TECHNIQUES

Articles suitable for publication in this section should describe either a novel technique or refinement of an existing one. Descriptions of methods, materials, study sites, etc., should be sufficiently detailed to permit an assessment of the utility of the technique or equipment for other areas or taxa. Manuscripts should be sent directly to the section editor: *Stephen D. Busack, National Fish & Wildlife Forensics Laboratory, 1490 East Main Street, Ashland, Oregon 97520, USA.*

The Snake Rake: A New Tool for Collecting Reptiles and Amphibians

Conant and Collins (1991) described several useful tools for collecting reptiles and amphibians including traditional snake hooks and potato rakes. The most useful tools in the field are often those that can serve more than one purpose. Unless one is planning on a single activity such as pinning snakes or raking through leaf litter, a multipurpose tool is advantageous. I have designed a simple, multipurpose tool for use in the field.

The snake rake, as I call it, is constructed from a 120 cm length of 19 mm diameter aluminum pipe and two 25 cm long pieces of 6.5 mm diameter steel round stock (Fig. 1). The two pieces of round stock are each bent 90 degrees at a point equidistant from the ends. The two pieces of round stock are then welded together along one length with the unattached ends directed roughly 25 degrees away from each other. The head is then attached to the end of the aluminum pole using two 27 mm hose clamps seated over the welded portion. This creates a two-tined fork that can be used to rake through leaf litter, roll logs and rocks, pin snakes and, lift bark and boards. This design is convenient when traveling since it can be disassembled for transport.

The snake rake can be constructed at home with a few tools. If welding materials are not available contact a local welding shop. Using heads that were constructed by a welding shop, I have assembled several rakes for less than twelve dollars each.

I have used snake rakes in habitats ranging from Ecuadorian cloud forests to Californian deserts and have found it to be a strong walking stick as well as a versatile tool. Low cost of construction and availability of materials add to the appeal of this design.

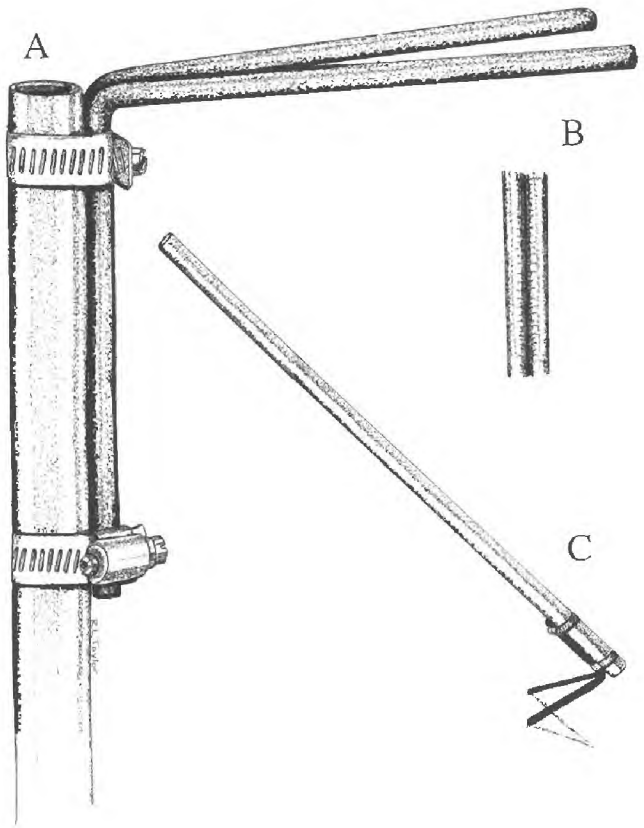

FIG. 1. (A) Detail of head of snake rake. (B) View of weld joining tines in plane of shaft. (C) Snake rake (120 cm).

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A Photographic Mark-Recapture Method for Patterned Amphibians

Studies involving mark-recapture in amphibians have employed a variety of techniques that facilitate the identification of individuals (Donnelly et al. 1994; Ferner 1979). The most widely used of these has been toe-clipping (Hillis and Bellis 1971; Twitty 1966; Wells and Wells 1976) and tagging (Elmberg 1989; Massey 1970; Nickerson and May 1973; Woolley 1973). More recent innovations include fluorescent marking (Nishikawa and Service 1988; Taylor and Deegan 1982), radioisotope tagging (Hardy 1985; Semlitsch 1981), and PIT (passive integrated transponder) tagging (Camper and Dixon 1988).

