Homing in the Chorus Frog, *Pseudacris triseriata*

An Honors Thesis (ID 499)

by

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INTRODUCTION

The ability to home, that is, to return to a former habitat, has been demonstrated in many animals, both vertebrate and invertebrate. It occurs naturally, as in the migration of birds or the movement of animals to breeding areas, but it is also observed after animals are intentionally displaced.

In the past few decades a number of studies of homing among anurans have been conducted. These studies have included frog species ranging from cyclic congregational breeders such as chorus frog (Landreth and Ferguson 1966) to opportunistic breeders such as Fowler's toad (Ferguson and Landreth 1966) to frogs which never move very far from the water like the green frog (Oldham 1967).

While on one hand many investigations are aimed at determining whether particular species home, others are concerned primarily with the mechanisms involved, particularly the senses and environmental cues that guide the animals. These mechanisms include, but are not limited to, auditory cues (Dole 1972), olfaction (Grubb 1975), and sun-compass orientation (Ferguson 1966).

The purpose of this study was to determine whether chorus frogs exhibited homing tendencies when removed from a breeding pond and released. The species with which this study is primarily concerned is the western chorus frog (*Pseudacris triseriata*) a member of the family Hylidae. Homing and orientation in this species were the subjects of studies done by Watrous (1967), and Ferguson and Landreth (1966). The western chorus frog is common throughout Indiana (Minton 1972) and is

usually only encountered for a few weeks in the spring during the breeding season, when large numbers of them gather at shallow bodies of water and call in chorus.

MATERIALS AND METHODS

The study was conducted on the Robert H. and Esther L. Cooper Woodland Area located 2 km northwest of Muncie, Indiana. The 13 hectare area consists of both forest and grassland. Figure 1 shows the location of woods, grassland, footpaths, breeding ponds, and other important features.

The westernmost one-half of the study area consists of grass and wildlife plantings. To the south lies a large grass field. The easternmost one-half of the area is deciduous hardwood forest that until 1950 was grazed by hogs and cattle. Since that time the forest area has been relatively undisturbed. In 1960 footpaths were cleared in the woods.

Spring rains create several temporary pools and swampy areas. One pool near the north end and two near the south end of the woods are important breeding pools for chorus frogs and small-mouthed salamanders (*Ambstoma texanum*). The larger of the two southern ponds is fenced and has several "pit-fall" cans sunk into the ground around its perimeter as part of a study being conducted on small-mouth salamanders.

The northern pond (pond A) and the fenced southern pond (pond B) were selected for this study because they were known to have populations of breeding chorus frogs. The two ponds are approximately 180 meters apart.

At the time the study began on 23 March 1987 only the northern pond was filled with water. The southern pond remained dry until heavy rains in early April filled it. Pond A contained about 20 cm of water at first but became deeper later with additional rainfall. The pond was generally open with only a few dead limbs breaking the surface of the water. The

