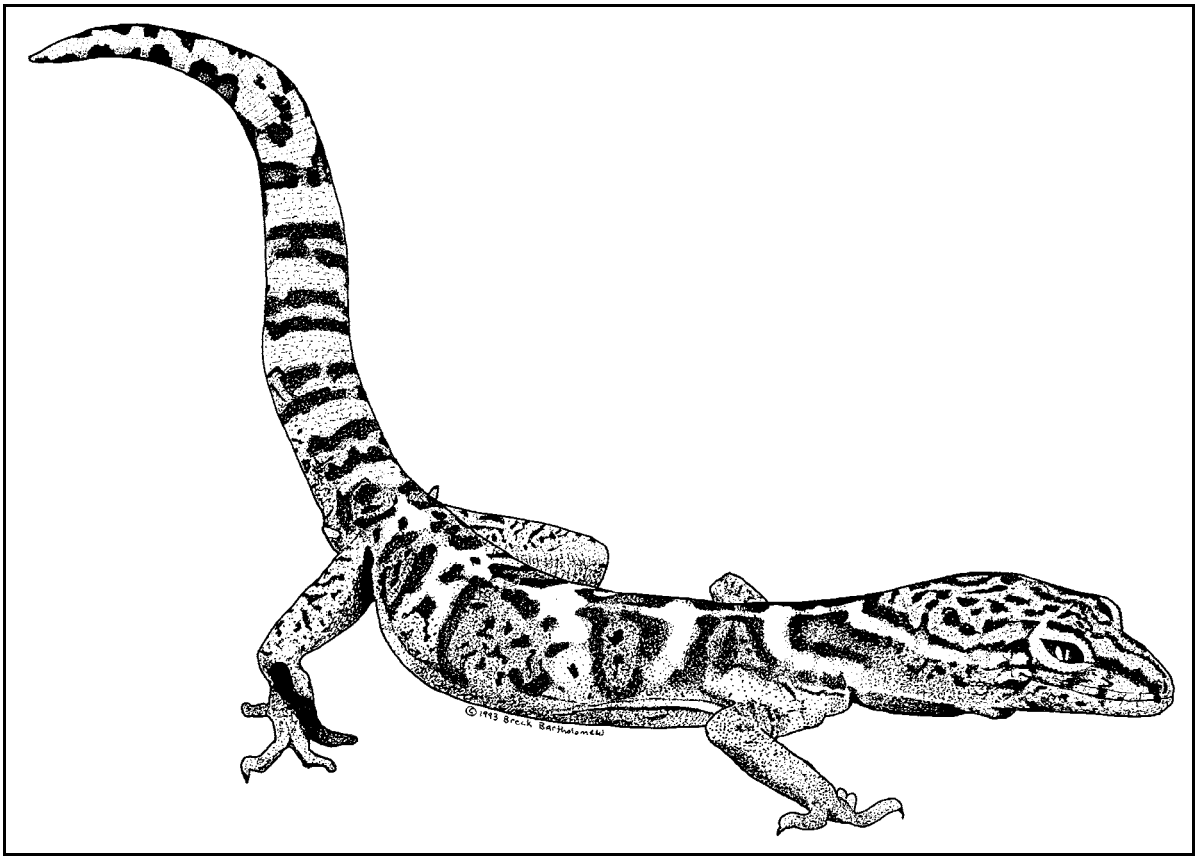
BULLETIN
of the
Chicago Herpetological Society

Volume 33, Number 11
November 1998



BULLETIN OF THE CHICAGO HERPETOLOGICAL SOCIETY
Volume 33, Number 11
November 1998

Cover: Western banded gecko, *Coleonyx variegatus*. Drawing by Breck Bartholomew.

The Chicago Herpetological Society is a nonprofit organization incorporated under the laws of the state of Illinois. Its purposes are education, conservation and the advancement of herpetology. Meetings are announced in this publication, and are normally held at 7:30 P.M., the last Wednesday of each month.

Membership in the CHS includes a subscription to the monthly *Bulletin*. Annual dues are: Individual Membership, $22.00; Family Membership, $25.00; Sustaining Membership, $50.00; Contributing Membership, $100.00; Institutional Membership, $38.00. Remittance must be made in U.S. funds. Subscribers outside the U.S. must add $12.00 for postage. Send membership dues or address changes to: Chicago Herpetological Society, Membership Secretary, 2060 N. Clark Street, Chicago, IL 60614. Publications are sent to U.S. members via third class bulk mail; the post office does not forward such mail, even if a special request is made to forward magazines.

Manuscripts published in the *Bulletin of the Chicago Herpetological Society* are not peer reviewed. Manuscripts should be submitted, if possible, on IBM PC-compatible or Macintosh format diskettes. Alternatively, manuscripts may be submitted in duplicate, typewritten and double spaced. Manuscripts and letters concerning editorial business should be sent to: Chicago Herpetological Society, Publications Secretary, 2060 N. Clark Street, Chicago, IL 60614. **Back issues** are limited but are available from the Publications Secretary for $2.50 per issue postpaid. **Visit the CHS home page at <http://www.Chicagoherp.org>.**

The BULLETIN of the Chicago Herpetological Society (ISSN 0009-3564) is published monthly by the Chicago Herpetological Society.

Bull. Chicago Herp. Soc. 33(11):225-236, 1998

Courtship Behavior and Systematics in the Subtribe Nectemydina
1. The Genus *Trachemys*, especially *Trachemys scripta callirostris* (Gray, 1855) [1, 2]

Uwe Fritz [3]
Wilhelma, Zoologisch-Botanischer Garten
Postfach 501227
D(W)-7000 Stuttgart 50
Germany

Translated from the German by Coenraad M. Adema, Elke C. Eggers and Uwe Fritz [4]

Abstract

The courtship behavior of *Trachemys scripta callirostris* is described from observations of nine males and six females over a period of eight years. The behavior of the male is highly ritualized and consists of four phases: 1) prelude; 2) contact; 3) courtship; and 4) copulation. The most striking behavior is head-nodding in a vertical plane by the male. Its function is probably the immobilization of the female for copulation. Despite a clearly structured sequence of the four phases a certain variability is present. The role of the female in courtship is mainly passive. First-time observations of the courtship of *T. s. ornata* from Puerto Marquez (Mexico) show no obvious differences from *callirostris*.

This study presents the first detailed description of the courtship of a member of the *ornata* group of *Trachemys* from Central and South America. Courtship sequences of the North American *scripta* group and the Central and South American *ornata* group reveal important differences: head-nodding in the *ornata* group, accentuated by the elongated snout, versus claw vibration in the *scripta* group, accentuated by the elongated foreclaws. These courtship differences, along with important morphological differences such as color pattern and sexually dimorphic features (elongated foreclaws in *scripta* group males; elongated snouts in *ornata* group males), support the view that the *scripta* and *ornata* groups are most probably not conspecific.

1. Introduction

The Colombian slider (*Trachemys scripta callirostris*) belongs to the family of true pond turtles (Emydidae; subfamily Emydinae) within the suborder of hidden-necked turtles (Cryptodira). The genus *Trachemys* is closely related to a few other New World pond turtle genera (see McDowell, 1964; Moll and Legler, 1971; Pritchard, 1979; Smith and Smith, 1980; Ernst and Barbour, 1972, 1989) that, together with *Trachemys*, were grouped by Smith and Smith (1980) in the subtribe Nectemydina (slider turtles, in a broader sense).

Within the order of turtles (Testudines), the genus *Trachemys* inhabits a uniquely large area of distribution, from the Great Lakes in North America to Argentina, Brazil and Uruguay (see Moll and Legler, 1971; Wermuth and Mertens, 1977; Pritchard, 1979; Ernst and Barbour, 1989). Additionally, numerous islands of the Bahamas and Antilles are inhabited (Seidel, 1988). Excluding the West Indian taxa, this genus contains approximately 20 forms (Moll and Legler, 1971; Smith and Smith, 1980; Iverson, 1986), in at least four morphologically distinct groups (Figure 1 and Table 1).

The taxonomy of *Trachemys* remains highly controversial. Many mostly Anglo-American authors distinguish only one or two species within the continental Americas (Carr, 1938, 1952; Hartweg, 1939; Williams, 1956; Legler and Webb, 1970; Moll and Legler, 1971; Ernst and Barbour, 1972, 1989; Pritchard, 1979; Smith and Smith, 1980; Fritz, 1981; Pritchard and Trebbau, 1984; Obst, 1985), whereas in German-speaking circles most follow Wermuth and Mertens (1961, 1977) who recognize four species, although these do not completely cover the morphological groups. Weaver and Rose (1967) and Ward (1980) assign full species status to even more taxa. Here, I will follow, for the time being, the most often recognized systematic concept of Carr (1938) and Moll and Legler (1971), which considers a single continental American species, *Trachemys scripta*.

Until recently, the systematics of turtles has been based almost exclusively on purely descriptive morphological comparisons. However, in the case of *Trachemys* and related turtle genera, one obtains equivocal results not only at the species level but also at the genus level, even with the inclusion of the additional considerations of serological characteristics and endoparasitic fauna (see review in Seidel and Smith, 1986; also see Smith and Smith, 1980).

---

1. Citation of original article: Fritz, Uwe. 1990. Balzverhalten und Systematik in der Subtribus Nectemydina: 1. Die Gattung *Trachemys*, besonders *Trachemys scripta callirostris* (Gray, 1855). Salamandra 26(4):221-245. Figures have been reprinted with permission.

2. This study is based upon the material of an MA thesis prepared at the Institute for Zoology at the University of Stuttgart-Hohenheim. This work was sponsored by a grant from the *Studienstiftung des deutschen Volkes*.

3. *Present address:* Staatliches Museum für Tierkunde, Forschungsstelle, Augustusstrasse 2, D-01067 Dresden, Germany.

4. Translation was arranged by James N. Stuart, and edited by J. N. Stuart, U. Fritz and Michael Dloogatch.

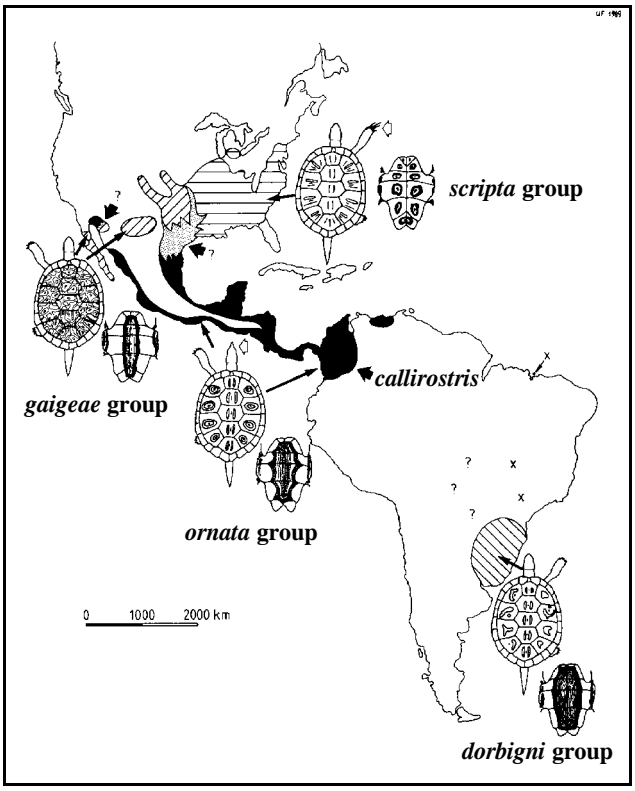


Figure 1. Distribution of the four morphological groups of *Trachemys* in continental America. The most important color patterns (often well developed only in juveniles) and sexually dimorphic characters (light arrows) of the males of the *scripta* and *ornata* groups are shown. Possible areas of intergradation are stippled.

Table 1. Synopsis of the four morphological groups of *Trachemys* from continental America. Combined from Williams (1956), Freiberg (1967), Moll and Legler (1971), Conant (1975), Smith and Smith (1980), Fritz (1981), Obst (1985) and the author's unpublished data. The shell pattern is often distinctly developed in juveniles only.

Morphological group	Distribution	Important characters
scripta (3 to 4 distinguishable forms)	Eastern and central USA, adjacent Mexico	Linear carapace pattern, plastral pattern with ocelli. Males with clearly elongated foreclaws, without distinctly pointed snout
gaigeae (about 5 distinguishable forms)	Central USA, northern Mexico	Reticulate carapace pattern, linear plastral pattern with lines following the scute seams. Males without conspicuous elongated foreclaws and without distinctly pointed snout.
ornata (about 10 distinguishable forms)	Northern Mexico to Colombia and Venezuela	Carapace pattern with ocelli, plastron with seam-following linear pattern. Males without conspicuous elongated foreclaws but with distinctly elongated snout.
dorbigni (1 or 2 distinguishable forms)	Southern Brazil, northeastern Argentina, Uruguay	Carapace with a more or less well developed ocellar pattern, plastron with seam-following linear pattern. Males without conspicuous elongated foreclaws and without distinctly pointed snout.

The innate, highly stereotypical courtship behavior of these turtles could yield powerful additional data that could provide a more certain evaluation of their systematics. This is because, as presented by Mayr (1975:126f.): "behavior is without a doubt one of the most important sources of taxonomic characteristics. In investigations of related species, and especially of sibling species, behavioral characteristics are in fact frequently superior to morphological characteristics." Mayr's statement should be interpreted narrowly, however, because it only applies unconditionally insofar as innate stereotypical behavior is concerned; that is, behavior that is no more than minimally influenced by acquired behavior and as a result is mostly determined by hereditary factors. This certainly applies to the behavior of reptiles, especially to their courtship behavior (see the extensive catalogue concerning innate stereotypical behaviors in Carpenter and Ferguson, 1977).

Exaggerated morphological features as determinants in the courtship behavior of the genus *Trachemys*

The males of the North American *scripta* group within *T. scripta* display grotesquely elongated front claws (Figure 2 and Table 1) that have an important function in the ritualized courtship behavior (Cagle, 1950; Moll and Legler, 1971; Jackson and Davis, 1972a) in that these emphasize forefoot vibrations of the courting males. Interestingly, this morphological feature is also found in all Antillean sliders which, according to the results of Seidel (1988), should be classified as four separate species.

The males of the *gaigeae*, *ornata* and *dorbigni* groups of Central and South America do not have conspicuously elongated foreclaws in comparison to the females. In contrast, elongated, tapered or knobby snouts occur in males of the *ornata* group (Figure 3, Table 1). Moll and Legler (1971) assumed that this feature has meaning in the courtship behavior of males.

The courtship behavior of the diverse *ornata* subspecies

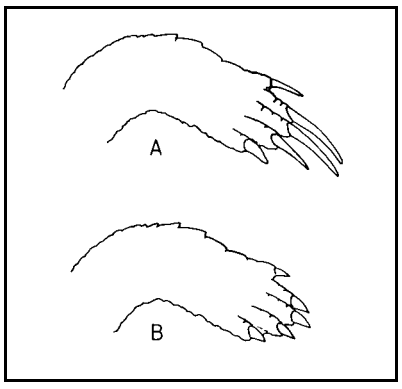


Figure 2. A. Foreleg of a male *Trachemys scripta elegans*. *T. s. scripta*, *T. s. troostii* and West Indian *Trachemys* forms have equally elongated foreclaws. In the genera *Chrysemys*, *Graptemys* and *Pseudemys* the same sexual dimorphism occurs. B. Foreleg of a female *T. s. elegans*. Females of all species and males of the *ornata*, *gaigeae* and *dorbigni* groups of *Trachemys* have the same claws. After Cagle (1948).

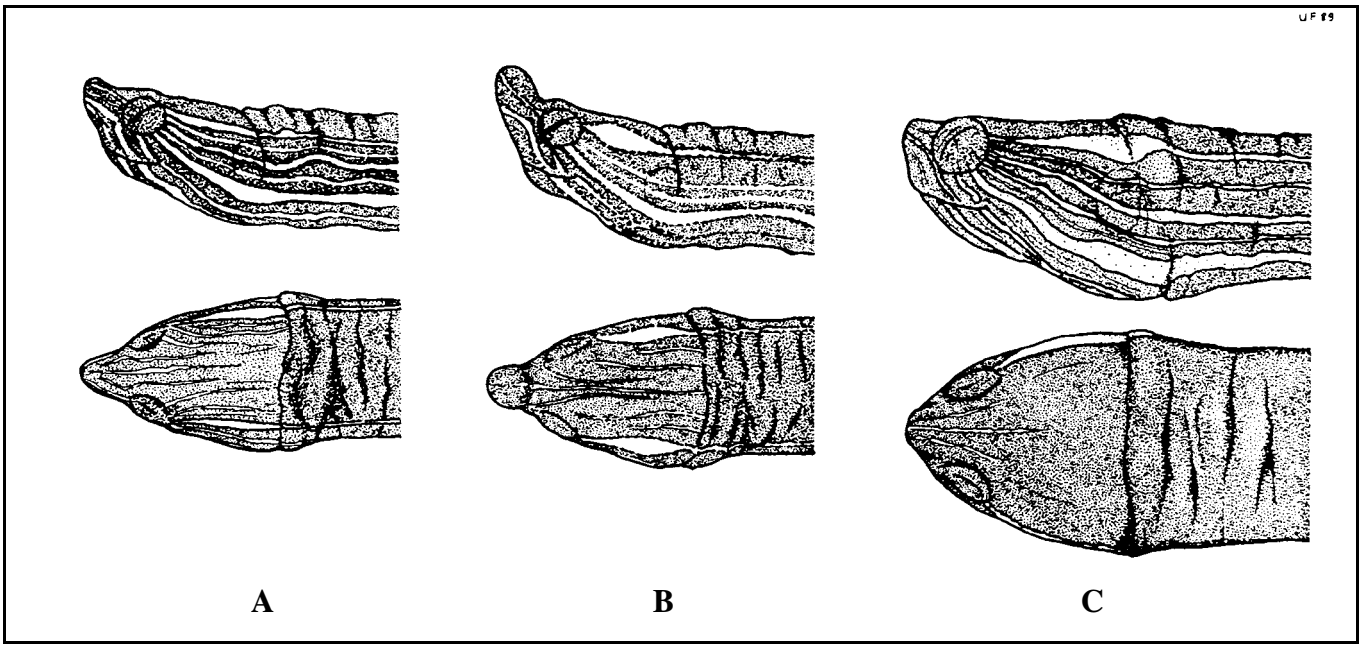


Figure 3. Sexual dimorphism in the shape of the head and snout within the *ornata* group of *Trachemys*. A. Male with pointed, upturned snout (Juan Mina, Canal Zone, Panama). B. Male with knobby, upturned snout (Tlacotalpan, Veracruz, Mexico). C. Female (Juan Mina, Canal Zone, Panama). Note the bulkier head and the blunt, rounded snout.