Ferner (1979) suggested the ideal method of recognizing individual salamanders was to use their variation in integument pattern. Hagstrom (1973) photographed ventral patterns of *Triturus cristatus* and *T. vulgaris* to identify individuals, and Healy (1975) used differences in dorsal spot pattern to distinguish between individual *Notophthalmus viridescens*. Loafman (1991) described a technique by which individual spotted salamanders (*Ambystoma maculatum*) could be recognized by their spot pattern.

Herein I describe an inexpensive photographic technique in which individual amphibians can be recognized by their dorsal patterns. Advantages of the technique include: 1) Animals are not physically harmed in any way, 2) animals are permanently "marked," and 3) the technique is easy to use, relatively time-efficient, and inexpensive.

A camera box (15 X 18 cm X 25 cm high) is constructed of 1.6 cm thick plywood, with a hole (7.1 cm diam) in the top to fit a 35-

mm camera lens (Fig. 1). A second hole (1.5 cm diam), also in the top, allows the insertion of a penlight. The bottom of the apparatus is removable and holds a small box in which specimens are placed (Fig. 1). The specimen box is sized appropriately to preclude movement during photography. A strap with a snap holds the bottom in place while the box is being carried or not in use. The stage (bottom) is painted black and is equipped with an adhesive label that can be numbered each time a different animal is photographed. The penlight eliminates the need for using a flash, which would require a more elaborate design. Although amphibians could be photographed without such an apparatus, the box allows consistency in photographic quality, and helps keep salamanders motionless while being photographed.

I have successfully employed the technique in the mark-recapture of 128 adult *Ambystoma opacum* in south-central Louisiana in 1991–92. Nesting females placed on their nests (after being photographed) were found to reattend their eggs in nearly all cases. Eight salamanders (6%) were identified as recaptures using the technique. Sampling bias (due to subterranean nesting) is believed responsible for the low recapture rate.

Salamanders were recognized by their distinct barring, including appearance and number of bars on the dorsum. No apparent ontogenetic change in pattern (an assumption of the technique) was seen over a one-year period; use of the technique with juvenile *A. opacum* would not be informative. As with *A. maculatum* (Loafman 1991), the head patterns alone of *A. opacum* in this study were often (80% of the time) different enough to distinguish between individuals.

A 35-mm camera and color print film (200 ASA) were used. Prints were easier to compare than were slides, and were placed in a photo album where they were labelled accordingly. Photographs of recent captures could then be compared to each previous photograph in the album.

Because individual *A. opacum* often display digit anomalies such as varying numbers of toes or branching of regenerated toes (pers. obs.), and because regeneration of toes can present problems in the identification of marked individuals (Ferner 1979), toe-clipping was not used. *Ambystoma opacum* metamorphs and juveniles show variable regeneration rates depending on the nature of the clip, but the technique is at least somewhat successful, and may be effective on adults (D. Scott, pers. comm.).

Pit-tagging is desirable because marking is permanent, the procedure is simple, and the tags are reliable. However, both the initial cost (tag reader) and individual tags are relatively expensive (Table 1).

TABLE 1. Comparative costs (in US $) of photography and the two most widely used techniques for marking salamanders (* = based on 50% recapture rate, ** = example for N = 300 salamanders marked).

Technique	Initial cost	Cost/salamander	Total**
toe-clipping	$ 5	no cost	$ 5
photography	$ 12	$ 1.06*	$ 330
PIT-tagging	$ 950	$ 5.75	$1725

Donnelly et al. (1994) recommended consideration of time and resources (as well as characteristics of the target organism) as important in the choice of marking technique for amphibians. Where expense is not a factor, PIT-tagging may be the preferred marking technique, particularly when very large numbers of animals are to be marked. Given a funding constraint, one is left with either toe-clipping or photography as a marking technique. Toe-clipping, while the most inexpensive (Table 1), is impeded by regeneration and may adversely affect the animal. Photography as a marking technique is intermediate in cost compared to other methods (Table 1), and is the least damaging of the available techniques.

