17, No. 3, pp. 242-246.

Johnson, Tom R.
1977 "The Amphibians and Reptiles of Missouri." University of Kansas Museum of Natural History, Public Education Series No. 6.

Karns, Daryl R.
1986 "Field Herpetology: Methods for the Study of Amphibians and Reptiles in Minnesota." University of Minnesota, Occasional Paper #18.

Lee County Soil and Water Conservation District
1972 "Resource Inventory of Lee County, Illinois."

Mohlenbrock, R. H.
1986 "Guide to the Vascular Flora of Illinois, Revised and Enlarged Edition." Southern Illinois University Press, Carbondale.

1989 "Midwestern Wetland Flora - Field Office Guide to Plant Species," under contract to USDA Soil Conservation Service - Midwest National Technical Center, Lincoln, Nebraska.

Morris, Michael A., R. S. Funk and Philip W. Smith
1983 "An Annotated Bibliography of Illinois Herpetological Literature 1960-80." Illinois Natural History Survey Bulletin, Volume 33, Article 2.

Pritchard, Dr. Peter C. H.
1979 "Encyclopedia of Turtles." T.F.H. Publications, Inc. Ltd.

Ross, D. A.
1985 "Habitat Use and Movements of a Blanding's Turtle Population in Central Wisconsin." Unpublished Master of Science Thesis.

Rowe, John W.
1987 "Seasonal and Daily Activity in a Population of Blanding's Turtle (Emydoidea blandingi) in Northern Illinois." Master of Science Thesis Eastern Illinois University, Charleston, Illinois.

Schuberth, Christopher J.
1986 "A View of the Past: An Introduction to Illinois Geology." Illinois State Museum.

Smith, Philip W.
1961 "The Amphibians and Reptiles of Illinois." Illinois Natural History Survey Bulletin, Volume 28, Article 1.

Vogt, Richard C.
1981 "Natural History of Amphibians and Reptiles of Wisconsin." Milwaukee Public Museum.

ACKNOWLEDGEMENTS

We wish to thank the following people and organizations for their cooperation and assistance during the turtle survey: the owners/operators who allowed us to trap; Hazel Reuter, Shirley Walder, David Benson and the staff at the USDA Service Center in Amboy; Bob and Dorothy Levin, Kevin Kellen, Dr. Cassandra Rodgers, Wally Janoskey, Doris Carey and other LeeNAG members who helped in the project; and especially Natural Heritage biologists Randy Nyboer and Jim Heim, and DOC fisheries pathologist Rod Horner, whose insights were very helpful in the preparation of this report.

DROUGHT IMPACT ON BLANDING'S TURTLE
AND
EPISTYLIS OCCURRENCE ON PAINTED TURTLES

CONDUCTED BY THE LEE COUNTY NATURAL AREA GUARDIANS

FUNDED BY THE ILLINOIS NONGAME WILDLIFE CONSERVATION CHECKOFF PROGRAM

EXPENSES

BILL FOR SERVICES RENDERED:	$ 250.00
COMMODITIES	125.00
CONTRACTUAL	350.00
MILEAGE	
TOTAL	725.00

Signed William E. Rogers Date 6-26-91

(William E. Rogers)

Signed Debra A. Osmer Date 6-26-91

(Debra A. Osmer)

Itemized bills on file at Lee County Soil and Water Conservation District

319 South Mason Amboy, IL 61310

815/857-3623

FEIN #36-2680632