Males of the Colombian slider correspond to the specimen in A. As far as known there are no differences in head shape among females throughout all populations of the *ornata* group (see C). Males of the *scripta* and *gaigeae* groups show no obvious differences in the shape of the snout compared to females (C); however, normally males have more slender heads than old females. A, C after Moll and Legler (1971); B original.

group is still mostly unknown. However, some superficial captive observations from Rosado (1967) concerning two Central American subspecies and field observations by Medem (1975) of *T. s. callirostris* suggest that fundamental differences are present in comparison to the courtship behavior of the North American *scripta* group. Important differences in the courtship behaviors of different morphological groups of *T. scripta* would clearly indicate that these groups belong to different biological species (see Ernst and Barbour, 1989: 205-206).

Scope and Objective

The first part of this study as follows will describe the courtship behavior of the Colombian slider (*T. scripta callirostris*) of Colombia and Venezuela, based on captive observations. This is the first time that courtship behavior of a subspecies belonging to the *ornata* group of *Trachemys scripta* has been thoroughly investigated.

The aim of this investigation is to compare the courtship behavior of *T. s. callirostris* of the Central and South American *ornata* subspecies group with the courtship behavior of the *scripta* subspecies group of North America. The present paper and the second part of this work [see Fritz, 1991, *Salamandra* 27(3):129-142] will test to what extent the elements of ritualized courtship behavior of species of the subtribe Nectemydina are suitable for a systematic classification at α- and additionally at β-taxonomic levels (at the species level and above the species level, respectively).

2. Materials and Methods

2.1 Study animals and maintenance

Altogether, nine adult males and six females of *T. s. callirostris* were observed for over eight years. The animals had carapace lengths between 12 and 35 cm. Four of the observed males were bred in captivity. Also, video recordings of courtship behavior in four pairs were made during a seven-month time interval.

The turtles were kept in several large aqua-terrariums that each had a land area for basking. The volumes of the different tanks ranged from 100 to 1000 l. The water was filtered continuously and replaced completely every one to two weeks. The water and air temperatures varied between 24 and 32°C. The four pairs of which video recordings were made were subjected to a 12:12 h dark–light regimen. The observation tank was illuminated with a 500W HWL mercury-vapor lamp over the land area (piled-up rocks forming a 40 × 40 cm dry area); at the same time this lamp provided additional heating of the air and the water. The sides of the hexagonal observation tank were 70 cm high and perpendicular to the ground; the alternating sides were 70 and 100 cm long. Water depth was about 50 cm. In addition to the rock construction that made up the land area, other stones were available for cover and to provide structure to the environment. The substrate consisted of a layer of quartz pebbles ca 5 cm thick.

The turtles were fed every three to four days with a diet of dog food (*Royal Canin Croc*, softened in water), small cut pieces of trout (*Salmo gairdneri*), cichlids (*Sarotherodon mossambicus, Tilapia mariae*), beef heart and chicken heart,

newborn mice (pinkies), bananas, lettuce, dandelions, and cockroaches (*Blaptica dubia* and *Periplaneta americana*). The food was partly enriched with mineral and vitamin preparations.

For comparative purposes, extensive direct observations of courtship behavior in the following turtles, maintained under identical conditions, were made starting in 1978 (the sex ratio is indicated in parentheses; 1.1 indicates one male and one female)

- *Chrysemys picta bellii* (2.1)
- *Graptemys nigrinoda delticola* (2.1)
- *Pseudemys floridana peninsularis* (1.1)
- *Pseudemys concinna hieroglyphica* (3.2)
- *Pseudemys concinna metteri* (1.2)
- *Pseudemys nelsoni* (1.1)
- *Pseudemys texana* (1.1)
- *Trachemys scripta scripta* (1.2)
- *Trachemys scripta troostii* (1.1)
- *Trachemys scripta elegans* (5.5)
- *Trachemys scripta taylori* (1.1)
- *Trachemys scripta ornata* (2.1)
- *Trachemys terrapen* (1.1)

2.2 Behavior recording (data collection)

Before videotapings, male turtles were kept isolated in small tanks for two weeks and in this manner were deprived sexually. For all video recordings, one male was placed together with one or two females in the observation tank that was described above. Motivated by the preceding solitary confinement, the male typically started courtship immediately. Video recordings were made with the use of standard VHS video equipment that included zoom and date-and-time capabilities. The camera was mounted about 1.5 m from the front window of the observation tank. Filming was done automatically in the absence of an observer, and additionally by hand to allow close-ups.

The following quantitative results are based upon analysis of video recordings of courtship behavior of four Colombian slider males for a total duration of 36 hours (9 hours for each male). Direct observations during the several-year observation interval supplemented these recordings.

2.3 Classification of behavior and analysis

The courtship behavior of turtles and other reptiles is divided according to descriptive and functional aspects into separate segments that ultimately, as a rule, are only descriptions of observed, especially pronounced types of movement sequences [e.g., claw vibrations would be one type of movement sequence] (Carpenter and Ferguson, 1977).

Accordingly, from extensive observations of courtship behaviors, all conspicuous and stereotypical behaviors were listed first. Standardized forms were then created, listing all of these previously determined stereotypical behaviors, and the videotape was then analyzed by noting on these forms the behaviors seen on the tape and their sequence. By means of the clock incorporated in the video images, the duration of each separate behavior phase was determined.

Definition of terms

The terms "courtship" and "courtship behavior" are applied exclusively in the following to such behaviors that serve directly to immobilize the courted female for mating. All behavior that occurs in a sequence before and after the courtship behavior will be defined together with the courtship behavior as "courtship display."

3. Results

3.1 The courtship display of *Trachemys scripta callirostris*

3.1.1 Description

The courtship display of *T. s. callirostris* is highly ritualized. It can be divided into four behavior segments, each of which consists of several motion sequences (Figure 4). These characteristic behaviors in the context of courtship display are performed exclusively by the male. On occasion, an identical behavior is displayed by females in other social situations (e.g., female–female interactions), as is also known to occur in other turtle species. The function of this non-procreative "pseudo-courtship" of females is not apparent (see for example, Kramer and Fritz, 1989).

The female remains mostly passive during courtship. Flight of the female evokes termination of a courtship sequence.

1) Prelude

1a) *Male sees female*. The female swims or walks underwater into view of the male.

1b) *Female approaches male from the front*. Alternative prelude to evoke advertising behavior of the male.

2) Contact

2a) *Male pursues female*. Reaction of the male to 1a). The male pursues the female, usually with his neck maximally extended; his snout is often oriented towards the tail of the female. Slow chewing movements by the male.

2b) *Male swims backwards in front of female*. Response of the male to 1b). By swimming backwards, the male maintains a position in front of the forward-moving female. If the female turns away, she is pursued by the male.

3) Courtship

3a) *Male achieves courtship position*. Follows after 2a) or 2b). The male swims next to, over, under, or in front of the female. During this phase, the female is frequently also circled by the swimming male. The male's head is always oriented in the direction of the head of the female and it follows the head movements of the female. The hyoid apparatus of the male pulses intermittently with chewing motions. If the female tries to flee, the male will again pursue. If the male successfully swims into a position directly opposite to the female, phase 3b) follows:

3b) *Male assumes snout-to-snout posture*. The male approaches the snout of the female with his snout in such a manner that it results in the touching of the snout tips. Usually at this point, the male is positioned more or less in front of the

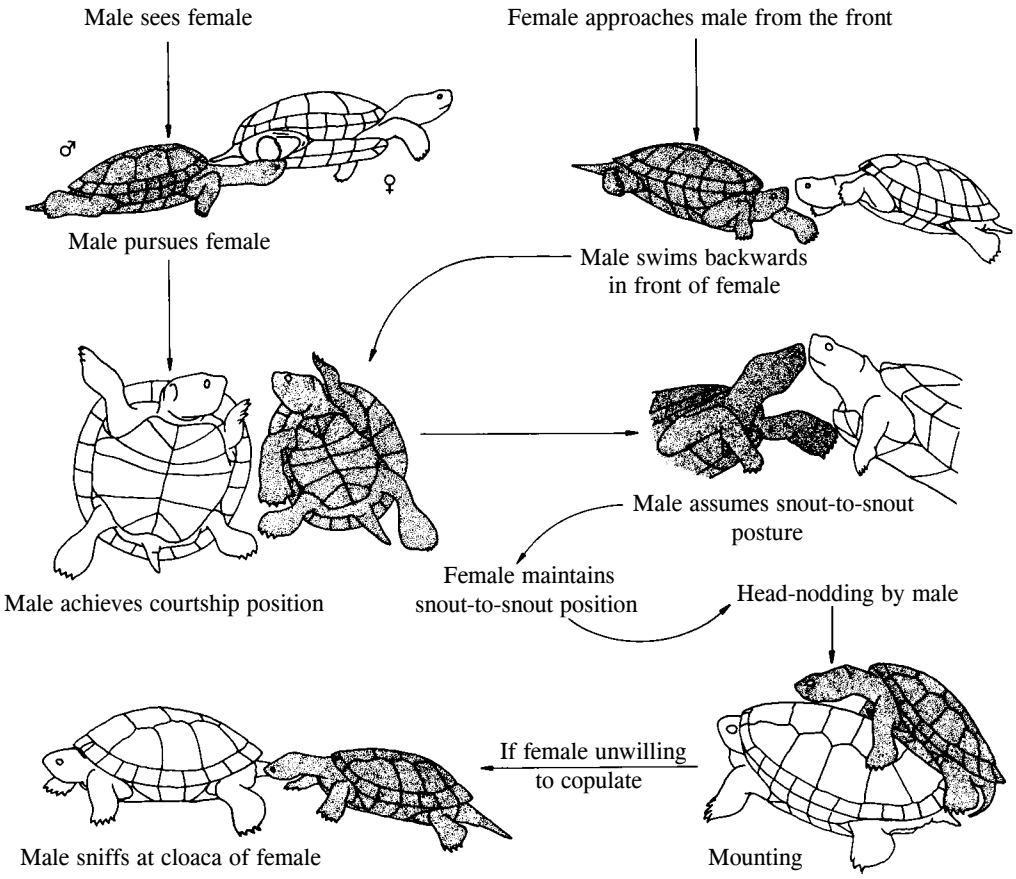


Figure 4. Flowchart of the courtship display of the Colombian slider, *Trachemys scripta callirostris*. Male is dark. Drawn from videotape.

female, but occasionally may also swim over, beside, or under her. While the male persists in the snout-to-snout position, there is an increase in pumping with the hyoid apparatus and in the chewing motions. While in this position, the courting partners very occasionally expelled air bubbles from the nostrils (out of 315 recorded snout-to-snout postures, this was observed ca 4% of the cases in males and < 1% of the cases in females). While in the snout-to-snout position, if the female does not stop her forward movement, or if she again starts to swim after a brief pause, the male will terminate the courtship display (in 69% of 315 observed cases).

3c) *Head-nodding by male.* If the female persists for at least 2 seconds in the snout-to-snout position, the male will nod his head. The nodding frequency is very constant at 1.91 ± 0.13 cycles of up-and-down movements of the head/second (weighted arithmetical average of a total of 53 observations from three males that could be analyzed due to similarity of recordings; see also Table 2). During the head-nodding, both animals remain in the snout-to-snout position. The speed of water-chewing and hyoid-pumping by the male increases again. As can be observed from the movements of small, floating particles in the water, the male expels water from the nostrils during the head-nodding. In about 20% of 70 filmed head-nodding events, air bubbles leave the nostrils of the male during the head-nodding, while this occurs with the female, more or less motionless during the head-nodding, in just 5% of the cases. If the female starts to swim or run following the head-nodding, the male tries again to bring himself into courting position.

In the advertising behavior of younger and consequently smaller males, head-nodding could be observed only very rarely. Not even a single nodding sequence could be recorded for the only small male that was videotaped. The analysis of the video recordings disclosed that, despite attempts to engage in a direct snout-to-snout posture, this animal never succeeded in persuading a female to stay in this posture.

4) Copulation

Mounting. Following the head-nodding of the male, if the female remains motionless or swims only very slowly, the male swims behind the female and mounts her. While in this position the male tries, by moving his shell from side to side, and by probing with the tip of his tail, to find the tail of the female. Following contact with the tail of the female, the male bends his tail in a J-shape around the tail of the female. To date, a copulation could neither be filmed nor observed.

Copulations must have occurred between the test animals because over 90% of the eggs of several clutches were fertile. A fertilization due to sperm storage can be ruled out because the females were captured as immature juveniles.

If the female started to move after the copulation attempt,

Table 2. Frequencies observed and mean durations of the courtship phases of four *Trachemys scripta callirostris* males. After the duration the standard error is given. After f_{obs} the frequencies observed for the individual males are given in brackets. For the youngest male not all the elements in the behavioral inventory could be filmed (see text). Except where otherwise noted the mean duration of a behavioral unit was calculated from 30 randomly selected behaviors of three or four males, as the case might be. f_{obs} = frequency observed.

Phase	Duration	f_{obs}
2a) Male pursues female	33.9 ± 7.9	910 [158; 313; 291; 148]
2b) Male swims backwards in front of female	18.1 ± 4.4	194 [51; 74; 69; 0]
3a) Male achieves courtship position	118.4 ± 7.8	885 [159; 308; 266; 152]
3b) Male assumes snout-to-snout posture	19.1 ± 3.2	315 [65; 108; 98; 44]
3c) Head-nodding by male	2.31 ± 0.13*	78 [22; 33; 23; 0]**
4) Mounting	32.2 ± 6.5	80 [17; 39; 24; 0]

* In some males a longer duration was observed, although not videotaped. The estimated duration was about 7 s.

** In 53 of these the recording quality was sufficient to be evaluated.

the courtship was terminated in about a third of the recorded copulation attempts, or alternatively the female was pursued again. In about a third of the film recordings, the female remained motionless. In these cases, the male would sniff the cloaca of the female, which was usually followed by termination of the courtship.

Table 2 summarizes the observed frequencies and average duration of the most important behavioral components of the advertising behavior.

The complex of behaviors of *T. s. callirostris* in connection to courtship is clearly structured and highly stereotyped. However, it should be borne in mind that the behavior always includes a continuous series of variable components, which are even more variable if an interaction involves several animals. Also, the particular reaction following a stimulus is usually only one of numerous possibilities. Many factors that interact in evoking a reaction, especially the different moods, are very much obscured from observation.

It is necessary to emphasize that the behavior sequence described above presents only the most likely order of reactions. In reality, several different behaviors could follow upon any given previous behavior event.

Figure 5 is an attempt to document the complicated "web" of different possible orders of reactions that result from these states/conditions by way of example, based on the behavior of a single male.

3.1.2 Discussion

A frequent concern directed against behavioral studies of captive animals is the possibility of a behavior-changing influence caused by the conditions of captivity (see for example, especially for aquatic turtles, Marchand, 1944).

For studies of courtship behavior of highly aquatic turtles, captive observations are inevitable, however, because observations in the open are not feasible within an acceptable time interval. For example, during his extensive underwater study of naturally occurring Florida redbelly turtles (*Pseudemys nelsoni*), Kramer (*in* Kramer and Fritz, 1989) could not observe even a single remotely complete courtship sequence. The courtship behavior of this turtle species could only be described completely through the use of captive observations (Kramer and Fritz, 1989). In comparing these with field observations only small differences were seen, mostly concerning the time duration of isolated behavior phases and the willingness of the females to be courted. On the whole it seems that the courtship behavior of turtles is so strongly coordinated genetically that captive observations offer a realistic view of the natural [non-captive] behavior. However, it seems doubtful that the documentation of duration of the different behavior phases in captive observations is useful based on the results from Kramer and Fritz.

The fragmentary observations by Medem (1975) of the courtship behavior of *T. s. callirostris* in the wild suggest some differences in the behavior described in this study. Medem observed that the female is circled by the courting male. Additionally, he could observe an "intensive snout rubbing with violent head movements," but he did not mention the head-nodding of the males.

A general difficulty in behavior observations in the field is presented by subtle movement sequences, such as fast movements of the feet and head-nodding, that are overlooked or are misinterpreted, frequently as a result of poor visibility. In the first descriptions of courtship behavior of a particular species, based on observations in the wild, such subtle movements usually remain unreported (e.g., for *Pseudemys concinna*: Marchand, 1944; for *P. nelsoni*: Lardie, 1973; for *Malaclemys terrapin*: Seigel, 1980), whereas later such fine movements could be described based on captive observations, after which they could then also be partly observed and described from wild observations (*Pseudemys concinna:* Jackson and Davis, 1972b; *P. nelsoni*: Kramer and Fritz, 1989; *Malaclemys terrapin*: Vogt *in* Seigel, 1980, Sachsse, 1984).