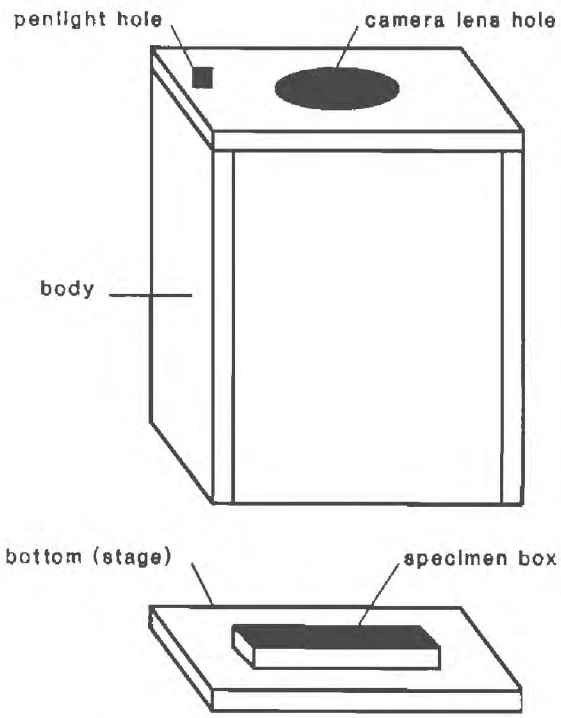

FIG. 1. Basic diagram of camera box for salamanders.

Pitfalls of the photographic technique include the expense of film (ca. $0.29/picture) and film processing (ca. $0.42/print), and the box is slightly cumbersome in the field (approx. wt. = 2090 g). Overall the box has been shown to be reliable for identification of *A. opacum*, was used successfully on several *A. maculatum* and a few *Rana utricularia*, and may be useful for a number of patterned amphibians as a preferred method in mark-recapture studies, particularly those constrained by money.

Acknowledgments.—I thank Jeanne Young, Daniel Doody, Jim Armacost, and Jeff Tamplin for their assistance in the field.

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A Method for Catching Lizards in Trees and Rock Crevices

A number of methods have been described for catching diurnal, active, and easily seen lizards, including pit fall traps, nooseguns, and rubber bands (Cogger 1992; Simmons 1987). A baited noose and plastic tube refugia were presented as capture methods by Strong et al. (1993). None of these methods is particularly successful on sedentary animals that inhabit tree hollows or rock crevices. To date the only method for extraction of these animals from their refugia has been through general harassment until the animal moves out. On many occasions this method results in the destruction of habitat, and/or harm to the animal.

During the wet season (November 1992–March 1993), a study commenced on the spotted tree goanna (*Varanus timorensis similis*) (Christian, unpubl. data). This is a pygmy goanna with a maximum snout-vent length of 230 mm and a maximum mass of 200 g. Average size is 186 mm SVL (SD = 26.2, N = 70) and 84 g (SD = 36.1, N = 69). The study site was located 30 km east of Darwin, Northern Territory, Australia. The goannas were found to frequent the hollowed center of wooden posts in an abandoned fence line. The depth of the central hole ranged from 200 mm to 1500 mm.

The two materials used in the extraction of the lizards from the hole were a set of stainless steel forceps (500 mm) to grasp the animal, and a length of wire (1500 mm long) with a hook at one end. The wire was a piece of plain fencing wire 2, 3, or 4 mm diameter (16, 10, or 8 gauge) bent to form a U-shape at one end. The sharp end of the U was bent back upon itself so that it did not have any rough or sharp edges (Fig. 1). A handle was made by bending 80 mm of wire at the top at 90°. The handle was bent in the same direction as the hook section so that when the hook was down a hole, it was possible to determine the direction it was facing.

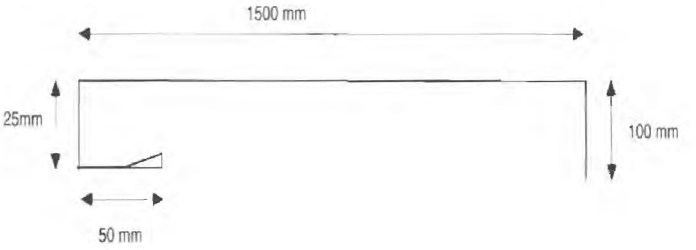

FIG. 1. Diagram of wire hook used to extract *Varanus timorensis similis*.