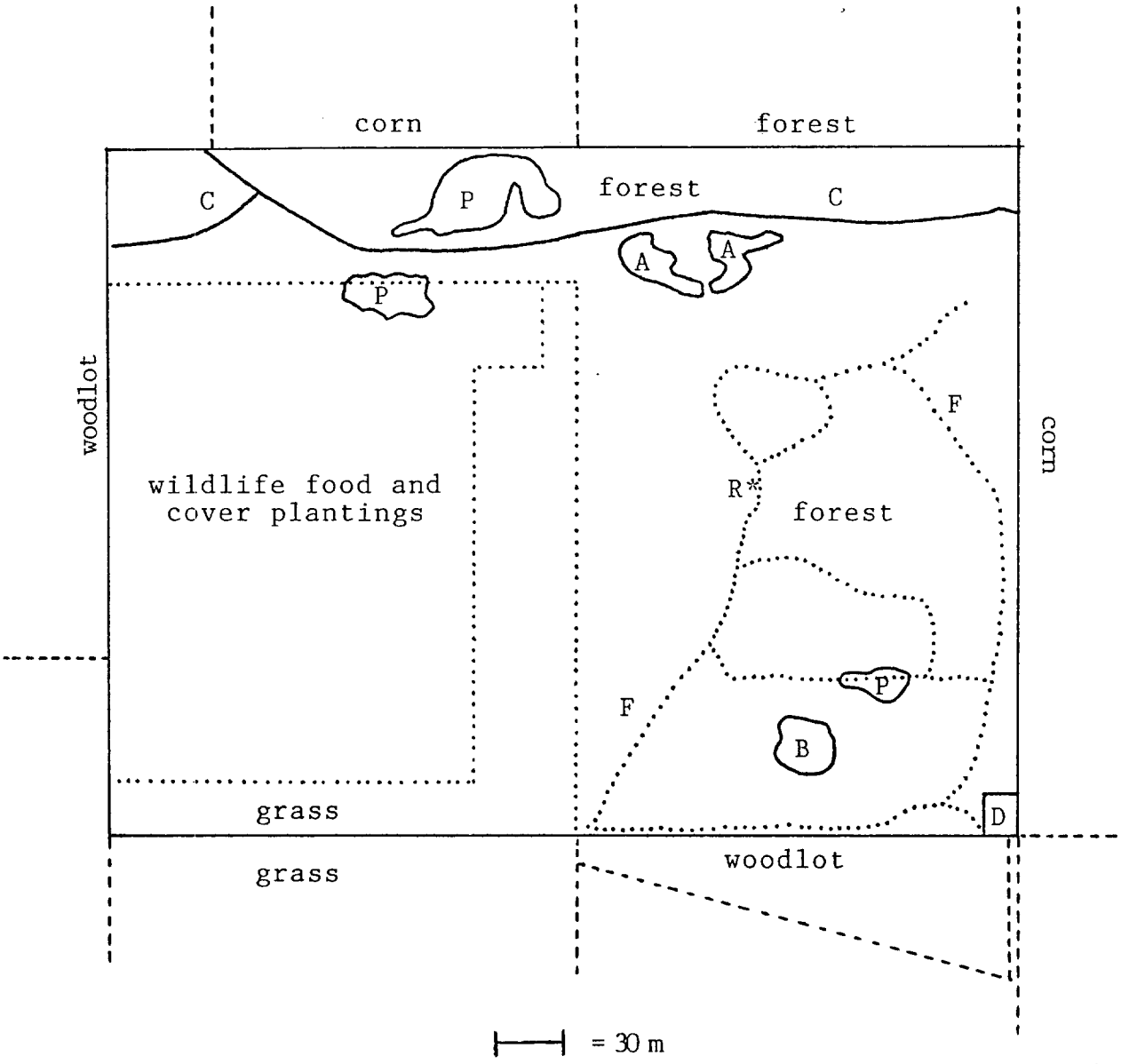

Fig. 1. The Robert H. and Esther L. Cooper Woodland Area (within solid lines). A = north study pond; B = south study pond; C = drainage ditch; D = parking area; F = footpaths; P = temporary pools; R = release point.

bottom and perimeter of the pond was covered with dead leaves. Frogs were often located resting on these branches and leaves in the shallow edges of the pond.

Pond B was of approximately the same depth but of different character. There were several dead trees located in and around the pond. These contributed large quantities of dead branches and floating debris. The edge of the pond was a mixture of grass and fallen leaves.

Collecting of frogs was done at night with the aid of a flashlight and a gas lantern. Frogs were normally found through random encounter due to their reluctance to call while I was in the ponds. Frogs were caught by hand and placed in a cloth bag. After an entire pond was searched the frogs were removed from the bag and identified according to size and sex. Sex was determined by the presence of a vocal pouch in the male. Size was measured dorsally from snout to vent. Each frog was marked for identification by a toe-clipping procedure. Figure 2 shows the system by which a number was assigned to a frog by removing one or more toes. After the frogs were marked they were released.

The first seven frogs were found in the northern pond and were all released in the western part of the pond. The remaining six frogs, caught in the fenced southern pond after it had filled were released at a point midway between the two ponds.