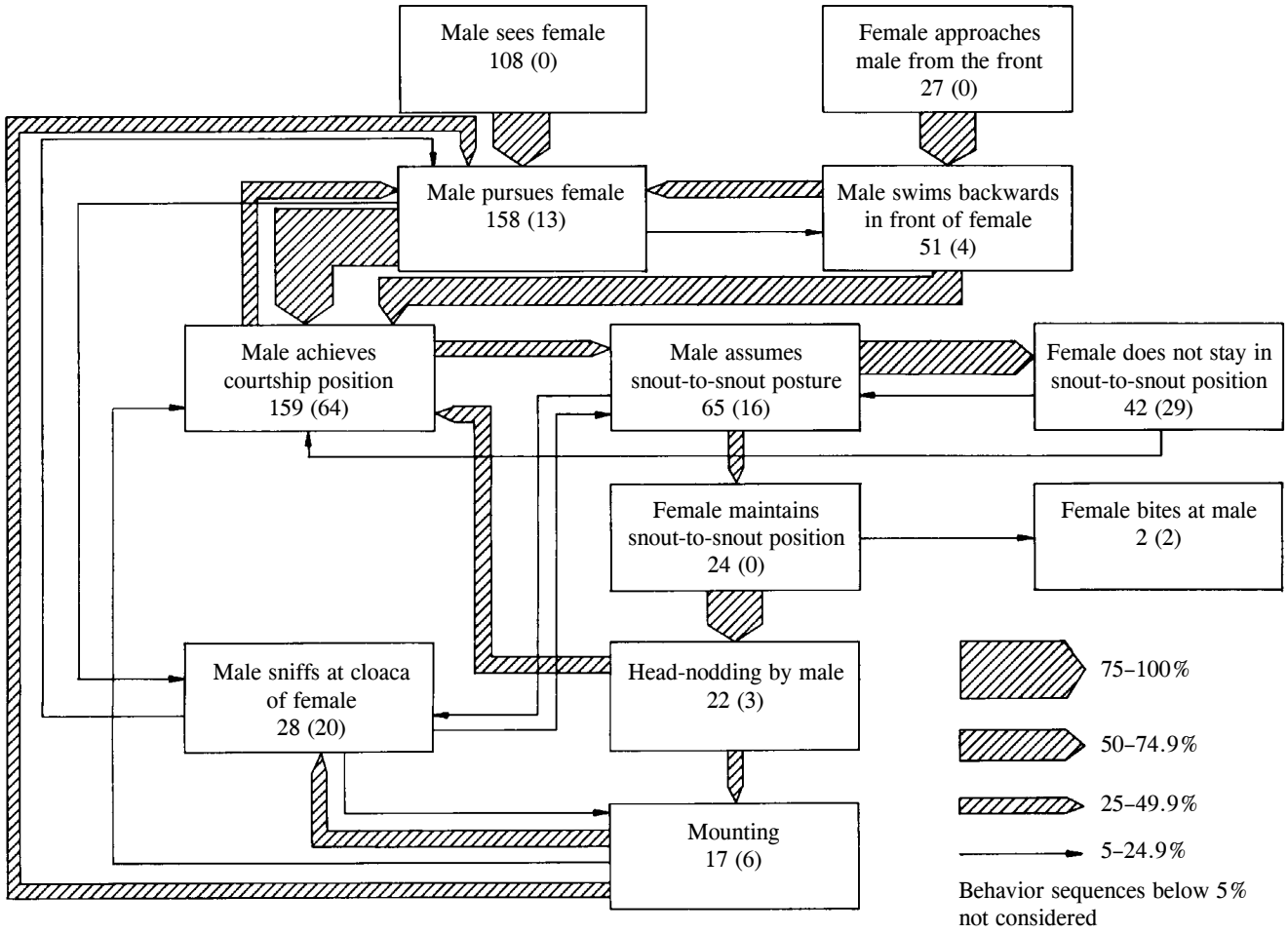


Figure 5. Quantitative flowchart of the courtship behavior of a single male Colombian slider, *Trachemys scripta callirostris*. Each box represents one behavioral element. The frequency observed is given right after the name of the behavioral element in each box; the value in parentheses gives the number of courtship sequences interrupted after this behavior. Width of the arrows symbolizes the frequency of alternatives. This flowchart is based on 9 h videotaping of the behavior of one male.

Rosado (1967) mentioned for the courtship behavior of males of two Mexican subspecies of the *ornata* group that courtship involves expulsion of water through the nostril in the direction of the head of the female. Such behavior also occurs in the courtship of *T. s. callirostris*, as presented in this study.

"Water spraying" is a widely distributed phenomenon in the courtship behavior of aquatic turtles (see for example, Harding, 1983, for *Platemys platycephala,* a pleurodiran turtle; and Roedel, 1985, for *Sacalia bealei*, a cryptodiran pond turtle of the subfamily Batagurinae) that originally may well have served in the stimulation of the mating partner by means of pheromones. In fact, two structures located close to the nostrils, rostral pores and chin glands, have been discovered and may have originally had an exocrine function (Winokur and Legler, 1974, 1975). In *Trachemys* and related genera, visual stimuli in the courtship behavior of the males have replaced pheromones, and the original exocrine structures are only rudimentary in their development today (Winokur and Legler, 1975). As an ethological equivalent to the rostral pores and chin glands that currently are without function, it seems that "water spraying" in the courtship behavior has been conserved as a vestige.

3.2 Courtship behavior of *Trachemys scripta callirostris* and *T. scripta elegans*

3.2.1 Comparison

The courtship behavior of the North American *T. s. elegans*, which was extensively investigated by Jackson and Davis (1972a), differs markedly from that of the Colombian *T. s. callirostris*. On the whole, it seems that the body posture of the advertising males is considerably more constrained than what is seen in *T. s. callirostris* (see Jackson and Davis, 1972a). The most conspicuous element of courtship behavior of *T. s. elegans* is the characteristic claw vibration of the male. Also, the male positions himself head-on to the female with extended foreclaws. Interrupted by pauses, the male produces fast vibration movements of the front legs and [in turn] of the sexually dimorphic, elongated claws (Figure 6). This characteristic behavior, also known from a few other emydids (see appendix in part 2 of this study), is lacking completely in the Colombian *T. s. callirostris*; instead the male of the Colombian slider head-nods.

In contrast, based on my unpublished observations, no

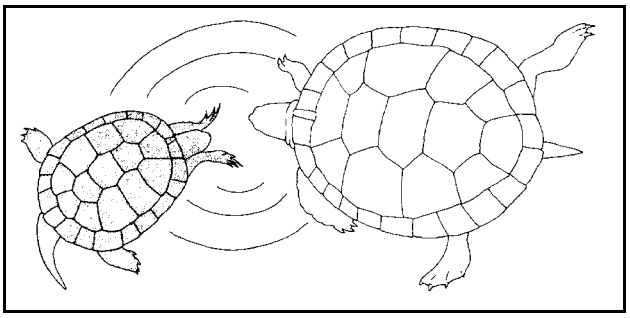


Figure 6. Courtship behavior of the *scripta* group of the genus *Trachemys*. The male (dark) faces the female and vibrates his foreclaws with a high frequency. The West Indian taxa of *Trachemys* show the same courtship pattern.

marked differences can be detected between the courtship behaviors of the three currently recognized North American slider subspecies, *T. s. elegans, T. s. scripta,* and *T. s. troostii*. These three taxa are considered to belong to the same subspecies group (*scripta*), whereas *callirostris* is a subspecies of the *ornata* group of Central and South America (see Introduction).

In Table 3, the behavior elements of *T. s. callirostris* and *T. s. elegans* are summarized and contrasted. Additionally, they are compared to the courtship behavior of a species only distantly related to the sliders, the snake-necked turtle, *Chelodina parkeri*, of the suborder of sideneck turtles (Pleurodira). From this comparison, it is evident that, in defining elements of courtship, *T. s. callirostris* resembles the snake-necked turtle, *Chelodina parkeri*, even more than *T. s. elegans*.

3.2.2 Discussion and α-taxonomic consequences

As far as currently known, the males of all Central American and South American subspecies of the *ornata* group of *T. scripta* do not possess especially elongated claws on the forefeet, but they do possess clearly pointed or bulb-shaped, elongated snouts (Moll and Legler, 1971; Smith and Smith, 1980; own unpublished data; see Introduction).

The long claws of the male of the North American *scripta* group are without doubt closely related in a functional sense to the use of claw vibration in courtship behavior (see Cagle, 1950; Moll and Legler, 1971; Jackson and Davis, 1972a). All

Table 3. Some elements of the courtship of *Trachemys scripta callirostris* (this study), *T. s. elegans* (Jackson and Davis, 1972a; own unpubl. data), and *Chelodina parkeri* (Fritz and Jauch, 1989).

Behavior element	***T. s. callirostris***	***T. s. elegans***	***Chelodina parkeri***
Male pursues female	+	+	+
Male swims backwards in front of female	+	+	–
Courtship position of male	variable	in front of female	on carapace of female
Ritualized courtship behavior of male	head-nodding	claw vibration	head-nodding

the males of species in the closely related genera *Chrysemys, Graptemys* and *Pseudemys* that display claw vibration during courtship behavior also have elongated claws on the front legs, just like the males of the *scripta* group and the four Antillean species of *Trachemys* (see for example, Ernst and Barbour, 1972, 1989).

In contrast, the males of *Graptemys geographica*, a species that does not use claw vibration during courtship behavior, as well as all other turtle species without this distinct mating behavior, have claws that do not differ in length from those of females (own unpublished data, voucher specimens in the Staatliches Museum für Naturkunde, Stuttgart).

With this knowledge one can assume that a lack of this sexually dimorphic characteristic in all the subspecies of the *ornata* group is a clear indication that claw vibration is lacking in the courtship behavior, and, on the other hand, that the unusual snout of the males has a function in courtship behavior.

This suspicion is supported by the first observations of courtship behavior of the Mexican *T. s. ornata* (collection locality: Puerto Marquez, Mexico; Fritz, unpubl.). One can recognize broad similarities to the courtship behavior of *T. s. callirostris*. Additionally, based on the observations by Kamprath (1990) of *T. s. chichiriviche*, a close relative of *callirostris*, it is possible that the courtship behavior of this subspecies is identical to that of *callirostris*.

Even if the courtship behavior of most subspecies within the *ornata* group remains unknown at present, the similarities of courtship behaviors in *T. s. callirostris, T. s. chichiriviche* and *T. s. ornata*, when considered along with the conspicuous snout shape of the males of all subspecies in the *ornata* group, seem to indicate that a homogeneous courtship behavior also occurs within the *ornata* group with head-nodding as the most marked characteristic, but without claw vibration.

The courtship behavior of *T. s. callirostris* and most likely all other taxa of the *ornata* group shows only superficial similarities compared to the courtship behavior of the North American *scripta* morphological group of *Trachemys*. These similarities are limited to behavior related to the contact and pursuit of the courted females.

In those behavioral elements that directly concern the stimulation of the female to mate and in those which must encode information pertaining to isolation mechanisms, the courtship behavior is radically different.

This raises the question of whether the long-held assumption, accepted by most authors, that the different *Trachemys* populations of continental America are subspecies of one and the same species, *T. scripta*, is justified, or whether not at least the *ornata* and *scripta* morphological groups are separate species.

Very closely related, morphologically similar turtle species frequently display markedly different courtship behavior. Although the sister species *Graptemys pseudogeographica* and *G. ouachitensis* can hardly be distinguished morphologically, their courtship behavior contains clearly different elements (Vogt, 1978,1980). The same situation occurs in the case of the closely related South American tortoise species *Geochelone*

denticulata and *G. carbonaria*, which were long considered to be identical (Auffenberg, 1965).

Carr (1938, 1952) and Legler (Legler, 1960, 1963, 1986; and *in* Legler and Webb, 1970, and Moll and Legler, 1971) have represented the opinion that all continental American populations of *Trachemys* should be assigned to one single species, *T. scripta*. The status of disjunct populations (*dorbigni, brasiliensis*) in Argentina, Brazil and Uruguay has been debated, as pointed out, especially recently by Ernst and Barbour (1989). They considered these populations, based on their isolated geographical occurrence, to be a separate species: *T. dorbigni*.

Concordant with Carr (1938), Hartweg (1939) and Fritz (1981), Legler (in the works cited above) believed that he had found a character shift from the *scripta* to the *ornata* group in Texas and northern Mexico, based on morphological studies. However, these morphological similarities pertain exclusively to color pattern characteristics (e.g., interrupted stripe behind the eyes) which could also result from convergence. Ward (1980) correctly, in my opinion, considered some of the populations that were previously designated as intermediate between the *scripta* and *ornata* groups as distinct, currently undescribed subspecies of the *scripta* group (see illustrations in Fritz, 1981: part 2, and the cover illustration from Obst, 1985).

All of the presently known specimens that have been classified as intergrades between the *scripta* and *ornata* groups can easily be assigned to either the *scripta* group (males with markedly elongated foreclaws) or the *ornata* group (males with elongated snout but without elongated foreclaws) based on sexual dimorphism.

In Tamaulipas (Mexico), particularly in the area where a large intergradation between the *scripta* and *ornata* groups could be expected, Pritchard (*in* Pritchard and Trebbau, 1984) believes to have encountered a classical case of character displacement between these two morphological groups, especially in regard to color pattern.

Despite all of the above, no single indication has yet been found for the subspecies status of the *scripta* and *ornata* groups, as evidenced by demonstration of a true intergradation. Of more or less certain status are only a few specimens which are intermediate between *T. s. elegans* and *T. s. taylori*. The assignment of the latter form to a particular morphological group is still debated (Legler, 1963: also see 3.3.2).

Nevertheless, isolated crossings between subspecies of *scripta* and *ornata* groups by captive specimens in terrariums have been reported (*T. s. elegans* × *T. s. callirostris*: Ter Borg, 1981; Kamprath, 1989, one voucher specimen in the Staatliches Museum für Tierkunde, Dresden).

However, in Central America, captive animals from certain parapatric populations of the *ornata* group do not interbreed even in zoo habitats, while at the same time and under the same conditions they do procreate frequently within populations (Alvarez del Toro, 1973, based on several years of observations of *T. s. venusta* and *T. s. grayi* in a free-range area in the Tuxtla Gutiérrez Zoo, Mexico). It seems that even between separate populations of the *ornata* group, under somewhat natural conditions, there exist isolation mechanisms that hinder interbreeding.

Smith and Smith (1980) considered these parapatric species as conspecific because they are genetically connected by intermediate (and related) populations occurring further to the north and south ("Zirkuläre Überlagerung" [circular overlapping] of Mayr, 1967). This reasonable working concept would basically remain unchanged if the three North American subspecies of the *scripta* group were to be classified separately as a different biological species. This is because the parapatric Central American populations of the Atlantic and Pacific coasts are connected geographically in southern Central America and northern South America by the occurrence of as yet undescribed populations that are likely a distinct subspecies of the *ornata* group (fide Moll and Legler, 1971) and by *T. s. callirostris* (see Figure 1).

Northern Mexico is the only area in which populations of the three different *Trachemys* morphological groups of the continental Americas (*scripta*, *ornata* and *gaigeae* groups) meet or occur in close proximity within a small geographic area. However, despite the considerable differences mentioned above, without extensive survey of this area it is impossible to state with absolute certainty that mixed populations between the populations of the morphological groups do not occur.

Combined, however, both morphological and ethological viewpoints provide several important arguments for a species-level difference between the *ornata* and *scripta* morphological groups of the genus *Trachemys* on the two American continents:

1. sexual dimorphism (males either with markedly elongated snouts or elongated foreclaws),

2. courtship behavior (either head-nodding or oscillating foreclaw movements) and

3. important pattern differences, at least in young animals (see Williams, 1956; Moll and Legler, 1971; Smith and Smith, 1980; Fritz, 1981; Obst, 1985; Ernst and Barbour, 1989; and Table 1).

Because of this it seems justified to consider the different Central and South American taxa of the *ornata* group as subspecies of a separate species, *Trachemys ornata* (Gray, 1831).

3.3 The courtship behavior of *Trachemys scripta taylori* does not fit the *ornata* or *scripta* scheme

3.3.1 Description

The courtship behavior of *Trachemys scripta taylori*, based on the observation of a single male by Davis and Jackson (1973), is not the same as the courtship behaviors of the *ornata* or *scripta* groups. *Trachemys s. taylori* is endemic to the Cuatro Cienegas Basin of northern Mexico (located about central in the possible intergradation zone on the Atlantic coast in Figure 1).

Some unpublished observations of mine on the courtship behavior of a *T. s. taylori* pair recorded over a three-year interval confirm to a large extent the investigations of Davis and Jackson (1973):

The *T. s. taylori* male pursues the female and tries to immobilize her by furious bites. As soon as the female is ready for mating, copulation generally follows within a few seconds. In contrast to the observations of Davis and Jackson, who did not employ females of the same subspecies, the bites of the male that I observed were distributed equally over all the body regions of the female. The higher concentration of bites on the rear carapace edge as reported by Davis and Jackson, may have resulted from the fact that the females used by these authors and observed as they evaded the male were of different subspecies or even different species. In flight, the rear part of the female's body is automatically presented most frequently to the pursuing male. The observations of Davis and Jackson also did not show that the non-receptive female of *T. s. taylori* attacks the male with furious bites and in so doing will drive him off.

Thus, the courtship behavior of *taylori* does not have ritualized elements.

3.3.2 Discussion

The assignment of *taylori* to a particular morphological group has long been debated. In its description, *taylori* was put within the *scripta* group (Legler, 1960). Weaver and Rose (1967) considered *taylori* a subspecies of their *Chrysemys gaigeae* based upon osteological research. In contrast, Smith and Smith (1980) considered *taylori* a subspecies of the *ornata* group, while I have provided considerable additional arguments that this form is a representative of the *gaigeae* group, which is mainly distributed in northern Mexico (Fritz, 1981). At least Obst (1985) has followed the assignment of *taylori* to the *gaigeae* group. Final certainty about its classification by no means exists, although it should be considered as proven that *taylori* does not belong to the *scripta* group.

If *taylori* actually belongs to the *gaigeae* group, its courtship behavior could indicate that the *gaigeae* group has also developed its own courtship behavior, dissimilar to the behaviors of the *scripta* and *ornata* groups. That would fit well with the lack of both a conspicuous snout and elongated foreclaws in males of the *gaigeae* group (see Table 1 and Figure 1).

The prolonged, climatically caused, complete isolation of the *taylori* distribution area from other slider populations could also have favored the loss of ritualized courtship behavior because there was no longer a selective advantage for maintaining extensive behaviors that functioned as isolating mechanisms (see Legler, 1960; Davis and Jackson, 1973; Smith and Smith, 1980).

Because of this isolation, should *taylori* indeed be a form belonging to the *gaigeae* group, the simple courtship behavior of this subspecies would not necessarily have to be a behavior complex that is characteristic of all forms of the *gaigeae* group.

The *gaigeae* group is distinguished from both *T. scripta* (sensu stricto) and *T. ornata* by: (1) the color pattern (see Williams, 1956; Smith and Smith, 1980; Fritz, 1981; Obst, 1985; and Table 1); and (2) sexual dimorphism (males lack elongated foreclaws or elongated snouts).

In light of current knowledge, the specific assignment of populations included in the mainly northern Mexican *gaigeae* group (either with or without *taylori*) to *Trachemys ornata* of Central and South America or to *T. scripta* of North America must remain speculative.

The highly disjunct distribution of most populations of the *gaigeae* group, caused by increasing aridity in northern Mexico, further complicates an assessment of the species assignment of isolated populations as part of population-based ecological investigations (see Smith and Smith, 1980; Figure 1).

Weaver and Rose (1967) assigned the *gaigeae* group species status based on purely morphological criteria. To my knowledge, however, this arrangement had not a single supporter in the literature over a decade's time. Nevertheless, Ward (1980), in his unpublished dissertation, arrived at very similar results. However, several results from Ward (1984) were contested due to a questionable species concept (see Ernst and Barbour, 1989; Fritz, 1989); therefore caution also seems recommended in this instance.

Until additional data are available, I propose to provisionally put the *gaigeae* group within *T. ornata* because the males of both groups lack both sexually dimorphic, elongated foreclaws and the characteristic behavior of foreclaw vibration.

3.4 The Antillean species of *Trachemys* conform completely in their sexual dimorphism and courtship behavior with *T. scripta* sensu stricto — An indication of conspecificity?