An animal was first sighted in a hole using a small flashlight, with note taken of its depth and orientation. The hook was then passed down the hole over the back of the animal until it was in line with the anterior third of the animal's tail, but below the legs, assuming the animal was facing the entrance of its hole. The hook was then turned so the tail was encompassed by the hook. At this point the legs acted as a towing point so when the hook was lifted it was positioned around the base of the tail and held by the back legs. The lizard was then lifted in a smooth motion to the top of the hole. The constant pressure on the hook when lifting the animal prevented it from turning around. When the animal was in reach it could either be grasped by the head with the forceps or pulled completely from the hole with the hook. Sometimes an animal turned around in the hole or was facing the wrong direction. A little more care was then needed to extract the animal; in most instances the animal was lifted at mid-body to a point where it could be grasped with the forceps and manipulated to allow the hook to pull it completely from the hole. Lizards could be extracted from shallow holes using only the forceps.

The combination of forceps and hook is the most effective method used by us to date for the capture of *V. timorensis similis*. During a twelve-month period, over 200 animals were caught using this method. The average time taken to catch an animal using this method was 3 min. Circumstances determined which type of wire was used. We were successful using both stiff and soft wire. Some words of caution should be expressed. Although this method is less damaging to the habitat and offers substantial benefits in reduced capture time of animals, it is possible to injure the animal. The most important point is to always make sure the hook is blunt with NO sharp or protruding edges. The hook should be around the base of the tail of the animal before pulling upward. It is an easy mistake to think the hook is around the tail when it has actually penetrated the cloaca. Therefore it is necessary to watch the progress of the hook using the flashlight during the initial positioning around the tail. The same caution holds for animals facing away from the opening. It is possible for an animal to open its mouth in an aggressive stand when facing this way, and the hook to enter its mouth. When first developing the hook system, we encountered penetration of the cloaca three times; however, all animals survived and were released at the point of capture.

We believe this technique should be applicable to both tree and rock-inhabiting lizards.

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Evaluation of a New Miniature Temperature Data Logger

Peterson and Dorcas (1994) described the advantages of using data loggers to measure variation in the environment. Scientists may be reluctant to use data loggers in field studies until their usefulness and reliability have been demonstrated. We used a new, miniature temperature data logger to measure the temperatures of nests and hibernacula of wild desert tortoises (*Gopherus agassizii*) at Yucca Mountain, Nye County, Nevada. Here we report on the accuracy, reliability, and ease of use of these data loggers. Reference to a company or product name does not imply approval or recommendation of the product by the U.S. Department of Energy to the exclusion of others that may be suitable. Quoted costs are from a published price list and are reported in U.S. dollars.

We obtained 30 reusable, temperature data loggers (Hobo-Temp, Onset Computer Corporation, Pocasset, Massachusetts; cost $99 ea.), contained in cylindrical plastic cases (35-mm film canisters) that were 3.3 cm in diameter and 5.3 cm long. Each unit with its case weighed 28 g. Measurable temperature range was -39 to 123°C, although other standard and custom ranges were available. Specified accuracy was 0.6°C from 0–40°C, 0.8°C at -10°C, and 1.0°C at -20°C. We chose units with internal thermistors, though units with an external thermistor were available for an additional $18 per unit. Each data logger could store 1800 measurements in nonvolatile memory. The data loggers could be programmed to measure temperatures over 31 possible durations from 15 min to 360 days with corresponding time intervals of 0.5 s to 4.8 h; they could not be programmed to measure temperatures at rounded intervals such as every hour. We used DOS and Windows versions of the program BOXCAR and a package of DOS programs called HOBO-PC (cost $49 ea.) to set sampling duration and other options and to download data. Data loggers were connected to a computer using a 9-pin to 3.5-mm stereo-jack cable (cost $9). We sealed the cases with cloth tape and/or silicone sealant to prevent the lids from leaking or coming off.