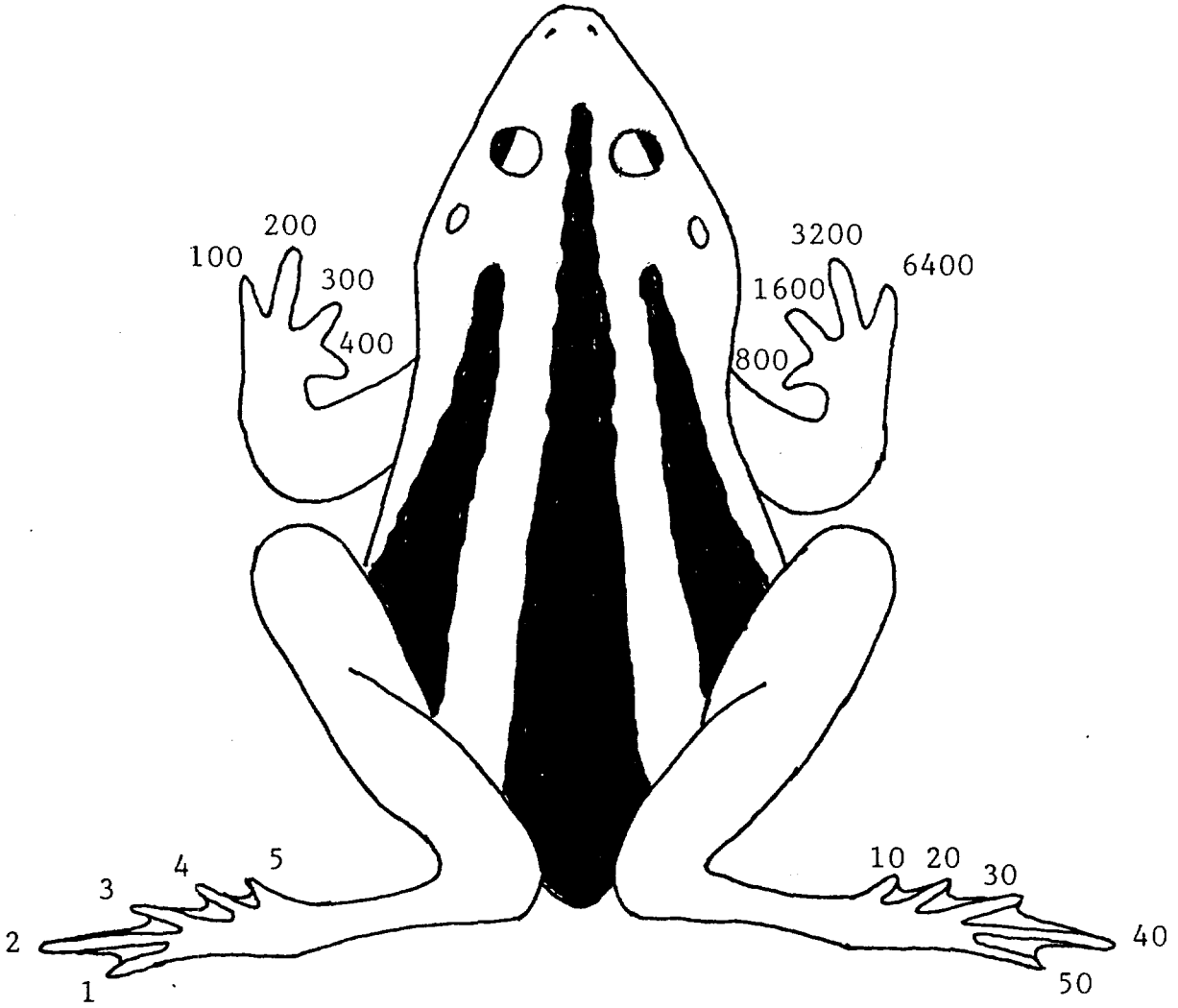

Figure 2. Toe-clipping Identification System

RESULTS AND DISCUSSION

Chorus frogs were calling on the night of 23 March 1987 when collecting began. Calling ceased in mid-April. Temperatures during this period ranged from around 10 to 18 degrees Celsius.

During the course of the study only 13 frogs were captured, two of which were found in pitfall cans at the south pond.

Frogs were normally captured in shallow water while resting on branches, leaves, and other debris. Most of those seen were captured easily, with only two escaping capture. However, Since so few frogs were caught, most frogs must have dived below the surface of the water before I had ever seen them, because far more frogs were heard calling each night than were caught, except on the first night.

Of the 13 frogs caught, ten were males and three were females. Frogs were captured on 7 nights from March 23 to April 10.

None of the 13 frogs which were marked and released were recaptured. Because of this, no conclusions about homing in this species could be made.

A review of the literature revealed several studies dealing with homing and orientation in anurans and other animals. These included a study of the cotton mouse, whose homing ability was related to the dispersal distance from the maternal nest. Mice traveling a greater distance before establishing a home range were familiar with a greater area (Griffo 1961). A similar situation may occur in amphibians, with those species which wander far from their breeding pools showing a better developed homing ability than those remaining near the water. However, this question was not addressed in the literature on amphibians.