According to Seidel (1988), the taxa of the genus *Trachemys* distributed across the Antilles and Bahamas may be assigned to four species: *T. decorata, T. decussata, T. stejnegeri* and *T. terrapen*. Morphologically they represent a fairly undifferentiated complex of ten distinguishable forms (see Seidel, 1988; Ernst and Barbour, 1989). The division into four partly polytypic species must be viewed with suspicion because, as true island forms, they necessarily do not comply with the criterion for erection of subspecies: in essence, the mixing [intergradation] of geographically neighboring populations. However, several briefly presented facts as follow make an extremely close, perhaps even subspecific relationship to *T. scripta* (sensu stricto) seem very likely:

As Seidel (1988) has indicated, all four Antillean species comply completely with *T. scripta* (sensu stricto) in regards to sexual dimorphism and courtship behavior in that males display clearly elongated foreclaws which they vibrate in a frontal position before the female.

Indeed the possibility exists that the artificially colonized population on New Providence Island, Bahamas, came into being by mixing of sliders from the West Indies and the United States (Groombridge, 1982; Seidel, 1988). That would imply that no isolation mechanisms exist in this "natural experiment" that would hinder gene exchange between *T. scripta* (sensu stricto) and the Antillean forms.

In this aspect, it also would seem that the species status of the Antillean forms is equally questionable, as is the subdivision in several Antillean species, because it is clear that animals from the separate populations of the Antilles and Bahamas can interbreed without restrictions (see for example, Inchaustegui Miranda, 1975).

Literature Cited

Alvarez del Toro, M. 1973. Los reptiles de Chiapas. Tuxtla Gutiérrez (Gobierno del Estado).

Auffenberg, W. 1965. Sex and species discrimination in two sympatric South American tortoises. Copeia 1965:335-342.

Cagle, F. R. 1948. Sexual maturity in the male turtle, *Pseudemys scripta troostii*. Copeia 1948(2):108-111.

———. 1950. The life history of the slider turtle, *Pseudemys scripta troostii* (Holbrook). Ecol. Monogr. 20(1):31-54.

Carpenter, C. C., and G. W. Ferguson. 1977. Variation and evolution of stereotyped behavior in reptiles. Pp. 335-554. *In*: C. Gans and D. W. Tinkle, editors, Biology of the Reptilia, Vol. 7, Ecology and Behaviour A. London: Academic Press.

Carr, A. F. 1938. Notes on the *Pseudemys scripta* complex. Herpetologica 1:131-135.

———. 1952. Handbook of turtles: The turtles of the United States, Canada, and Baja California. Ithaca, NY: Comstock.

Conant, R. 1975. A field guide to reptiles and amphibians of eastern and central North America. 2nd ed. Boston: Houghton Mifflin Co.

Davis, J. D., and C. G. Jackson. 1973. Notes on the courtship of a captive male *Chrysemys scripta taylori*. Herpetologica 29:62-64.

Ernst, C. H., and R. W. Barbour. 1972. Turtles of the United States. Lexington: Univ. Press of Kentucky.

Ernst, C. H., and R. W. Barbour. 1989. Turtles of the world. Washington, DC: Smithsonian Inst. Press.

Freiberg, M. 1967. Diferencias sexuales secundarias y descripción del alotipo macho de la tortuga *Pseudemys dorbignyi* (D. et B.). Acta Zool. Lilloana 23:389-394.

Fritz, U. 1981. Zwei interessante mexikanische Schmuckschildkröten der Gattung *Chrysemys* Gray, 1844. Herpetofauna 3(14):25-32.

———. 1989. Beitrag zur Kenntnis der Texas-Schmuckschildkröte (*Pseudemys texana* Baur, 1893), (Reptilia, Testudines, Emydidae). Sauria 11(1):9-14.

Fritz, U., and D. Jauch. 1989. Haltung, Balzverhalten und Nachzucht von Parkers Schlangenhalsschildkröte, *Chelodina parkeri* (Testudines: Chelidae). Salamandra 25(1):1-13.

Groombridge, B. 1982. The IUCN Amphibia–Reptilia red data book, Part 1, Testudines, Crocodylia, Rhynchocephalia. Gland, Switzerland: International Union for the Conservation of Nature and Natural Resources.

Harding, J. H. 1983. *Platemys platycephala* (twistneck turtle): Reproduction. Herpetological Rev. 14:22.

Hartweg, N. 1939. Further notes on the *Pseudemys scripta* complex. Copeia 1939(1):55.

Inchaustegui Miranda, S. J. 1975. Las tortugas Dominicanas de agua dulce *Chrysemys decussata vicina* y *Chrysemys decorata* (Testudines, Emydidae). An. Acad. Cienc. Rep. Dominicana 1(1):139-278.

Iverson, J. B. 1986. A checklist with distribution maps of the turtles of the world. Richmond, IN: Privately Printed.

Jackson, C. G., and J. D. Davis. 1972a. A quantitative analysis of the courtship display behavior of the red-eared turtle, *Chrysemys scripta elegans* (Wied). Herpetologica 28:58-64.

Jackson, C. G., and J. D. Davis. 1972b. Courtship display behavior of *Chrysemys concinna suwanniensis*. Copeia 1972:385-387.

Kamprath, U. 1989. DDR-Erstnachzucht von *Chrysemys scripta callirostris*, der Pfauenaugen-Schmuckschildkröte und die Zeitigung von Schmuck-Schildkröten-Bastarden. Aquar. Terrar. 36(12): 415-417.

———. 1990. Nachzucht der Venezuela-Schmuckschildkröte *Chrysemys scripta (ornata) chichiriviche* (Pritchard and Trebbau 1984). Sauria 12(1):11-14.

Kramer, M., and U. Fritz. 1989. Courtship of the turtle, *Pseudemys nelsoni*. J. Herpetology 23(1):84-86.

Lardie, R. L. 1973. Notes on courtship, eggs, and young of the Florida red-bellied turtle, *Chrysemys nelsoni*. HISS News J. 1:183-184.

Legler, J. M. 1960. A new subspecies of slider turtle (*Pseudemys scripta*) from Coahuila, Mexico. Univ. Kansas Publ., Mus. Nat. Hist. 13(3):75-83.

———. 1963. Further evidence for intergradation of two Mexican slider turtles (*Pseudemys scripta*). Herpetologica 19(2):142-143.

———. 1986. The genus *Pseudemys* in Mesoamerica: Taxonomy, distribution and origins. Abstract, symposium "Tortugas de Agua Dulce Neotropicales," San Andres Tuxtla.

Legler, J. M., and R. G. Webb. 1970. A new slider turtle (*Pseudemys scripta*) from Sonora, México. Herpetologica 26(2):157-168.

Marchand, L. J. 1944. Notes on the courtship of a Florida terrapin. Copeia 1944:191-192.

Mayr, E. 1967. Artbegriff und Evolution. Hamburg and Berlin: Parey.

———. 1975. Grundlagen der zoologischen Systematik. Hamburg and Berlin: Parey.

McDowell, S. B. 1964. Partition of the genus *Clemmys* and related problems in the taxonomy of the aquatic Testudinidae. Proc. Zool. Soc. London 143(2):239-279.

Medem, F. 1975. La reproducción de la "Icotea" (*Pseudemys scripta callirostris*), (Testudines, Emydidae). Caldasía 11(53):83-106.

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.

Obst, F. J. 1985. Schmuckschildkröten. Die Gattung *Chrysemys*. 2nd ed. Wittenberg-Lutherstadt, Germany: Ziemsen, Neue Brehm Bücherei 549.

Pritchard, P. C. H. 1979. Encyclopedia of turtles. Neptune, NJ: T.F.H. Publ.

Pritchard, P. C. H., and P. Trebbau. 1984. The turtles of Venezuela. New York: SSAR, Contr. Herp. 2.

Rödel, M. O. 1985. Zum Verhalten von *Sacalia bealei* (Gray), (Testudines, Emydidae). Salamandra 21:123-131.

Rosado, R. 1967. La "Jicotea". Intern. Turtle Tortoise Soc. J. 1: 16-19.

Sachsse, W. 1984. Long term studies of the reproduction of *Malaclemys terrapin centrata*. Acta Zool. Pathol. Antverp. 78(1):297-308.

Seidel, M. E. 1988. Revision of the West Indian emydid turtles (Testudines). Amer. Mus. Novit. 2918:1-41.

Seidel, M. E., and H. M. Smith. 1986. *Chrysemys, Pseudemys, Trachemys* (Testudines: Emydidae): Did Agassiz have it right? Herpetologica 42:242-248.

Seigel, R. A. 1980. Courtship and mating behavior in the diamondback terrapin *Malaclemys terrapin tequesta*. J. Herpetology 14: 420-421.

Smith, H. M., and R. B. Smith. 1980. Synopsis of the herpetofauna of Mexico, Vol. 6, Guide to the Mexican turtles, Bibliographic addendum 3. North Bennington, VT: Johnson.

Ter Borg, J. P. 1981. De invloed van de broedtemperatuur op de sekseverhouding in legsels van reptielen. Lacerta 39(11):171-175.

Vogt, R. C. 1978. Systematics and ecology of the false map turtle complex, *Graptemys pseudogeographica.* Dissertation, University of Wisconsin, Madison.

———. 1980. Natural history of the map turtles *Graptemys pseudogeographica* and *G. ouachitensis* in Wisconsin. Tulane Stud. Zool. Bot. 22:17-48.

Ward, J. P. 1980. Comparative cranial morphology of the freshwater turtle subfamily Emydinae: An analysis of the feeding mechanisms and the systematics. Unpubl. Ph.D. Diss., Raleigh (North Carolina State University).

———. 1984. Relationships of chrysemyd turtles of North America (Testudines: Emydidae). Spec. Publ. Mus. Texas Tech Univ. 21: 1-50.

Weaver, W. G., and F. L. Rose. 1967. Systematics, fossil history, and evolution of the genus *Chrysemys*. Tulane Stud. Zool. 14: 63-73.

Wermuth, H., and R. Mertens. 1961. Schildkröten, Krokodile, Brückenechsen. Jena, Germany: Fischer.

———. 1977. Testudines, Crocodylia, Rhynchocephalia. Tierreich 100:1-174.

Williams, E. E. 1956. *Pseudemys scripta callirostris* from Venezuela with a general survey of the *scripta* series. Bull. Mus. Comp. Zool. 115:145-160.

Winokur, R. M., and J. M. Legler. 1974. Rostral pores in turtles. J. Morphol. 143:107-120.

Winokur, R. M., and J. M. Legler. 1975. Chelonian mental glands. J. Morphol. 147:275-292.

Bull. Chicago Herp. Soc. 33(11):237-242, 1998

The Amphibians and Reptiles of Scott Air Force Base and Mid-America Airport, St. Clair County, Illinois

Kenneth S. Mierzwa
TAMS Consultants, Inc.
180 N. Stetson, Suite 3200
Chicago, IL 60601
E-mail: kmierzwa@tamsconsultants.com

John G. Palis
529 N. Main Street
Jonesboro, IL 62952

Introduction

Scott Air Force Base is located in St. Clair County, Illinois, approximately 39 km east of St. Louis, Missouri. Land adjacent to the existing Air Force Base was recently developed to allow joint military and civilian use of the site and provide additional passenger and cargo capability for southwestern Illinois. The civilian facility, sponsored by St. Clair County and named Mid-America Airport, was completed in late 1997 at an estimated total cost of $308 million (Bodapati and Cornell, 1994). The project included construction of a 3848 m runway, a 2134 m taxiway connecting the civilian and Air Force runways, a control tower, and terminal facilities (Bodapati and Cornell, 1994).

Environmental aspects of the project included preparation of an Environmental Impact Statement (EIS) and development of a detailed wetlands mitigation plan as part of a Section 404 permit application. Ultimately, over 80 hectares of former cropland will be restored to floodplain forest through removal of levees and planting of native trees and herbaceous vegetation. At this writing mitigation planting is well underway.

Amphibians and reptiles were sampled as part of a detailed baseline biotic inventory prior to preparation of the Environmental Impact Statement. Additional inventory work was carried out to provide information for preparation of the wetlands mitigation and monitoring plan, and will continue until completion of all wetlands related work. This paper reports on findings during pre-construction and construction monitoring.

Most existing information on amphibians and reptiles in St. Clair County is old. Hurter (1893) reported a number of species from the county, but most of these were collected on the Mississippi River floodplain area usually referred to as the "American Bottoms" or on the adjacent bluffs. These areas are quite different from the project area in physiography and ecology.

Study site description

The study site is bounded by Interstate 64 on the north, Illinois Route 4 on the east, Illinois Route 161 on the south, and Illinois Route 158 on the west (Figure 1). It is located within the Effingham Plain Section of the Southern Till Plain Division (Schwegman, 1973). This area was within the limits of Illinoian glaciation, and is characterized by level to rolling topography, loess derived soils, and meandering, low-gradient streams within wide floodplains. Much of St. Clair County was a mix of prairie, upland forest, and floodplain forest in presettlement times (Baum, 1965). Within the study area almost all of the land was forested, although there was an extensive prairie just to the east.

Small-scale clearing of the forest is believed to have occurred several thousand years ago, primarily for Native American agricultural plots (Woods, 1986). There was a substantial Native American presence in the Silver Creek valley, and the study area is only 24 km east of the Cahokia site (Holley, 1993; Koldehoff et al., 1993). More frequent and larger scale clearing began shortly after the arrival of the first European settlers.

The project area is bisected by Silver Creek, a low-gradient, sixth order tributary of the Kaskaskia River. North of Interstate 64 Silver Creek has been channelized, but within the site it retains a natural system of meanders. At the crossover taxiway the mean width of Silver Creek is 10.5 m at normal summer low water (TAMS Consultants, Inc., 1996), and the stream flows within a well defined channel with steep silt and clay banks. The stream averages 0.6 m in depth at low water, but pools are frequent and are sometimes over two meters deep. Silver Creek floods regularly, although the frequency of over bank conditions varies from year to year. During the study period, Silver Creek reached flood stage once in 1990, at least three times in 1993, and once in 1995. Turbidity is generally high. Tributary streams within the study area include Little Silver Creek and Crooked Creek, both relatively small second order streams.

The project area is dominated by the floodplain forest community associated with Silver Creek. The forest consists largely of early successional tree species such as eastern cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), American elm (*Ulmus americana*), hackberry (*Celtis occidentalis*), and boxelder (*Acer negundo*). Pin oak (*Quercus palustris*) is locally common.

By the time of the earliest available aerial photographs (1937), all of the original floodplain forest had already been cut and replaced by relatively young second growth. Frequent disturbance of the floodplain forest has continued to the present. An extensive area was clearcut sometime in the 1940s, probably to maintain runway clear zones during World War II. The southern part of the study area was clearcut in the 1960s, and at about the same time most of the remainder of the site was selectively cut. Additional areas within the Air Force Base boundaries were clearcut in 1984, 1986-87, and 1989. Almost all of the existing forest within the project area is now less than 50 years old.

Two types of forest structure are common on the Silver Creek floodplain. Areas which have been clearcut in the past now consist of even age stands of similar sized trees. These usually have a single layered canopy with few saplings or

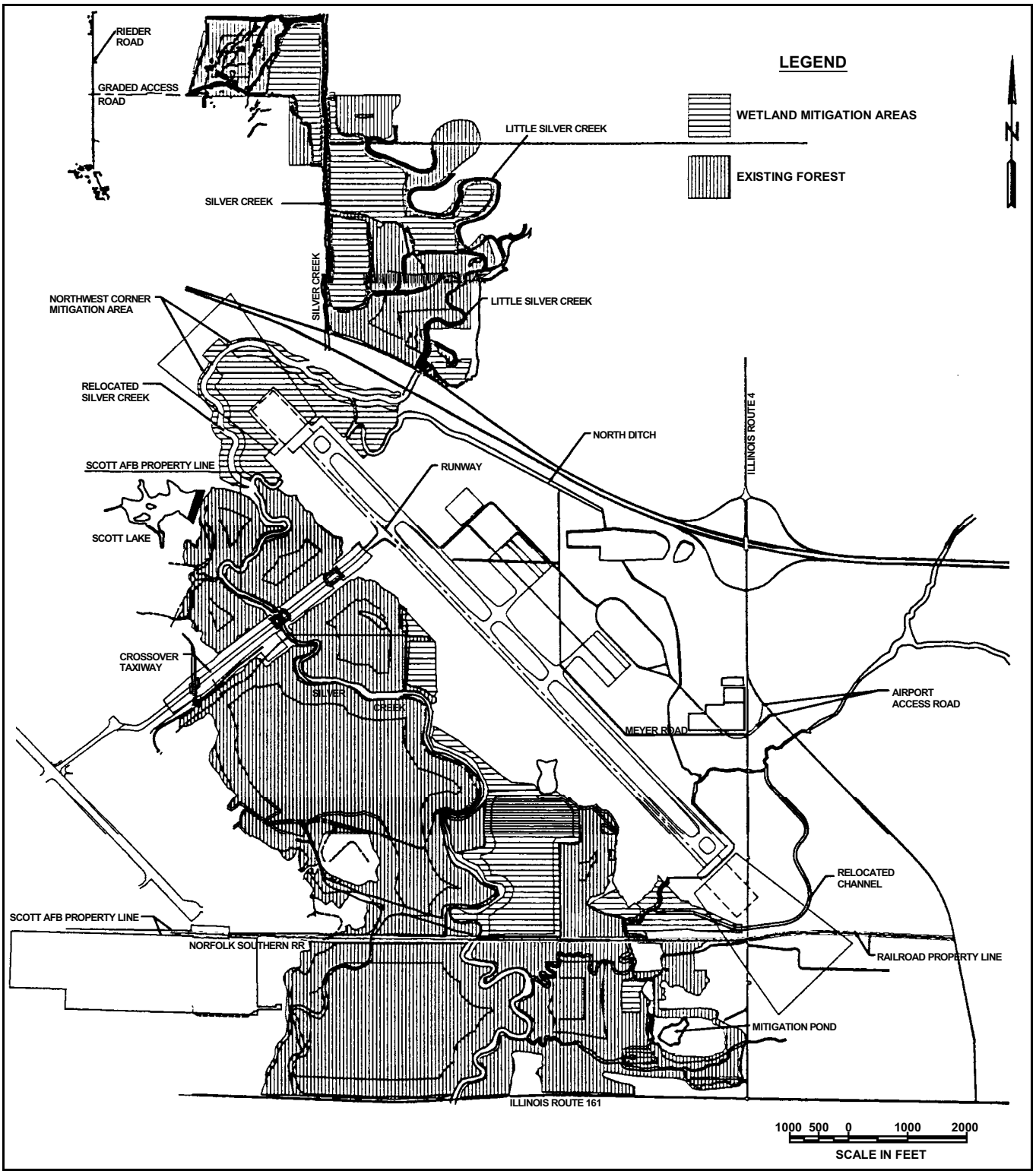


Figure 1. Wetland mitigation areas and existing forest at Scott Air Force Base and Mid-America Airport.

shrubs in the understory, few snags, and little deadfall. Wildlife diversity is relatively low in this type of forest, in part because of the lack of structure (Schroeder et al., 1992). Areas of the forest which have been selectively cut typically have widely spaced trees of moderate size and clusters of saplings and shrubs in light gaps. A dense herbaceous understory is usually present, and deadfall is abundant. Forest-edge animal species are often present in these relatively open forests.