We tested the accuracy of the data loggers at 10°C intervals from -20 to 40°C using an oven (Delta Design, model 3900) and a calibrated thermometer (Instrulab, model 4202, system accuracy ≤0.04°C within tested range). Accuracy averaged 0.34°C (SD = 0.23°C) with a maximum error of 1.03°C. The data loggers were within manufacturer's specifications on 94% of the measurements, and the maximum deviation from the specifications was 0.2°C.

We used the data loggers in the field to measure temperatures of desert tortoise nests and hibernacula. In January 1993, we glued data loggers to the carapaces of three radio-marked, hibernating tortoises that were near their hibernacula entrances. We set the data loggers to record temperatures for 90 days at intervals of 1.2 h. We placed glue (Devcon Plastic Welder) on the data logger case and then pressed the case against the carapace without moving the tortoise. We pried the data loggers from the carapace of each animal after it left its hibernaculum in March 1993.

We placed 23 data loggers in desert tortoise nests at depths of 3–24 cm during May-July 1993 to measure nest temperatures. We programmed these units to record temperatures for 122 days at intervals of 1.6 h.

We judged the reliability of the data loggers based on whether all data were acquired by each data logger. No data loggers placed on tortoises or in nests failed. All data were within expected ranges.

We judged ease of use of the software subjectively. All programs were simple to use and worked well. We found that the delayed start-up option, whereby data sampling could be initiated without a computer by removing and re-inserting the battery, was not ideal because the time recorded by the data logger automatically started at midnight of 1 January 1980 and had to be corrected after the data were downloaded. If the start time and date were not recorded manually, this information was lost. For this reason, we preferred using a laptop or handheld computer to start data loggers in the field. We had to ensure the computer's internal clock was accurate because that is where the data loggers obtained the start time and date.

We preferred using the Windows version of BOXCAR when first learning how to start-up and download data loggers because all of the options were visible on a menu. However, when starting-up or downloading many data loggers or when translating many files to a spreadsheet format, the programs included with HOBO-PC were beneficial because options could be set using a batch file. This reduced the chance of selecting an incorrect option.

We found the Hobo-Temp to be a reliable and easy-to-use temperature data logger. A more advanced product now available features rounded sampling intervals (e.g., an interval of one minute or one hour), a switch for starting units in the field without a computer and without loss of time data, programmable start times, averaging of multiple samples, and storage of up to 32,000 measurements. In addition, similar products are available for measuring relative humidity, light intensity, voltage, pressure, and vibration. A waterproof case that is made for the temperature and light intensity data logger may enable use in wetter climates and aquatic habitats, but the relatively large size of the waterproof case (6 cm in diameter and 10 cm long) reduces the advantage of the data logger's small size. Though, data loggers will undoubtedly evolve into smaller and more feature-rich units, biologists already have access to useful miniature data loggers that are valuable tools for field studies.

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HERPETOLOGICAL HUSBANDRY

Notes on the Captive Husbandry and Reproduction of the Texas Salamander *Eurycea neotenes* at the Dallas Aquarium

The Texas salamander, *Eurycea neotenes*, is one of several hemidactyliine neotenic plethodontid salamanders endemic to the waters of the Edwards Aquifer of south central Texas (Chippindale et al. 1992). They are distributed throughout the aquifer (Dixon 1987), and their taxonomy is currently being evaluated (Chippindale et al. 1992).

The Edwards Aquifer is a subterranean reservoir with outflow water surfacing at many points. The waters of the aquifer have been taxed heavily in recent years by cities, farms, and industries. Five species found in the aquifer are listed as endangered; consequently there is much concern for the welfare of the endemic wildlife of the area. Proper management of this aquifer is vital to the survival of these species.

In the spring of 1990, during a prolonged drought and continued heavy human use of water, parts of the Comal Springs began to dry rapidly. The Edwards Aquifer Research and Data Center (EARDC) at Southwest Texas State University organized the field collection of 80 *E. neotenes* during June 1990. A conference was called to receive input and opinions regarding the depletion of the aquifer's water and the resulting threats to the environment. United States Fish and Wildlife Service, EARDC, San Marcos National Fish Hatchery, Texas Parks and Wildlife, and four North American zoos/aquariums were represented at the conference. Salamanders collected prior to the conference were distributed among interested institutions with the hope that detailed data could be collected regarding the husbandry and reproductive strategies of this little known species. Naturally deposited eggs of neotenic *Eurycea* found in the Edwards Aquifer have never been discovered in the wild, despite concerted efforts.