Table 1. Summary of frogs caught

No.	Sex	Length (mm)	Date	Caught	Released
13	male	27	23 March	east part of north pond	west part of north pond
14	male	28	"	"	"
15	male	28	"	"	"
16	male	25	"	"	"
17	male	27	"	"	"
18	female	31	24 March	"	"
19	male	26	24 March	"	"
20	male	27	25 March	south pond	midway between ponds A & B
21	female	32	7 April	south pond	midway between ponds A & B
22	male	24	7 April	south pond	midway between ponds A & B
30*	male	25	8 April	south pond	midway between ponds A & B
31	male	26	9 April	south pond	midway between ponds A & B
42	female	32	9 April	south pond	midway between ponds A & B

* This frog had toes 10 and 20 missing when captured.

Salamanders were the focus of several studies. The newt *Taricha rivularis* was able to orient directly to its home area following translocation of up to 630 m (Twitty 1959). Homing was also demonstrated in *Desmognathus fuscus* (Barthalmus 1972). In the latter experiment, salamanders were displaced downstream from three to 30 meters. Significant numbers returned to home zones, with most homing from distances greater than three meters. The ability of female *Desmognathus auriculatus* to home toward their nests was found to be a function of distance and angle of displacement (Rose 1966). Females displaced at right angles to their stream showed less ability to home than those placed along the stream.

Homing and orientation were observed among a number of anurans. Ferguson (1966) found that adult Fowler's toads approached a breeding site following a compass course, at least when auditory cues were absent. When these animals were trapped en route to the pond and released several miles away, they continued on the same compass course.

The western toad *Bufo boreas* exhibited a clear ability to return to a breeding site when displaced up to 200 m (Tracy 1969) and was also capable of homing to a particular breeding site when placed in a different part of the same pond (Gorman 1970).

The giant toad *Bufo marinus* was also found to home (Brattstrom 1962). Fifteen toads were captured under lights in three spots. They were all released from a common point. From this point 5 could see their correct light, 5 could see the building where their light was located but could not see the light itself, and 5 could see neither their light nor their building. Eleven of the 15 released frogs were recaptured, and all of them had found

their correct light. Surprisingly enough, all of the frogs from the group that could see neither their light nor their building returned home. Of the other two groups, 2 of the 5 that could see their home light returned, and 4 of the 5 that could see only their building returned.

Dole (1972) found that American toads (*Bufo americanus*) displaced up to 235 m from a breeding pond were able to orient generally homeward, but many animals returned by indirect routes. They moved first to the shoreline, then turned more directly homeward.

In a study more closely related to the one I attempted, Jameson (1957) moved 414 Pacific tree frogs (*Hyla regilla*) 900 m to a different pond with a breeding chorus. One month later none of these frogs were found in the new location, but five had returned to their original pond.

Studies of *Pseudacris triseriata* have shown some evidence of homing and orientation. Ferguson (1963) moved 409 chorus frogs 45 to 790 m from a home pond including 181 which were placed among another chorus 440 m away. He recaptured 18 % of the 409 in their original pond. No mention was made of the number of frogs which remained among the new chorus. Ferguson stated there was a "seemingly marked attachment to a particular breeding assemblage."

In a study very similar to mine, Watrous (1967) captured 230 western chorus frogs and released them midway between two ponds separated by a distance of about 90 m. Of the 230 frogs released, 51 were recaptured at least once. Of those recaptured, 30 (58.8%) had returned to their original breeding population. Watrous concluded that these findings indicated "random movement in these frogs following displacement and release."

These two studies do not agree that chorus frogs home. A separate

study by Ferguson and Landreth (1966) shows that chorus frogs are capable of orienting themselves with respect to a shoreline. In one investigation, frogs were caged on the shore of an unfamiliar pond. These frogs were removed after 72 hours, carried in light-tight bags to the testing area and released in the center of a plastic testing pool. Five of the frogs swam in a direction that would have returned them to land. The other ten swam in a direction that would have taken them toward water. Ferguson supported this finding of a bi-directional response. He stated that chorus frogs sometimes move into deep water to escape and others return to shore to seek cover.

The ability to home has thus been demonstrated in several species of amphibia. This ability is probably related to the animal's habits. With respect to chorus frogs, there is some evidence that they are able to orient themselves, and this orientation ability may allow them to home when displaced from their breeding pool, although the two studies addressing this particular point are in disagreement.

Additional studies might be made to determine if chorus frogs return to the same breeding pond each year and if frogs removed from one pond and placed among another breeding chorus in a separate pond return to their original pond or remain in the new pond.

SUMMARY

Western chorus frogs were collected from two breeding ponds located in the Cooper Woodland Area, marked for identification and released away from their original capture site in order to determine if they exhibited homing abilities. A total of 13 frogs was captured and released from 23 March 1987 to 10 April 1987. None of the marked frogs was recaptured. No conclusion about homing was reached.

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