Oxbow ponds and shrub swamps are present in old meander scars within the floodplain forest, representing former locations of the Silver Creek channel. These wetlands contribute to habitat diversity, and tend to support concentrations of amphibians.

Patches of successional field are present where the floodplain forest has recently been clearcut. These range from relatively young areas with only herbaceous cover to somewhat

Table 1. Amphibians and reptiles observed at Scott Air Force Base and Mid-America Airport, 1991–1997.

		– Baseline monitoring –			– Construction monitoring –			
Common name	Scientific name	1991	1992	1993	1995	1996	1997	Total
Smallmouth salamander	*Ambystoma texanum*	0	1	5	21	9	0	36
American toad	*Bufo americanus*	0	7	17	14	2	4	44
Fowler's toad	*Bufo fowleri*	0	0	0	0	0	1	1
Northern cricket frog	*Acris crepitans*	6	14	26	14	12	49	121
Cope's gray treefrog	*Hyla chrysoscelis*	3	2	10	5	2	5	27
Western chorus frog	*Pseudacris triseriata*	0	10	11	3	0	0	24
Bullfrog	*Rana catesbeiana*	4	8	11	42	0	5	70
Southern leopard frog	*Rana sphenocephala*	28	21	70	14	1	18	152
Common snapping turtle	*Chelydra serpentina*	0	2	2	2	9	0	15
Common musk turtle	*Sternotherus odoratus*	0	1	0	2	0	1	4
Painted turtle	*Chrysemys picta*	5	34	10	27	17	12	105
Eastern box turtle	*Terrapene carolina*	2	2	2	2	1	0	9
Slider	*Trachemys scripta*	2	7	8	17	5	12	51
Eastern spiny softshell	*Apalone spinifera*	0	6	1	0	0	0	7
Broadhead skink	*Eumeces laticeps*	1	1	0	0	0	0	2
Racer	*Coluber constrictor*	0	0	1	1	1	1	4
Eastern rat snake	*Elaphe obsoleta*	2	1	3	0	0	1	7
Prairie kingsnake	*Lampropeltis calligaster*	0	1	0	2	0	1	4
Plainbelly water snake	*Nerodia erythrogaster*	0	0	0	3	0	1	4
Diamondback water snake	*Nerodia rhombifer*	0	0	1	0	0	0	1
Northern water snake	*Nerodia sipedon*	1	2	1	21	0	3	28
Brown snake	*Storeria dekayi*	1	0	2	1	1	0	5
Common garter snake	*Thamnophis sirtalis*	1	15	3	26	4	1	50
Number of species		12	18	18	18	12	15	23
Number of individuals		56	135	184	217	64	115	771
Number of field days		n/a	n/a	22	13	14	6	

older areas with numerous shrubs and saplings.

Other areas had been cleared, leveed, and converted to agriculture, contributing significantly to forest fragmentation. As part of wetlands mitigation these farm fields have been replanted with native trees, and the levees removed to restore hydrology.

No area of the Silver Creek floodplain forest between Interstate 64 and Illinois Route 161 has the multi-layer canopy, mix of tree age classes, high species diversity, abundance of oaks and other hard mast species, frequency of snags and deadfall, and high interspersion characteristic of old-growth forest. The nearest old-growth example is Freeburg Woods, a privately owned Illinois Natural Area Inventory site located about 8 km downstream.

The upland forest that originally covered the eastern part of the project area was logged long ago and converted to agriculture. Almost all of the upland was used as cropland until the end of 1992. A few narrow strips of grassland were present along roadsides and drainage swales. Upland areas outside of

construction zones have now been allowed to go fallow, and are covered by pioneer grasses and forbs.

Methods and materials

Amphibians and reptiles were sampled in May 1991 and from March through October of 1992 and 1993, before the onset of construction. Sampling continued during construction activities in 1995, 1996 and 1997. Numerous visits, ranging in duration from one to 12 days, were made to the project site. Many of the observations were made during general searches of the various habitat types present. Animals were observed crossing trails, basking, or were flushed from vegetative cover. Others were found by turning cover objects such as logs, boards, or sheet metal. Frogs and turtles were occasionally caught in seines during fish sampling, and isolated wetlands were dipnetted. A number of dead specimens were salvaged from roads, especially Illinois Route 161. Frogs were identified by call, and in 1993 a special effort was made to visit the site on warm rainy nights in April and May. Numerous individual amphibians were observed crossing roads on these evenings. Drift fences, constructed from two 15 m lengths of 0.5 m high aluminum flashing, were installed in floodplain forest and successional field communities. One 18.9 l bucket was installed flush with the soil surface at the midpoint of each fence, and a funnel trap constructed from aluminum window screen and 20.3 cm outside diameter plastic funnel was placed at both ends of each fence. Pairs of drift fences were opened simultaneously and checked for periods of several weeks during 1992, 1993 and 1995.

In 1996 and 1997 baited turtle traps were set in some wetlands in the southwestern part of the site; all turtles captured were marked and released. Also in the post-construction period, time-constrained searches were initiated in the mitigation sites to monitor anticipated colonization by amphibians and reptiles residing in nearby floodplain forest.

Voucher specimens of some species have been deposited in the collection of the Illinois Natural History Survey, and other species have been documented photographically.

Results

A total of 771 individual amphibians and reptiles belonging to 23 species were observed or collected during this study (Table 1). Accounts of each species follow; nomenclature follows Collins (1997).

Smallmouth salamander *Ambystoma texanum*

Adults and larvae of this species have been collected in moderate numbers in the southeastern part of the floodplain forest, where oxbow ponds and mature trees are present. Relatively few have been seen elsewhere on the site. On one occasion an adult female was unearthed from a depth of several centimeters during installation of a drift fence pitfall. Larvae were observed in a man-made ditch in one of the leveed farm-fields, about 15 m outside the treeline. On another occasion 25 larvae and three metamorphs were collected in a short time. Smallmouth salamanders are easily found and apparently common at nearby Freeburg Woods, a privately owned old-growth floodplain forest.

American toad *Bufo americanus*

Toads were commonly observed throughout the project area. Breeding was observed in shrub swamps and oxbow ponds within the floodplain forest, in marshes and ditches in open areas, and in tire ruts on old logging roads. Adults are occasionally collected in a variety of habitats, including agricultural fields, during the summer months. In 1995, toad tadpoles were observed in recently created wetlands within the largest mitigation area.

Fowler's toad *Bufo fowleri*

Although reported from nearby open habitats by local residents, this species was not observed within the study area until 1997 when an adult was captured on formerly farmed upland near the new runway. Later the same year a juvenile was observed in one of the wetland mitigation sites. Conversion of cropland to early successional field habitat may have opened a dispersal corridor from a nearby population.

Cricket frog *Acris crepitans*

Although often seen along the banks of Silver Creek, the cricket frog is most abundant along the margins of ditches and ponds in open, sunlit areas. Before construction, a shallow ditch through the largest of the leveed farm-fields was especially productive of this species. Shallow wetlands in all of the mitigation areas currently support large numbers of cricket frogs, with more observations in 1997 than in any previous year.

Western chorus frog *Pseudacris triseriata*

Chorus frogs appear to be uncommon within the study area, and have been heard calling only from ditches and marshes in the agricultural areas east of the floodplain forest. No more than a few frogs have been heard calling at any one time, and no adults have been collected. During 1995, a few chorus frogs were heard calling from shallow wetlands within the largest mitigation area.

Cope's gray treefrog *Hyla chrysoscelis*

The harsh buzzing call of this frog can be heard during May and June from widely scattered locations throughout the floodplain forest. Most calling individuals located to date have been in trees or shrubs near small wetlands, or along the edges of flooded tire ruts on old logging roads. Tadpoles were ubiquitous in rain pools throughout the forested portions of the site.

Bullfrog *Rana catesbeiana*

Bullfrogs are locally common, with the highest concentration of large individuals at Scott Lake. Juveniles are frequently seen in shrub swamps within the floodplain forest.

Southern leopard frog *Rana sphenocephala*

The southern leopard frog is abundant in much of the project area. Breeding occurs in late March and early April in a variety of wetland types, including shrub swamps and oxbow ponds within the floodplain forest, and in ditches and temporary ponds in successional fields. In late summer juveniles are conspicuous on logging roads and near Silver Creek. In 1997 southern leopard frogs were observed in wet vegetation within several mitigation areas.

Common snapping turtle *Chelydra serpentina*

Snapping turtles are probably more common than the 15 sightings to date would indicate. Silver Creek and several permanent farm ponds likely provide the best habitat.

Common musk turtle *Sternotherus odoratus*

A single musk turtle was captured while seining Little Silver Creek in 1992, and two others were observed in 1995. An adult was collected while crossing the new runway in the summer of 1997.

Eastern box turtle *Terrapene carolina*

Box turtles are seen regularly but in small numbers. Most individuals have been crossing logging roads or walking through clearcuts.

Painted turtle *Chrysemys picta*

Easily observed because of a tendency to bask on logs or other exposed objects, painted turtles are common in Scott Lake, Silver Creek, and various permanent oxbow ponds and farm ponds.

Slider *Trachemys scripta*

This is another basking species, common in Scott Lake, Silver Creek, and some of the larger farm ponds.

Eastern spiny softshell *Apalone spinifera*

These wary turtles have been seen only at the southern end of the project site. During late April and May they frequently bask on the muddy banks of Silver Creek near the Illinois Route 161 bridge.

Broadhead skink *Eumeces laticeps*

A large adult male was captured under a board alongside Route 161; another specimen was observed basking on a fallen log over a forest-edge ditch.

Racer *Coluber constrictor*

The few specimens taken to date have been in upland successional fields or around abandoned buildings.

Eastern rat snake *Elaphe obsoleta*

Seven eastern rat snakes have been observed. Two of these were on trails or logging roads in the floodplain forest; one was under sheet metal in a successional field just east of the floodplain forest; one was found dead on Illinois Route 161 adjacent to floodplain forest; two were found dead on roads through cropland east of the forest; and one was captured while swimming across Silver Creek. The climbing ability of this snake may allow it to easily escape from floods.

Prairie kingsnake *Lampropeltis calligaster*

A single specimen was found dead in October 1992 on a gravel road through farm fields, and two individuals, one live and one dead, were found along Illinois Route 161 in 1995. A juvenile was observed on the shoulder of old Route 4 near Crooked Creek in 1997. This species is common in the surrounding region (R. Axtell, pers. com.) and the number of sightings may increase now that cropland is reverting to successional field.

Plainbelly water snake *Nerodia erythrogaster*

The three specimens of this species collected in 1995 represent the first documented occurrence for St. Clair County (Palis and Mierzwa, 1995). A large adult was captured in Sprague's Pond, within the southeastern part of the site, in 1997.

Diamondback water snake *Nerodia rhombifer*

A single dead specimen was salvaged from Route 161 immediately adjacent to wet floodplain forest.

Northern water snake *Nerodia sipedon*

Several specimens have been captured under cover objects in successional fields near ephemeral marshes. Individuals were also observed in Silver Creek and Crooked Creek, in open floodplain forest, and basking in shrub swamps.

Brown snake *Storeria dekayi*

Only five specimens have been collected to date. One was found under a board in early successional field within a 1984 clearcut. Another was found dead on Route 161.

Common garter snake *Thamnophis sirtalis*

The most commonly observed snake in the area, this species occurs in most habitat types. Specimens are often seen in the floodplain forest in early spring and late fall when sunlight penetrates the tree canopy, but during the remainder of the active season most sightings are on logging roads, in shrub swamps, or in successional fields.

Discussion

The Scott Air Force Base/Mid-America Airport site is inhabited mostly by tolerant and adaptable species of amphibians and reptiles. Most of the species encountered are common in southwestern Illinois. Species richness is moderate within and adjacent to the floodplain forest, but upland habitat other than cropland was very scarce prior to construction and as a result some species are absent or rare. As parts of the upland recently removed from crop production are allowed to revegetate, amphibian and reptile species characteristic of open habitats are expected to become more numerous.

As leveed farm-fields are restored to floodplain forest, habitat fragmentation in the southern part of the study area will be reduced. Species able to use forest interior habitat, especially amphibians, are expected to eventually benefit from this. Some forest-edge species currently using these areas may become less common on the floodplain but will likely be able to utilize other parts of the project site where disturbance is more frequent.

Acknowledgments

Steve Culberson, Kathryn King, Gerri O'Brien, Teri Radke, Christine Ross, Brad Thiele, and Mark Thompson of TAMS Consultants participated in field work. Some incidental observations were made during site visits or monitoring with Danny McClendon (U.S. Army Corps of Engineers), Joyce Collins (U.S. Fish and Wildlife Service), Denise Steurer (U.S. Environmental Protection Agency), and Randy Sauer (Illinois Department of Natural Resources). Dave Cornell, Ted Rigo and the staff of the TAMS Fairview Heights office provided site access and logistical support.

Literature Cited

Baum, U. G. 1965. A study of the distribution of trees in St. Clair County, Illinois. Unpublished Ph.D. Thesis, Western Illinois University.

Bodapati, N., and D. M. Cornell. 1994. Streamlining modern airport projects. Construction Business Review.

Collins, J. T. 1997. Standard common and current scientific names of North American amphibians and reptiles. Fourth edition. Society for the Study of Amphibians and Reptiles, Herpetological Circular No. 25.

Holley, G. R. 1993. Observations regarding sedentism in central Silver Creek and the enduring significance of the FAI-64 archaeological mitigation program. Pp. 276-284. *In*: T. E. Emerson, A. C. Fortier and D. L. McElrath. Highways to the past: Essays on Illinois Archaeology in honor of Charles J. Bareis. Journal of the Illinois Archaeological Survey 5(1-2).

Hurter, J. 1893. Catalogue of amphibians and reptiles found in the vicinity of St. Louis, Missouri. St. Louis Acad. Sci. Trans. 6(11): 251-261.

Koldehoff, B., T. R. Pauketat and J. E. Kelly. 1993. The Emerald Site and the Mississippian occupation of the central Silver Creek valley. Pp. 331-343. *In*: T. E. Emerson, A. C. Fortier, and D. L. McElrath. Highways to the past: Essays on Illinois archaeology in honor of Charles J. Bareis. Journal of the Illinois Archaeological Survey 5(1-2).

Palis, J. G., and K. S. Mierzwa. 1995. Geographic distribution: *Nerodia erythrogaster*. Herpetological Review 26(4):210.

Schroeder, R. L., L. J. O'Neil and T. M. Pullen, Jr. 1992. Wildlife community habitat evaluation: A model for bottomland hardwood forests in the southeastern United States. U. S. Dept. Interior, Fish and Wildlife Service. Draft Biological Report.

Schwegman, J. 1973. The natural divisions of Illinois. Illinois Nature Preserves Commission, Springfield.

TAMS Consultants, Inc. 1996. Mid-America Airport Scott Joint-Use project: Wetland mitigation and monitoring 1994-1995 annual report. Unpublished report to the U.S. Army Corps of Engineers, St. Louis District.

Woods, W. I. 1986. Prehistoric settlement and subsistence in the upland Cahokia Creek drainage. Unpublished Ph.D. dissertation, University of Wisconsin–Milwaukee.

Bull. Chicago Herp. Soc. 33(11):242-243, 1998

TV Program/Videotape Review: *Archie Carr: A Naturalist in Florida*

Available in video for $19.95 + $4 S&H from:
University of Florida, WUFT-TV, P.O. Box 118405, Gainesville, FL 32611-8405
(800) 983-8885, Extension 101 <http://www.wuft.org>

Raymond Novotny
Ford Nature Center, Mill Creek MetroParks
840 Old Furnace Road
Youngstown, OH 44511

In 1989, two years after the death of Archie Carr, Kraig Adler suggested that Carr had a wider readership than any other herpetologist. While that observation was undoubtedly accurate, I remember fearing then that Carr's stature had faded. Most of his books had gone out of print and I wondered whether his writing would be forgotten.

Not if his widow, Marjorie Harris Carr, had anything to do with it. As Dr. Carr sat in his deathbed, the couple compiled a list of his writings suitable for his uncompleted project, a book on Florida. Seven years later, after gathering and editing both unpublished and previously published pieces by her husband, Mrs. Carr produced the book, *A Naturalist in Florida: A Celebration of Eden*. Quite recently, WUFT-TV, the PBS station at the University of Florida, produced a one-hour program based on that book. Although the book's original subtitle has been left out of the television program title, the joy that Archie Carr felt for this natural paradise continues as the theme.

The program begins with a reenactment of Archie Carr in the 1930s, exploring the Suwannee River and the nearby, crystal-clear, northern Florida springs. Here he swam in the chilly water wearing a pre-Cousteau homemade diving mask in search of mastodons, bisons and other Pleistocene fossils. David Webb, vertebrate paleontologist at the University of Florida, then explains Florida's fossil record in the first of many interviews with Dr. Carr's family, friends, colleagues, students and admirers.

Short reminiscences from all of Dr. Carr's children and his wife follow. This leads into a charming segment about the reptilian inhabitants of Wewa Pond, the body of water in front of the living room window at the Carr home on their farm in northern Florida. First there is "Jasper," the remarkably tame alligator snapping turtle, *Macroclemys temminckii*, who lived for several years in the pond. Family members assure us that even the objective scientist Dr. Carr grew to love that turtle, who would surface when called. The Carrs also grew to love,

but respect, the female alligator that still resides there: she did once force Archie up a tree when he approached too closely in his attempt at photographing her nest.

The next topic is frogs. Dr. Carr prided himself on his knowledge of frog song and once wrote that he collected the songs of frogs in his head as some people collect stamps in a book. As the camera focuses on a calling green treefrog, *Hyla cinerea*, the narrator expresses what is perhaps Carr's most oft-quoted passage, "I have always liked frogs . . . especially the way they get together in wet places on warm nights and sing about sex."

In the following segment Carr's colleagues and students describe him as an accomplished, inspirational teacher. It has been one of my regrets that when I lived in Gainesville, the home of the University of Florida, for two years in the 1980s, I was unable to arrange my work schedule to enroll in his famous field-oriented course, Community Ecology.