The Dallas Aquarium acquired 20 specimens from the EARDC, a portion of which were divided into presumed pairs. Three pairs were housed individually in separate 3.8 L aquaria with a constant flow of fresh water from the aquarium well. Temperature of the well is a constant 22°C with pH ranging from 7.5–8.0 (Table 1). Overflow ports were fitted to the back of the aquaria to allow for water drainage. Wild specimens of *E. neotenes* have been collected in gravel substrate, dense submerged aquatic vegetation, and under rocks (Bruce 1976; Sweet 1977), so tank furniture was varied for each enclosure. Additionally some *Eurycea* spp. are known to deposit their eggs on the underside of buried rocks (Ireland 1974). The first aquarium was furnished with a 7 cm gravel substrate, the second was heavily planted with *Vesicularia dubyana* and *Hygrophila* sp., and the third was half filled with partially buried rocks and rock shards. The remaining individuals were housed in a 189.3 L aquarium with constant water flow and no furnishings other than several 25 cm sections of 1.3 cm (1/2 in) PVC pipe. All aquaria were positioned under a skylight to provide natural photoperiods. No other lighting was provided. Live foods offered included tubificid worms, *Gammarus* sp., and adult *Artemia* sp. Salamanders were observed feeding at various times of the day on all food types.

TABLE 1. Dallas Aquarium water composition.

Parameters:	
pH	7.5
Turbibity (NTU)	0.04
Chlorine	0.0
Total suspended solids	0.0
Total dissolved solids	635.
Total alkalinity as $CaC0_3$	353.
Phenol alkalinity as $CaCO_3$	0.
Total hardness as $CaCO_3$	451.
Calcium hardness as $CaCO_3$	432.
Chloride as Cl	61.
Sulfate as SO_4	86.
Nutrients:	
Ammonia as N	0.02
Organic as N	0.18
Nitrate as N	4.4
Nitrite as N	0.0
Ortho phosphate as P	0.07
Total phosphate as P	0.11
Demand:	
Total BOD_5	0.9

All results are in mg/L except pH, or as indicated.

Little activity was observed during daylight hours. Nocturnal activity was recorded on videotape with tinted red lighting as a source of illumination. Salamanders were observed feeding and moving throughout the enclosures with very little interaction noted between individuals. On 22 August 1990 an adult female in the planted tank exhibited obvious egg development, visible through the translucent abdominal wall. The following day a presumed male was observed chasing this female, but no other breeding or courtship behavior was observed. In the following months all animals were closely observed for egg development and/or courtship behavior. Nothing significant was recorded during this period.

During the evening hours of 18 and 19 February 1991, the gravid female deposited 19 white eggs, 2 mm diam, each surrounded by

a gelatinous envelope, and fixed singly to live plants. The eggs were moved to a separate tank to ensure there would be no predation by the adult salamanders or snails present within the breeding enclosure. After a period of 48 h, the incubation tank was covered with black polyurethane to exclude light, addressing the concern that light intensity might have any deleterious effect on the egg development. Embryonic development was documented by photomicrographs. Several eggs developed a fungal growth and were preserved. Between 5–10 March 1991, four eggs hatched. One larva was deformed and expired immediately. Upon hatching, the larval ground color was a creamy white with scattered pale tan dorsal speckling. The larvae possessed rudimentary external gills, no limbs, and an unpigmented iris. TL of hatchlings was 7 mm. Front limb development began with buds visible two days post hatching. Within four days, front legs were complete with digits, and larvae exhibited brown dorsal pigmentation with paired light colored vertebral spots. Hind limb development was observed on 15 March with digits visible on all four legs by 24 March. At 30 days post hatching, larvae were 15 mm TL and began feeding on live newly hatched brine shrimp nauplii, confirmed by the bright orange color of the brine shrimp visible through their translucent abdominal skin. At age two months, the young salamanders were 26 mm TL, and by 6 months of age the largest offspring measured 60 mm TL and showed signs of ova development. At one year post-hatching, two of the three offspring were obviously gravid with fully developed eggs. The third individual showed no ovarian development and was presumed to be a male. No other reproductive behavior was seen in the adults for a period longer than 1.5 yrs. The cues that triggered the first reproduction are unknown.