We now begin to explore Florida. The first stop is a look at Payne's Prairie, a 15,000-acre state nature preserve just outside of Gainesville, and according to Carr, "the best thing on Rt. 441 between the Smoky Mountains and Key West." Then it's south to the region of Carr's final book, *The Everglades*, to see the wood storks of Corkscrew Swamp, the strands of the Big Cypress National Preserve, and Everglades National Park itself.

Carr won several prestigious awards for his writing. Mrs. Carr describes his usual methods—seven revisions, the last one being "smooth as silk." On Carr's style, Pulitzer prize-winning author William W. Warner says Carr "brings the field to the reader." Others discuss writers Carr admired: Kipling, Twain, Marjorie Kinnan Rawlings and, of course, William Bartram, whose descriptions of Florida were used by Coleridge in his epic poem, *Kubla Khan*.

Then finally, what should please the readers of this publication, snakes. As Florida serpents of varied size and color move across the screen, we hear the narrator quote from Carr's two essays on snake and reptile preservation, the second of which, "A Dubious Future," from *The Reptiles*, I consider to be his masterpiece.

But didn't Carr devote his life to turtles? Although one might think the program would begin with chelonians, it instead crawls at their pace toward the topic near the end. Carr's 1956 book, *The Windward Road*, inspired the creation of the Caribbean Conservation Corporation. Its research program saved the large green turtle rookery in Tortuguero, Costa Rica, and helped to establish the national park there. Closer to home, in 1989 the federal government established the Archie Carr National Wildlife Refuge in central Florida near Cape Canaveral. Several unnamed people give their testimonials about the moving experience of watching the turtles nest there and their admiration for Carr. His oldest son, Archie Carr III (aka "Chuck"), reveals what an honor it is to see their shared name in letters two feet tall on a sign at the refuge.

Space restrictions do not permit me to tell you about everything in this program, but then we reviewers are not supposed to "spoil it" anyway. Which one is better, the book or the movie? Because the depth of these two projects is so different, it is impossible to say that one is better. The book is a detailed look at Carr and his writing. This program is more of an overview and offers unique intimate interviews and beautiful videography. I recommend it highly. It will serve as a wonderful introduction or complement to the book and if it receives nationwide broadcast over Public Television, as WUFT hopes, Archie Carr and his writing will become known to an entirely new audience, ensuring his place in the canon of nature writing. WUFT-TV and the major financial contributor, Holbrook Travel, Inc., are to be commended on this project. Sadly, Mrs. Carr passed away just before the program was finished and it has been dedicated to her.

I will reveal the ending. The narrator is David Godfrey, Executive Director of the Caribbean Conservation Corporation, an organization that has been funding sea turtle research for nearly four decades. He reads from *Ulendo*, Carr's first book on Africa:

> You cannot argue the case for saving any wilderness on grounds of practicality alone. If this difficult saving is done, it will be because man is the creature who preserves things that stir him. Reckoned in terms of human nerves and juices, there is no difference in the value of a work of art and a work of nature. There is a difference, though, in the kinds of things they are. Any art might somehow, some day, be replaced—the full symphony of the landscape never. Basically, what must be done are the harder jobs, like justifying a future for snakes, which have no legs, hear no music, and badly clutter subdivisions. Bore through to the core of what is required and you see that it is an aggressive stewardship of relics, of objects and samples of original order and organization of cosmic craft. This work will take staunch people.

Although Archie Carr wrote that passage almost 35 years ago, I think he was speaking to us.

References

Adler, K. K., editor. 1989. Contributions to the history of herpetology. Society for the Study of Amphibians and Reptiles.

Carr. A. 1956. The windward road: Adventures of a naturalist on remote Caribbean shores. New York: Alfred A. Knopf.

———. 1963. The reptiles. New York: Time-Life Books.

———. 1964. Ulendo: Travels of a naturalist in and out of Africa. New York: Alfred A. Knopf.

———. 1973. The Everglades. New York: Time, Inc.

Carr, M. H., editor. 1994. A naturalist in Florida: A celebration of Eden. New Haven, CT: Yale University Press.

Note: WUFT-TV reports that this program will be shown throughout the country beginning this fall. Check your local program listings or contact your PBS station. Also, excerpts and still photos from this program are available at the WUFT website.

Bull. Chicago Herp. Soc. 33(11):244-245, 1998

Updates to the List of Illinois' Endangered and Threatened Amphibians and Reptiles

Michael Redmer*
Illinois Department of Natural Resources
Division of Natural Heritage
30071 S. Route 53
Wilmington, IL 60481

Glen Kruse
Illinois Department of Natural Resources
Division of Natural Heritage
524 S. Second Street
Springfield, IL 62701

On August 21, 1998, the Illinois Endangered Species Protection Board (ESPB) voted on proposed additions, deletions, and changes to the official list of state Endangered and Threatened species. By law, the board reviews and revises the list every five years. In Illinois, an endangered species one which is in danger of extinction as a breeding species in the wild within all or portions of its range in the state. A threatened species is one in which the population is low enough, or declining to the point that it will likely become an endangered species in the foreseeable future.

This year's ESPB review of the list includes six changes that involved amphibians and reptiles. No amphibian or reptile species was removed from the list this year. As revised, the state's list of endangered and threatened amphibians and reptiles now includes 22 species (Table 1), over 20% of the species known to occur in the state. The additions and changes to the list of Illinois Endangered and Threatened species, and the rationale for each follow:

Added as Threatened:

Jefferson Salamander (*Ambystoma jeffersonianum*). This salamander was recently discovered in the state, but since has been documented from only two counties.

Bird-voiced treefrog (*Hyla avivoca*). This species is restricted primarily to cypress–tupelo swamps in extreme southern Illinois. A recent survey found that choruses are small at most localities. In addition, most localities are isolated, and habitat at many of these is in decline.

Blanding's turtle (*Emydoidea blandingii*). Loss of wetland habitat has reduced and isolated most remaining populations.

Flathead snake (*Tantilla gracilis*). This snake is known from few localities (all along Mississippi River bluffs), some of which are vulnerable to habitat destruction.

Moved from Threatened to Endangered:

Alligator snapping turtle (*Macroclemys temminckii*). This species has been found in Illinois only once in the past 15 years.

Coachwhip (*Masticophis flagellum*). This snake is known from only three locations in the state, and has not been found in over 20 years.

Obtaining Permits:

The above changes go into effect on January 1, 1999. After that date, a permit from the Illinois Department of Natural Resources (IDNR) will be required for take, possession, transportation, sale, offer to sell, or other disposition of the added species. Due to their popularity as pets, the addition of the Blanding's turtle to the state threatened list is likely to affect many people who possess this species.

If you have a Blanding's turtle(s), that you acquired before the species was added to the list, you should apply for a permit immediately. Until December 31, 1998, possession permits for Blanding's turtles already in your possession will be issued by request. No documentation of the origin of the animals will be required with applications received by December 31, 1998.

Beginning January 1, 1999, a receipt or other proof of the origin of Blanding's turtles will be required before a possession permit can be issued. Possession of Blanding's turtles (or other amphibians and reptiles on the new list) without a permit after official adoption of the revised endangered and threatened

Table 1. Checklist of endangered and threatened Illinois amphibians and reptiles, including additions and changes which go into effect January 1, 1999.

Threatened
Jefferson salamander (*Ambystoma jeffersonianum*)
Four-toed salamander (*Hemidactylium scutatum*)
Bird-voiced treefrog (*Hyla avivoca*)
Illinois chorus frog (*Pseudacris streckeri*)
Blanding's turtle (*Emydoidea blandingii*)
Kirtland's snake (*Clonophis kirtlandii*)
Timber rattlesnake (*Crotalus horridus*)
Great Plains rat snake (*Elaphe guttata emoryi*)
Western hognose snake (*Heterodon nasicus*)
Mississippi green watersnake (*Nerodia cyclopion*)
Flathead snake (*Tantilla gracilis*)
Endangered
Silvery salamander (*Ambystoma platineum*)
Hellbender (*Cryptobranchus alleganiensis*)
Dusky salamander (*Desmognathus fuscus*)
Spotted turtle (*Clemmys guttata*)
Illinois mud turtle (*Kinosternon flavescens*)
Alligator snapping turtle (*Macroclemys temminckii*)
River cooter (*Pseudemys concinna*)
Coachwhip (*Masticophis flagellum*)
Broad-banded watersnake (*Nerodia fasciata*)
Eastern massasauga (*Sistrurus catenatus*)
Eastern ribbon snake (*Thamnophis sauritus*)

* Present Address: Forest Preserve District of DuPage County, P.O. Box 2339, Glen Ellyn, IL 60138.

species list will be a violation of the Endangered and Threatened Species Protection Act, and could result in prosecution.

There is no charge for an endangered species possession permit. To receive an application, or for more information, contact Glen Kruse or Joe Kath, IDNR Division of Natural Heritage, 524 S. Second Street, Springfield, IL 62701-1787. You can also request an application by phone at (217) 785-8774, or by E-mail at <endspec@dnrmail.state.il.us>.

What Can You Do to Help?

Illinois residents can help the state's endangered and threatened species by making a voluntary contribution to the Illinois Wildlife Check-off fund. If you are eligible or a state tax refund, you may donate all or a portion of it to the check-off. If you are ineligible for a tax refund, or would like to donate an amount greater than your refund, you may still make a contribution by indicating the amount you wish to donate and including a check in that amount. Indicate on your Illinois tax form what amount you would like to contribute, or ask (and remind) your licensed tax preparer to do so for you. Every year, the IDNR and the ESPB earmark some funds from the Wildlife Check-off for studies of the state's endangered and threatened amphibians and reptiles. These studies are used to help make informed habitat and species management decisions, and thus they directly benefit these species.

Bull. Chicago Herp. Soc. 33(11):245-247, 1998

HerPET-POURRI

by Ellin Beltz

Sailing away

In what's being described as proof of natural rafting events, a resident of Anguilla observed the arrival of a natural tangle of trees bearing fifteen large iguanas. Local scientists contacted North American colleagues and the result was a paper in the journal *Nature* [395:556, 8 October 1998]. In a story covering the story, the *New York Times* reports: "The journey of the iguanas began in September 1995 when two powerful hurricanes moved through the eastern Caribbean. A month later the iguanas, fearsome-looking creatures up to 4 feet long that resemble dinosaurs, washed up on Anguilla's shores on an immense raft of trees, the Nature paper reported. Dr. [Ellen] Censky said the lizards, which rest in trees, were probably blown down with them into the sea. She and her colleagues studied the tracks of the two hurricanes, Luis and Marilyn, and ocean currents and decided that the lizards probably came from Guadeloupe. [October 8, 1998, from James Harding and P. L. Beltz] I have a few questions. If it turns out that human influenced global warming is responsible for more hurricanes, will future events of this kind be judged "unnatural"? And who is to say how naturally the Guadeloupe population was established? Isn't "rafting" on a U.S. Navy ship a natural event for the brown snake? It doesn't realize that a steel raft is different than a tangle of trees—or does it?

The foodchain bites the hands that feed it

Fertilizer and sewage are among the nutrient sources blamed for the increase in the growth of blue-green algae in Florida waters. Since many algae release chemicals known to be toxic to liver cells and nervous systems of animals, scientists have suggested a link between the algae surge and the wave of mysterious alligator deaths this year. Others have suggested that algal toxins may be the cause of non-cancerous tumors found on sea turtles. [*GreenLines*, October 22, 1998, from Roger Featherstone]

Dominion or stewardship?

The Christian Environmental Council released a resolution yesterday calling for the "end of all commercial logging on U.S. National Forests." The CEC asks the Forest Service to redirect timber program money to fund forest restoration and to benefit logging communities. The unanimous resolution was passed in early October. CEC chair, Ann Alexander, said, "Paying timber companies nearly a billion dollars every year to needlessly decimate these irreplaceable forests, which God created and loves, is to commit a sin of greed and waste." [from Roger Featherstone" <RFeather@albq.defenders.org> October 12, 1998]

Silent Fall

Several of the thought-provoking items to hit my in-box this month were so unsettling that I'd like you to read them whole. First item: "Help Ban the Harvest of Sargassum—A Vital Habitat for Hatchling Sea Turtles. Sargassum seaweed is an essential component of the open-ocean ecosystem. It is particularly important to the survival of hatchling and post-hatchling sea turtles, which are known to spend portions of the first year or more of their lives drifting in the sargassum rafts that gather in the Gulf Stream and circle the Atlantic. Sargassum also supports a diverse community of marine invertebrate and vertebrate species, some of which are only found in floating sargassum, by providing food and shelter from prey. In the last few years, commercial fishermen operating along the east coast of the United States have begun to harvest sargassum weed for use as a cheap additive to livestock feed. Until now, there have been no real regulations on the harvest of this important marine resource—despite ample evidence documenting the role sargassum plays in the survival of countless marine organisms. Fortunately, the governmental body that oversees commercial fishing regulations is considering implementing a complete ban on the harvest of sargassum—before the commercial harvest gets out of hand. The South Atlantic Fisheries Management Council (SAFMC) will meet at the end of November to vote on the proposed regulation. Your help is needed to let Council members know that the public supports the ban. The vote will be close, but with your input this important sea turtle habitat can be protected. The SAFMC met on September 24, 1998, to vote on the measure, but several

Council members were absent and the vote ended in a tie. We have until the end of November to make sure the ban is approved. Other background information: Research has found that sargassum provides nearly 60 percent of the primary productivity in the upper three feet of the ocean and provides nutrients to organisms at deeper water depths as the older plants die and eventually sink. Sargassum plays a vital role in the early stages of life for hawksbill, green and loggerhead sea turtles. Once hatchlings reach the ocean from their nesting beach, they swim out to the floating mats of sargassum seaweed. The floating mats provide a wide variety of food and provide cover, helping to increase their chance of survival at this very vulnerable stage in life. It has been suggested by proponents of continued sargassum harvest that sea turtle hatchlings and other wildlife can be removed and released alive while the sargassum is collected. In addition to the fact that hatchling turtles and other small critters would be difficult to spot in the weed mats, even the released turtles would likely die without the food and shelter provided by the sargassum. You can help stop the harvest by contacting the SAFMC and urging its members to support the proposed ban. You can mail or fax your own letter or sign-on to a convenient E-mail letter available on CCC's web site at <http://cccturtle.org/act-now/sargassum.htm>. Send letters to: South Atlantic Fisheries Management Council, 1 Southpark Circle, Suite 306, Charleston, SC 29407-4699, Fax: (843) 769-4520. For more information, please contact STSL Coordinator Dan Evans, (352) 373-6441, <stsl@cccturtle.org>, 4424 NW 13th Street, Suite A-1, Gainesville, FL 32609." [October 23, 1998, E-mail forwarded by James Harding]

Deadly virus crosses to reptiles

In our second scary story, Steve Grenard compiled E-mails and explained one of nature's latest mysteries: "*Ranavirus*, found previously in amphibians and fish has, apparently crossed over to reptiles as the following compilation seems to indicate. It may be of interest to amphibian decline workers involved in studying the role of infectious disease in amphibian declines. . . . `Smuggled green pythons intercepted at Cairns airport in May [1998] were carrying a new virus that may have had the potential to devastate Australia's native reptiles, fish and amphibians. The Australian Quarantine and Inspection Service (AQIS) seized the 10 smuggled snakes as they were being brought into the country hidden in a man's trousers. Two of the snakes died soon afterward and were sent to the CSIRO Australian Animal Health Laboratory (AAHL) in Geelong, Victoria, for testing. A team of AAHL scientists isolated a virus from both snakes that belongs to a group of viruses that cause disease in Australian fish and amphibians. "It's possible that this virus, which hasn't been identified in Australia before, could have seriously affected Australia's valuable aquaculture industry as well as our wildlife," says Dr. Deborah Middleton of CSIRO Animal Health. "We know this type of virus can cause disease across a range of species, and survives well in the environment." . . . Two people were sentenced in a Cairns court yesterday for their part in smuggling the diseased snakes into Australia. All the intercepted snakes have since been sent to AAHL for testing. As a follow-up, an Australian reptile keeper who is already before the Courts facing more than 50 unrelated charges involving his dealings with reptiles has been charged in connection with the above importations by both the Australian Customs Service and the Queensland Police Fauna Squad. The same man had been issued a wildlife demonstrator license in Queensland by a senior DEH law enforcement officer, despite the application having been originally rejected by the appropriate licensing officials, and despite having been previously convicted of wildlife offenses in New South Wales. . . . He is due to appear in the Innisfail Magistrates Court. . . . The virus isolated was identified by electron microscopy as an Iridovirus (family Iridoviridae) and further characterized as a ranavirus (genus *Ranavirus*) which differed from previously described ranaviruses. These viruses have been previously identified in fish and amphibians, but infections occur across a range of species. I understand that the snakes originated out of Irian Jaya and as for the motive I can only guess that these snakes are in demand and that money could be made.' Malcolm Love, Regional Operations Coordinator, Cairns Region: `Since these animals came via a dealer in Singapore who sourced them in Indonesia, the presence of a potentially dangerous virus should be relevant to the U.S. and Europe as well as to Australia, especially if cross-infection to other captive [reptiles] is a possibility.' David Williams: `One of the characteristics of the international wild animal trade is that the stressed animals and birds readily acquire infections while "in transit" as they are frequently held in unnaturally high densities in less than optimum hygienic conditions. So while this Iridovirus might have originated in Irian Jaya, it could just as easily have been, for example, a Thai virus rampant in the Singapore facility.'" [<http://www.icomm.ca/venom> from J. N. Stuart, October 6, 1998, by E-mail]

The third and final story

"A recent die-off of salamanders in Utah has prompted USGS [United States Geological Survey] wildlife health officials to issue an October 21, 1998, wildlife health alert. The incident followed salamander die-offs earlier this summer in Maine and North Dakota. In all three cases a virus is believed to be responsible. The Utah event occurred in early September at Lake Desolation located east of Salt Lake City. U.S. Fish and Wildlife Service biologists reported finding about 200 tiger salamander carcasses littering the shoreline and lake bottom. Salamanders that were still alive appeared lethargic, swam in circles and were unable to remain upright. The sick salamanders also had red spots and swollen areas on the skin. A small number of seemingly healthy salamanders were also observed, but quickly swam into deeper water. No other species appeared to be affected. Dr. Carol Meteyer, a USGS wildlife pathologist at the National Wildlife Health Center in Madison, Wisconsin, examined some of the salamanders and found bleeding beneath the skin and microscopic changes in the internal tissues that indicated a viral infection. Meteyer and Douglas Docherty, a USGS virologist, reported isolating a virus from diseased tissues. They are conducting further tests to identify and characterize the virus. In addition to the salamander die-off at the Utah site, Docherty also found a virus in dead tiger and spotted salamanders earlier this year from Maine and North Dakota. Until these viruses are identified

and characterized, Docherty will not know if they are the same virus as the iridovirus isolated from Utah event. Data from these salamander die-offs are still being collected and evaluated. The health alert asks wildlife biologists to report any unusual observations of mortality or disease in salamanders to the USGS center. The die-offs are troubling to scientists because many amphibians . . . have shown sharp population declines in many parts of the world in recent years. Whether the recently identified salamander disease is related to global amphibian declines is still unknown. Salamander die-offs have been reported previously, but scientists are not sure how common such events may be. USGS biologists say die-offs of tiger salamanders were recorded at the same Utah location during in the early 1980s but these deaths were thought to be caused by a bacterial infection. In 1995 researchers at the University of Arizona reported on a similar die-off of tiger salamanders living in stock ponds in southern Arizona. These deaths were also attributed to an contagious iridovirus infection. Canadian scientists recently announced that they too had isolated an iridovirus from a tiger salamander die-offs near Regina, Saskatchewan, in Canada. Salamanders are a member of the group Amphibia, a word which means `double life' and which refers to the ability of amphibians to live both on land and in water. Amphibians, which have been on Earth for some 350 million years are among the most ancient land-dwelling vertebrate animals. The international scientific community has expressed growing concern over population declines in all amphibian groups. These losses are now well documented and have occurred in a wide range of habitats, including remote and pristine areas in California, the Rocky Mountains, Costa Rica, Puerto Rico, and Australia. On September 22, the federal government's interagency Taskforce on Amphibian Declines and Deformity met for the first time. This group was formed at the initiative of Secretary of the Interior Bruce Babbitt to help investigate the causes of global amphibian declines. It will focus on science, conservation, international and education efforts. Researchers are trying to determine why amphibians are disappearing. Current hypotheses to explain the declines include widespread infection by viruses, fungi, bacteria or parasites; increased exposure to ultraviolet radiation due to ozone thinning; the spread of non-native predators; contamination from pesticides and other chemicals; and rising temperatures. Many biologists suspect that a combination of factors may be responsible." Contact Paul Slota, (608) 270-2420, <paul_slota@usgs.gov > or read <http://biology.usgs.gov/pr/newsrelease/1998/10-22.html>. [October 23, 1998, from Barbara Birmingham]

Thanks to everyone who E-mailed stories to me this month. And back to clippings for December as the file folder slowly fills. Thanks to everybody who has sent stuff recently and to those who will be sending stuff after reading this appeal. Send whole pages of newspaper/magazine (weighs very little) and put your name on each page (address labels are great) and mail to: Ellin Beltz, 1647 N. Clybourn Avenue, Chicago, Illinois 60614-5507. Also, if you send your Christmas herp fotocard or photos, I will mention you in the December issue! Look forward to seeing lots of pictures of you and your friends.

Bull. Chicago Herp. Soc. 33(11):247-250, 1998

Herpetology 1998

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

EFFECTS OF TROUT ON LARVAL SALAMANDERS

T. J. Tyler et al. [1998, J. Herpetology 32(3):345-349] note that introduced fish have been implicated as reducing abundance or eliminating ambystomatid salamanders from montane lakes in western North America. The authors tested the null hypotheses that survivorship, growth, and refuge use of larvae reared for 30 d did not differ between artificial ponds with trout and without trout. Larval survivorship for both *Ambystoma macrodactylum* and *A. gracile* was significantly lower in ponds with trout than in fishless ponds. Both species had significantly lower snout–vent lengths in ponds with trout than in fishless ponds at the conclusion of the experiments. Only *A. gracile* had significantly lower body weight in ponds with trout than in ponds without trout. For both species, substrate locations of larvae were significantly influenced by trout at the conclusion of the experiments. Larvae of both species were found in a narrower range of substrates in ponds with fish than in control ponds. The findings of this study support inferences from field studies that the presence of trout have negative impacts on larval *A. macrodactylum* and *A. gracile*.

CAUSES OF DEATH IN HATCHLING TORTOISES

C. Keller et al. [1998, J. Herpetology 32(2):238-243] assessed mortality causes and survival rates for 59 free-ranging *Testudo graeca* hatchlings. Individuals were followed for varying lengths of time from emergence from the nest in August–September to April using thread-trailing. Fifteen hatchlings died from unknown causes (no external agents of mortality were identified and carcasses were intact), mainly soon after emergence; these belonged mainly to clutches which also contained unhatched eggs. Other causes of mortality were predation, car traffic, and trampling by large ungulates during the activity season (autumn and spring). Predation was low, and available data on potential predator diets also indicate low predation upon hatchlings. The authors found seasonal differences in survival; highest survival was in winter and lowest in spring. The overall survival rate for the 8-month period was 0.39. Mortality causes registered during continuous monitoring were similar to anecdotal observations recorded over an 11-year period.

SEAFARING IGUANAS

E. J. Censky et al. [1998, Nature 395:556] note that the possibility and probability of over-water dispersal as a mechanism to explain the distribution of terrestrial animal species in the Caribbean has been hotly debated since the early part of this century. They present evidence of over-water dispersal by green iguanas, *Iguana iguana*. On 4 October 1995, at least 15 green iguanas appeared on the eastern beaches of the Caribbean island of Anguilla. This species did not previously occur on the island. They arrived on a mat of logs and uprooted trees, some of which were more than 30 feet long and had large root masses. Local fishermen say the mat was extensive and took two days to pile up on shore. They reported seeing iguanas on both the beach and on logs in the bay. Within the previous month two hurricanes had moved through the eastern Caribbean. The tracks of these hurricanes, the distribution of *I. iguana* in the Lesser Antilles, and the general west-northwest ocean currents in the region suggest to the authors that these iguanas originated on the island of Guadeloupe. A survey was established within a month of the invasion. Captured individuals (three males and five females) ranged in snout-vent length from 276 to 400 mm. Iguanas were captured between December 1995 and March 1998. The authors' most recent sighting of *I. iguana* on Anguilla, on 11 March 1998 (29 months after the invasion), was of a female with enlarged ovarian follicles (possibly oviductal eggs). Because both males and females invaded the island, survived and appear to be healthy, with a female in reproductive condition, the likelihood of reproduction is high. These observations confirm that raft dispersal can occur successfully.

LIFE-HISTORY THEORY AND TURTLE CONSERVATION

S. S. Heppell [1998, Copeia (2):367-375] reports that as more reptiles find their way onto endangered species lists, it is increasingly important to identify management alternatives that can be applied across taxa. The author compared life tables from several turtle populations using elasticity analysis, a method that calculates the proportional contribution of each vital rate (age-specific survival and fecundity) to the annual population multiplication rate, λ [$\ln(\lambda) = r$, the intrinsic rate of increase]. Most freshwater turtles share similar elasticity patterns across age classes, in spite of large variations in mean annual fecundity, annual survival, and age at maturity. High adult survival elasticity and low fecundity elasticity in these species suggests that conservation efforts that reduce mortality of adults are likely to stabilize declining populations. Desert tortoises and sea turtles had different elasticity patterns, with relatively higher juvenile elasticities when summed across age classes. Three different life tables for painted turtles also showed variation in elasticity patterns. Approximate elasticities can be generated for age-based matrices without a complete life table for each species, requiring only age at maturity, adult female annual survival, and population multiplication rate. This approximation may help identify sensitive life stages for poorly known species, thereby guiding research and management efforts and furthering our understanding of life-history patterns.

CHUCKWALLA SYSTEMATICS

B. D. Hollingsworth [1998, Herpetological Monographs 12: 38-191] combines a traditional monographic revision of the chuckwallas (genus *Sauromalus*) with a modern phylogenetic analysis. Included are a reassessment of alpha taxonomy and geographic variation, a hypothesis of evolutionary relationships, a reevaluation of the relationships of *Sauromalus* to other iguanid genera, and an examination of trends in morphology, biogeography, and natural history within *Sauromalus* in light of the recovered phylogeny. Two phylogenetic analyses were performed, each using different coding schemes for polymorphic characters. The monophyly of all currently recognized iguanid genera is supported by both analyses. Because the relationships between the *obesus*, *australis*, and *ater* operational taxonomic units are unresolved and these taxa cannot be diagnosed from each other using fixed character differences, *obesus* and *australis* are synonymized with *ater*. The phylogenetic relationships within *Sauromalus* are: (*varius* (*hispidus* (*ater* (*klauberi* + *slevini*)))). Accounts of each species of *Sauromalus* include a synonymy, etymology, definition, diagnosis, detailed description of external morphology and color pattern, skeletal characterization, geographic variation, natural history, fossil record and distribution. A redescription of the type specimen of *S. ater* is provided and the type locality is restricted to southern coastal Sonora, México.

DEMOGRAPHY OF *LACERTA VIVIPARA*

B. Heulin et al. [1997, Herpetologica 53(4):432-444] note that *Lacerta vivipara* is a bimodal reproductive species of lizard with allopatric egg-laying and live-bearing populations. The demography of this species has previously been studied in several viviparous populations but has never been studied in oviparous populations. This four-year mark–recapture study includes estimates of survival rates and densities for two oviparous populations in the French Pyrénées. Densities fluctuated between 513 and 709 individuals/ha in the mountain population at Gabas and between 920 and 1830 individuals/ha in the lowland population at Louvie. Survival rates of juveniles from first clutches, subadults, and adults were generally higher at Louvie than at Gabas. These demographic characteristics are very likely responsible for the difference in density. Earlier maturity and higher annual fecundity (due to the ability to lay two clutches/year) could also account for the higher density observed at Louvie. A comparison of demographic (density, survival) and reproductive (birth dates, maturity, reproductive frequency) characteristics of oviparous and viviparous natural populations reveal that oviparous populations occur under ecological conditions that allow (1) birth dates and age at first reproduction to be similar to those observed in viviparous populations and (2) density levels and annual fecundities to be at least comparable to (Gabas), or even greater than (Louvie), those observed in viviparous populations. Differences in survival rates between oviparous and viviparous populations were generally not clear-cut. Although these comparisons between allopatric oviparous and viviparous populations cannot be regarded as direct tests of the theories of the evolution of viviparity in reptiles, they yield data for future research (transplant experiments) designed to test these theories.

HORNED ADDER FOOD HABITS AND REPRODUCTION

R. Shine et al. [1998, Copeia (2):391-401] note that horned adders (*Bitis caudalis*) are small heavy-bodied viperid snakes widely distributed across a range of habitat types in southern Africa. Measurement and dissection of 580 preserved specimens in museum collections provided information on morphology, food habits, and reproductive biology of this species. In particular, it enabled the authors to assess the effects of sex and habitat type (arid to mesic) on adult body sizes and shapes, dietary composition, and reproductive output. Female horned adders mature at larger sizes than do males and grow much larger. At the same snout–vent length, females have larger heads and shorter tails than do males. Arid-zone snakes are longer and thinner than conspecifics from more mesic areas and have longer tails and larger heads. Horned adders feed primarily on lizards (especially lacertids, skinks, and geckos) but also take other small vertebrates. Dietary composition varies according to the snake's body size, sex, and geographic location: endothermic prey are taken mostly by larger snakes; by females rather than males; and by arid-zone rather than mesic-habitat snakes. Most prey are small relative to predator size, especially in large snakes. Litter sizes (3–19 offspring) increase with maternal body size, with no significant geographic differences in this relationship. However, reproductive frequency (as inferred from the proportion of adult females that were reproductive when collected) was significantly higher in mesic-habitat snakes (> 50%) than in their arid-zone relatives (15%). Habitat-associated differences in resource availability may have affected traits such as body size and shape, degree of dietary specialization, growth rates and female reproductive frequencies.

INDIAN COBRAS OF THE GENUS *NAJA*

W. Wüster [1998, Hamadryad 23(1):15-32] reviews the species of cobra inhabiting India. All Asiatic cobras used to be considered part of a single species, *Naja naja*. In fact, four species are found in India alone: *Naja naja* (more or less throughout the country), *Naja kaouthia* (east and northeast), *Naja oxiana* (extreme northwest) and *Naja sagittifera* (the Andaman Islands). The systematics of the four species is reviewed, all four species are described, and the literature on their natural history and medical importance is summarized.

VARANID DEFENSIVE SOUNDS

B. A. Young et al. [1998, Hamadryad 23(1):1-14] analyzed the hiss and other defensive sounds from 16 specimens of *Varanus salvator*, and from representatives of 13 additional monitor species. While there are considerable interspecific differences in the acoustic properties of the hisses, they all have simple acoustics due to the paucity of frequency modulation and temporal patterning. Observations and experimental occlusion of the external nares demonstrate that the hisses are produced through the nasal passageway. The interspecific variation observed in the acoustic profiles of the hisses may be a reflection of interspecific variation in the size and structural arrangement of the nasal passageway.

BREEDING BIOLOGY OF THE GOPHER FROG

J. G. Palis [1998, J. Herpetology 32(2):217-223] studied the breeding biology of the gopher frog, *Rana capito*, for one breeding season at a 1.2 ha pond in Okaloosa County, Florida. Frog movement was monitored with a drift fence and pitfall traps; egg deposition site selection was examined using wading surveys. A total of 301 unmarked adult frogs was captured, nearly half in February. Movement of immigrating frogs was positively correlated with rainfall. Frogs that entered and exited the pond only once, exited within an average of 38.5 m from the point of entry. Males spent more time in the basin than females and males recaptured more than once stayed in the basin longer than males recaptured only once. Overall, the sex ratio did not differ from parity; however, nightly operational sex ratios were overwhelmingly male-biased. The eight-month breeding season (October through May) encompassed three major breeding events (one each in October, February, and April). A total of 146 complete egg masses was found, 67 of which contained an average of 2210 eggs. Frogs oviposited non-randomly, preferring rigid, vertical stems upon which to lay eggs. Each female deposited one egg mass.

THERMOREGULATION IN CAPTIVE ALLIGATORS

C. S. Asa et al. [1998, J. Herpetology 32(2):191-197] used biotelemetry and time-lapse video to investigate thermoregulation in the American alligator, *Alligator mississippiensis*. Temperature transmitters were surgically inserted into the abdominal cavities of five adult alligators. Four were maintained at the St. Louis Zoo in two outdoor enclosures and one indoors; all had free access to pools with circulating water. Temperature data were recorded every 10 minutes, 24 h per day from November through July. Each enclosure was videographed two or three days per month from February through July. A compilation of data from video and biotelemetry revealed that the outdoor alligators were able to survive at body temperatures as low as 7.4—8°C. They most often avoided conditions that resulted in body temperatures above 31°C, although one reached 33.7°C. Alligators regularly moved out of pools to bask while air temperatures were still considerably lower than those of the water. They did not wait until sun struck the pools, but oriented visually toward sunny areas, then emerged from the water and moved into the sun to bask. Movements of the alligators between the thermal zones of their enclosures, represented by pool and land areas, clearly resulted in significant changes in core body temperature.

TRACKING OLIVE SEA SNAKES

G. Burns and H. Heatwole [1998, J. Herpetology 32(3): 350-358] tracked the short-term movements of 12 olive sea snakes, *Aipysurus laevis*, using ultrasonic transmitters fed to the snakes. This species restricts itself to a home range of about 1500–1800 m^2. Three individuals displaced from their home ranges did not home to them. The home range often is linear along a reef face where the reef abuts open sand. Snakes forage by investigating crevices in coral or rock but do not linger over open sand. Home ranges of individuals broadly overlap. No territoriality was displayed.

AQUATIC SNAKES AND RECLAIMED STRIP MINES

M. B. Keck [1998, The Southwestern Naturalist 43(1):13-19] studied habitat use by semi-aquatic snakes on a reclaimed strip mine in northeast Texas. During two years, snakes of the genera *Agkistrodon* and *Nerodia* were trapped at ten study ponds. Additionally, five adult male *Nerodia erythrogaster* and five adult male *N. rhombifer* were tracked using radio-telemetry to compare habitat use between these two species, the most abundant snake species at the study site. The intra-specific density of *N. erythrogaster* and *N. fasciata* did not differ statistically among the ponds. The density of *N. rhombifer* was not uniform among the ponds, but mining history, pond age, shoreline length, and shoreline vegetation did not explain the observed among-pond differences. However, when the data from all ponds were combined, more *N. rhombifer* were captured in vegetated than unvegetated areas. The density of *Agkistrodon piscivorus* was not uniform among the ponds; the presence of a forested bottomland abutting one pond may have accounted for its high density there. Radio-tagged *N. rhombifer* were more closely associated with water than were radio-tagged *N. erythrogaster*. In the summer, *N. rhombifer* spent more time near permanent ponds than did *N. erythrogaster*, which spent relatively more time near temporary bodies of water. In the autumn, however, as *N. rhombifer* increased its use of temporary water sources, the use of permanent ponds vs. temporary sources did not differ significantly between the species. The results of this study indicate that semi-aquatic snake populations can recover quickly after surface mining, provided that ponds and other low-lying areas are created in the reclamation process and that there is a nearby source pool for colonization.

SEX RATIOS OF PACIFIC LEATHERBACKS

C. A. Binckley et al. [1998, Copeia (2):291-300] note that laboratory incubation of eggs and histology of gonads indicates that the pivotal temperature for leatherback turtles nesting on the Pacific coast of Costa Rica at Playa Grande was 29.4°C — not biologically different from that determined for Atlantic leatherbacks. They calculated sex ratios of leatherback hatchlings by monitoring beach and nest temperatures for eight thermal profiles and 47 nests during the 1994—1995 nesting season. Leatherbacks at Playa Grande nest mainly in the open beach zone (86.8–90.0%) and in the middle beach section (68.6–80.9%). Sand temperature increased as the nesting season progressed and reached 30.0°C (100% female) by mid-November. Monitored nests that produced hatchlings had temperatures above 30.0°C during the critical sex determining period. The sex of all hatchlings determined by gonad histology for 18 monitored nests (n = 10–20 per nest) was 100% female. Estimated sex ratio for the 1993–1994 season was 0% male:100% female, for the 1994–1995 nesting season was 6.5% male:93.5% female, and for the 1995–1996 season was 25.7% male:74.3% female. These ratios were more female biased than sex ratios reported for the past 25 years in Suriname on the Atlantic coast of South America. Gene flow between populations and the response of leatherback populations to thermally different nesting areas may be responsible for the lack of intraspecific variation in pivotal temperature.

A NEW GENUS AND SPECIES OF COLUBRID SNAKE

J. A. Campbell and E. N. Smith [1998, Herpetologica 54(2): 207-220] describe a new genus of colubrid snake, *Chapinophis*, from high elevations in cloud forest of the Sierra de las Minas in east-central Guatemala. The characteristics of the new species, *C. xanthocheilus*, include a mottled linear pattern on the body and a series of distinctive yellow markings on the lips, an anterior reduction of longitudinal dorsal scale rows, giving a formula of 15-17-17 smooth dorsal scales, a high number of ventrals (178-196), a prefrontal scale that contacts the orbit, a divided anal scute, a round pupil, a maxilla with 12–13 teeth and no diastema or enlarged rear teeth, and a bilobed, bicapitate hemipenis with a centripetal sulcus spermaticus and calyces on the distal part of the organ. On one hand, the new taxon shares certain features, especially of the maxilla, with *Adelphicos*, *Geophis* and *Atractus* and may be in the clade containing these snakes, *Ninia* and *Chersodromus*. Alternatively, the hemipenial morphology of *Chapinophis* appears to be similar to that of several genera of snakes (*Rhadinophanes* and *Tantalophis*) known from isolated regions on the Mexican highlands west of the Isthmus of Tehuantepec, and its affinities may lie with these snakes.

GENETIC VARIATION IN THE FLORIDA GREEN WATERSNAKE

J. S. Thompson and B. I. Crother [1998, Copeia (3):715-719] note that the Florida green watersnake, *Nerodia floridana*, is currently listed in South Carolina as a Species of Special Concern. The range of this species in southern South Carolina is disjunct from the greater part of the species' range in Florida, southern Georgia and southern Alabama. The authors examined four specimens from the northern range and five specimens from the southern range to analyze allozyme variation between the two disjunct populations. Also examined were samples of *N. cyclopion*, *N. erythrogaster* and *N. fasciata*. The analysis yielded 37 scoreable loci. The results did not reveal allozymic divergence between the disjunct populations of *N. floridana*, and in fact, samples from the two populations were fixed for the same allele at all loci. Based on these results, the authors believe that the disjunct northern population of *N. floridana* should be dropped from consideration for federal protection.

Advertisements

American Federation of Herpetoculturists: A nonprofit national membership organization of herpetoculturists, veterinarians, academicians and zoo personnel involved in the captive husbandry and propagation of amphibians and reptiles. Membership includes highly acclaimed magazine, *The Vivarium*, dedicated to dissemination of information on herpetocultural accomplishments, herp medicine, breeding and maintenance, field studies and adventures, enclosure design and much more. AFH membership is $26. Send information requests to: AFH-News, P.O. Box 300067, Escondido CA 92030-0067.

For sale: *Bulletin* boxes, $10 each. Library quality with "Chicago Herpetological Society" imprinted. Each container holds about two years' worth of *Bulletin*s. Send check or money order to Chicago Herpetological Society, 2060 N. Clark Street, Chicago IL 60614. Allow four weeks for delivery.

For sale: rats and mice—pinkies, fuzzies and adults. Quantity discounts. Please send a SASE for pricelist or call Bill Brant, *THE GOURMET RODENT*, 6115 SW 137th Avenue, Archer FL 32618, (352) 495-9024, E-mail <GrmtRodent@aol.com>.

For sale: murine-pathogen-free rats and mice available in all sizes, live or frozen: pinkies, fuzzies, crawlers, small, medium and large. Frozen crawler mice in lots of 2000, $.17 each. Also available, full grown hairless mice. FOB shipping point. Master Card accepted. Call (518) 537-2000 between 8:00 A.M. and 5:00 P.M. or write SAS Corporation, 273 Hover Avenue, Germantown NY 12526 for prices and additional information.

For sale: from **The Mouse Factory**, producing superior quality, frozen feeder mice since 1989. Our mice are frozen separately and vacuum-packed to greatly extend freezer life by reducing freezer burning and preserving vitamin and nutrient content. We feed our colony a nutrtionally balanced diet of Mouse Chow and four types of natural whole grains and seeds. Prices: pinkies, $25/100; fuzzies, $30/100; weaned, $35/100. Quantity discounts available. Ray Queen, P.O. Box 85, Alpine TX 79831. Call (800) 720-0076 or E-mail us at <mousefac@overland.net>. Fax (915) 837-0156.

For sale: from Bayou Rodents, excellent quality feeder mice and rats. Every size available. Pinks starting at $20/100. Orders are shipped by overnight service Monday thru Thursday. We accept Visa, MasterCard and Discover. For more info, contact Rhonda or Peggy, (800) 722-6102.

For sale: **high quality frozen feeders**. Over a decade of production and supply. Seven sizes of mice availabe: small newborn pinks up to jumbo adults. Prices start at $25 per 100. Feeders are separate in the resealable bag, not frozen together. Low shipping rates. Free price list. Kelly Haller, 4236 SE 25th Street, Topeka KS 66605, (913) 234-3358 evenings and weekends.

For sale: Herp bags—colors vary, translucent ripcord nylon, super lightweight, extremely durable construction with hot corners sewn in, double seamed. Custom sizes made upon request. Sizes: 46" × 14", $7 each; 24" × 12", $6 each; 24" × 6", $5 each. Shipping fees, $1 for first bag, $.30 each additional bag. Nicole Lechowicz, 2511 S. Illinois Avenue, #104, Carbondale IL 62901, (618) 457-2783.

For sale: **SALE! Berwyn pick-up only.** two nice 23" × 15" × 14½" wood cages with Plexy window, hinged front opening, internal lightbulb sockets and plug fixtures, linoleum floors, $50 each; 48" × 18" × 24" wood (redone hi-fi cabinet), top-opening, Plexy window, vinyl-lined cage (iguana!), **free**; aquarium-style (doesn't hold water) 44" × 25" × 30", metal frame, slate bottom glass cage on castered wood platform with (torn) screen top, **free**; 50" × 28" × 24" wood frame, mostly wire, tabletop cage, with Plexy side openings, **free**; two new silver-metal-frame screen tops for 15-gal./20-gal. tall tanks, $8 each; heated plastic lizard limb, $5; two new, large, plastic hide boxes (paid $6.60 each), 2/$10, one of the same, used, $2. Call Janice, (708) 484-7307, leave a message, please.

For sale: one leopard tortoise, one *sulcata*, both yearlings, $50 each; one 10" male leopard tortoise, $75; one 10" male *sulcata* "with a deformed shell," free. Will sell only to responsible persons who will give the best care. Colin, (773) 784-4669.

For sale: one male and one female California kingsnakes (*Lampropeltis getula californiae*), c.b. '95, young adults, outstanding "desert phase" with locality data, $150/pair; one male and one female Mexican gopher snakes (*Pituophis deppei jani*), c.b. '97, very handsome, lots of orange, $170/pair. Also have adult breeder bullsnakes (*P. melanoleucus sayi*), please inquire, permit where necessary. Bart Bruno, (203) 773-9257 evenings and weekends. [CT]

For sale: **Breeders:** one male and one female Baird's ratsnakes, $100; one male and one female Mexican milksnakes, $200; one male and two female prairie kingsnakes,$135; one male and one female albino speckled kingsnakes, $150; one male and one female Mexican black kingsnakes, $200; one male and three female red milksnakes, $325; two female Sinaloan milksnakes, $200; one male and two female Pueblan milksnakes, $300; one male and one female Ruthven's kingsnakes, $$250; one male and one female Nuevo León kingsnakes, $250; one male and two female Durango mountain kingsnakes, $350. **Hatchlings:** trans-Pecos ratsnakes, $45 each; graybands, $75 each; Nuevo León kingsnakes, $65 each; red milksnakes, $35 each. Steve Mitchener, (405) 748-6566 after 6:00 P.M. CST. [OK]

For sale: **Mutant bulls and lots of them!** 1998 hatchlings include: albinos (het. for snow), $100; anerythristic (male), $100; hypomelanistic double het. (male), $200; hypomelanistic double het. (female, imperfect), $125; **snow bull** (male), $500. All in perfect health, sexed and eating well. Beautiful patterns and colors from outstanding parents! Other 1998 offspring available: **northern blue tongue skinks** (*intermedia*), $50; black pines, $35. Also: **adult male Colombian boas**, proven breeders, flawless, $100 each. Jim, (414) 654-6303 after 6 P.M. Located just north of Chicago in Wisconsin.

For sale: beautiful, tricolor kingsnakes. Send SASE for **free** list. Also, free phone consultation on snake husbandry problems as a service to the herp community. Robert Applegate, P.O. Box 338, Campo CA 91906, (619) 478-5123. Thank you for your attention.

For sale: **Adults:** male het ghost, $60; black king, $55; male *thayeri* (milksnake phase), $100; pair of ball pythons, $175/pair; Indonesian bluetongue, $55; *Rhacodactylus auriculatus*, c.b. '98, $150; *Phelsuma madagascariensis grandis*, c.b. '98, $20. Flexwatt heat tape, $2.50/ft, $5 each connection. Steve Bostwick (515) 274-4580, E-mail <liasis@juno.com>. [IA]

For sale: one male and one female c.b. '98 hypo Honduran milks, light orange with faded bands, beautiful and rare. Serious inquiries only. Also, c.b. '98 green tree pythons from various genetic backgrounds. All feeding very well. Prices range from $525 to $750. Eugene and Cindy Bessette, (352) 495-3075. [FL]

For sale: green tree pythons—female, light green with lots of blue marking, long-term captive, tame, ready to breed—male, 2-year-old, captive born, high blue vertebral striping, yellow sides, docile and a great eater, $600 each or $1100/pair. Also, 2-month-old, c.b., 50/50 Cal kings, $50. Mark Petros, Strictly Serpents, (847) 854-3259.

For sale: Send SASE to CRC, P.O. Box 0731, Las Vegas NV 89125-0731 for brochures and list of species available. Limited bookings available for guided tours of herpetological collection sites in Nevada. Call/fax (702) 450-0065. URL <http://www.herp.com/crc/> E-mail <crcsafetie@aol.com>.

Tours: Adventure tours to Madagascar! Join **Bill Love** seeing and photographing fauna and flora, heavily herp-biased, across the world's least known mini-continent. Maximum fun & photo ops assured on every trip. Contact him at: BLUE CHAMELEON VENTURES, P.O. Box 643, Alva FL 33920. TEL: (941) 728-2390, FAX: (941) 728-3276, E-MAIL: <blove@cyberstreet.com>.

Tours: **Road-riding in Costa Rica!** Treat yourself to the trip of a lifetime! Learn about tropical herps, find them, photograph them, see where they live. **Greentracks, Inc.**, offers the best herpetological tours led by internationally acclaimed herpetologists and herpetoculturists. See the Amazon, visit cloud forests, experience the world's greatest rainforest, super sunsets and good company. Call (800) 9-MONKEY.

Advertisements (cont'd)

Wanted: big-headed turtles; mata mata turtles; Mexican giant mud turtles (*Staurotypus triporcatus*); exceptionally large common snappers (45 lbs. & up); large alligator snappers (over 90 lbs.); spectacled caiman from Trinidad, Tobago and Surinam; dwarf caiman; smooth-fronted caiman; albino turtles (except red-eared sliders). Walt Loose, (610) 926-6028, 9:00 A.M. – 1:00 P.M. or after 11:30 P.M. Eastern Time.

Wanted: Any dinosaur toys or dinosaur-related items for 1999 ReptileFest's new DINO-RAMA exhibit next May 1-2, 1999. Any items to be donated should be brought to any CHS general meeting. Contact: Gary Fogel, (773) 935-6938.

Line ads in this publication are run free for CHS members — $2 per line for nonmembers. Any ad may be refused at the discretion of the Editor. Submit ads to: Michael Dloogatch, 6048 N. Lawndale Avenue, Chicago IL 60659, (773) 588-0728 evening telephone, (312) 782-2868 fax, E-mail <MADadder0@aol.com>.

Unofficial Minutes of the CHS Board Meeting, October 9, 1998

The meeting was called to order at 7:55 P.M. Ron Humbert and Jack Schoenfelder were absent.

Officers' and Committee Reports

The minutes of the September (quorum not present) and August Board of Directors meetings were read, corrected and accepted.

The Treasurer's report was read and accepted.

Membership: Current membership is 984. Gino Martinez reported that he is sending stocks of membership applications to vets in the area, some of whom have called to say their supply had dwindled.

Shows: Jenny Vollman reported that the Windy City show (October 10-11) is all set up and that all CHS exhibitors have their packet of information.

Library: Jennie Picciola will be purchasing the annual allotment of books for the members' library. A suggestion was made that since a nice selection of books will be available at the Midwest Symposium books could be purchased there and shipping costs would be avoided. Board members in attendance will make recommendations to Jennie at that time.

Sales: The recent "thrift" sale at our last general meeting was well attended. There is another sale scheduled for the November election meeting. Jenny Vollman is hoping to sell the remaining stock to free up space in the storage area.

ReptileFest: Flyers for next year's show are ready for distribution at upcoming events like the Windy City show and the Midwest Symposium. Lori reported that the construction at Northeastern Illinois University (site of the 1999 ReptileFest) is on schedule and that the newly designed space should be ready in time for our show, which is set for May 1-2.

Old Business

Website: Jennie will update the CHS website to include ReptileFest 1999 dates and information, speaker and general meeting dates and promotion of the November merchandise sale. She will also add a link to the Turtle Club website.

Wildlife Discovery Center: Rob Carmichael has informed us that the money donated to the Lake County, Illinois, Recreation Department by the CHS for development of the reptile and amphibian displays has helped them achieve their goals. The animals have acclimated well to their new enclosures. Public talks and programs for children have begun. Rob will be sure to display any membership or show information that he is provided with by the CHS.

New Business

A discussion on local conservation initiatives was held.

A motion was made by Mike Dloogatch and seconded by Jenny Vollman to have the CHS write an official letter in support of Richard Fife's proposed amendment to the FDA's regulations that would allow the sale of turtles with carapace length under 4 inches under certain conditions. The vote was 5 in favor, 3 opposed and 1 abstaining. Mr. Fife filed a petition with the FDA to change their regulations and had asked for the CHS to support him in his efforts. Corresponding Secretary, Lori King-Nava, will write the official letter.

The board voted unanimously in favor of allocating $2,000 for Herpetological Grants for 1999. The motion was made by Mike Dloogatch and seconded by Gary Fogel. John Driscoll will continue as Grants Chairperson through 1998. The CHS received a thank-you letter from one of this year's grant recipients, Chuck Knapp.

Round Table

Audrey has followed up on the upcoming special "America's Greatest Pets." She will be exhibiting the largest collection of uromastyx in the country on national TV. Stay tuned for details.

The Shedd Aquarium has expressed an interest in having the CHS participate in their seasonal lecture series. Jennie will discuss possibilities with Shedd education staff.

Lori pointed out the article in *Sports Illustrated* on Rattlesnake roundups. She read to us some of the angry comments from readers who were disappointed in the magazine for covering such an event.

Mike informed the board that the 25th anniversary of the Kansas Herpetological Society would be held November 5-8, 1998.

The meeting adjourned at 9:40 P.M.

Respectfully submitted by Recording Secretary Jennie Picciola

UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, November 25, at the Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, in Chicago.

The speaker at the November 25 meeting will be **Dan Warner**, a CHS member who is currently a graduate student in the Biology Department at Virginia Polytechnic Institute and State University in Blacksburg, Virginia. Dan will speak about his research project, undertaken while he was a student at Iowa State University, on an Illinois population of six-lined racerunners, *Cnemidophorus sexlineatus*. Also at this meeting our annual election of officers and members-at-large of the board of directors will also take place.

Speaking at the December 30 meeting will be John Levell, of Lanesboro, Minnesota. John, a former Chicagoan and CHS board member, will discuss his book, *A Field Guide to Reptiles and the Law*, which is now in its second edition.

We are required to use the entrance on the west side of the museum. **We are allowed to use the free parking lot to the west of the museum. Entrance to this lot is from McFetridge Drive, the wide street just to the south, between the museum and Soldier Field.** Public transportation is an option: the Roosevelt Road (12th Street) bus now goes directly to the museum, thus providing a connection with the el and subway. This bus service runs until 11 P.M.

Turtle Club

The Chicago Turtle Club will meet Sunday, November 22, at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Visit the CTC web site, <http://www.geocities.com/~chicagoturtle>.

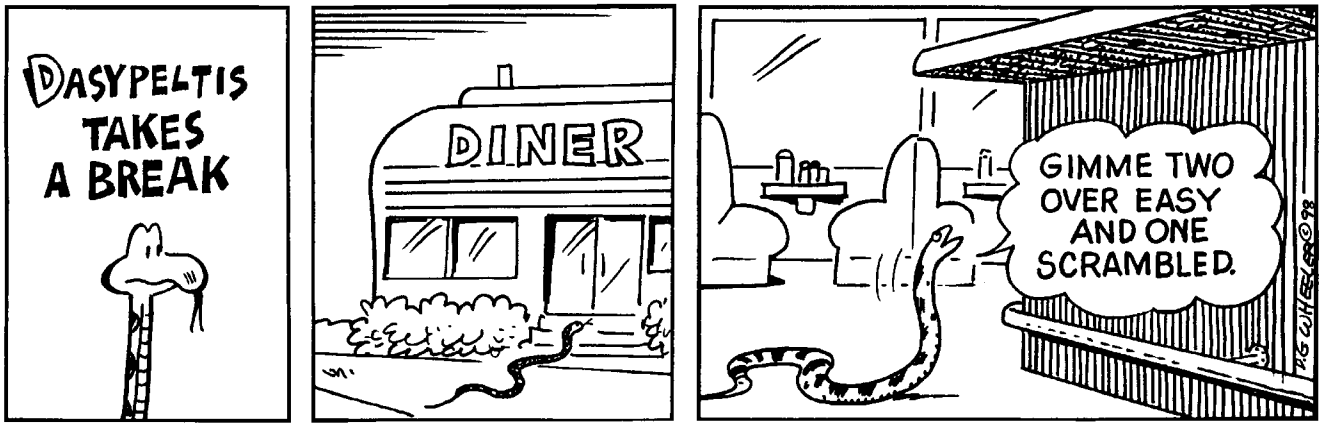
CHS STOREWIDE SALE! NOVEMBER GENERAL MEETING

Our entire inventory of herp-related merchandise has been marked down to ridiculously low prices in an effort to bring about a neater and much less crowded storage area. T-shirts are $5 each! Books as low as 50 cents apiece! Coffee mugs, enamel pins, frog tapes and CDs, and numerous other items—all at rock-bottom prices for your shopping pleasure. Get yours while supplies last. Do your Christmas shopping early at our CHS sale extravaganza!

MOVING??

Please let us know in plenty of time of any change in your mailing address. The *Bulletin of the Chicago Herpetological Society* is sent to our U.S. members by bulk-rate third class mail. This means that the U.S. Post Office will not forward your *Bulletin* with the rest of your mail. This is so even if you make a special request that your magazines be forwarded (such a request only applies to second class mail).

THE ADVENTURES OF SPOT



CHICAGO HERPETOLOGICAL SOCIETY

Affiliated with the Chicago Academy of Sciences

2060 North Clark Street • Chicago, Illinois 60614