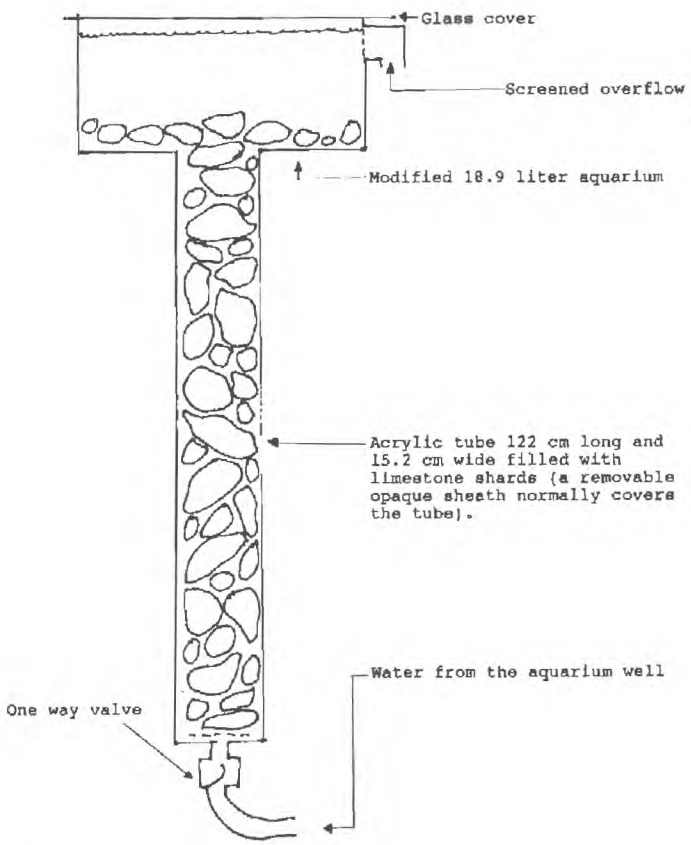

FIG. 1. Schematic of artificial aquifer.

The EARDC found that *E. nana* larvae of different ages can be collected in nets positioned over spring upwellings (Glenn Longley, pers. comm.). Our extended underwater observations in Comal Springs led us to hypothesize that the salamanders travel downward into the spring upwellings to deposit their eggs.

To test this hypothesis, we constructed an artificial aquifer consisting of a 122 cm long, 15.2 cm diam acrylic tube filled with limestone shards and fitted to the bottom of a 18.9 L aquarium (Fig. 1). Water was pumped upwards through the tube and exited through a screened overflow at the top of the aquarium. Flow rate for the artificial aquifer was measured at 5.5 L/min. The tube was equipped with a removable opaque covering to simulate the darkness of an underground aquifer and to permit periodic observations.

One of the original pairs and one F_1 pair were placed in the artificial aquifer on 23 February 1993. The original male was 91 mm TL and the female was 74 mm; the F_1 male was 76 mm TL and the F_1 female was 65 mm TL. Eggs laid by the F_1 female were discovered 38 days (2 April 1993) after the animals had been placed in the aquifer. Based upon rate of development of the previous clutch, the eggs appeared to be 2–4 days old. They were attached singly to rock shards in the lower portion of the aquifer. Hatching occurred ca. 12–13 April. On 10 May 1993 the founder female deposited more than 40 eggs in the artificial aquifer. The larval development subsequent to this oviposition differed from the two previous reproductions. A few of the larvae hatched, unpigmented and with no limb development on 30 May, but the majority of the larvae hatched between 6 and 13 June. The latter group of larvae hatched in a more advanced state with pigmentation of skin and iris diaphragm, and development of front limb buds. After hatching, 20 of the larvae were removed and placed in a separate aquarium for rearing. The remainder of the larvae were left in the parent enclosure for approximately two months. No predation on larvae by the adults was observed during this time. Neonates were then removed from the aquifer and divided between two rearing tanks.

On 13 March 1994 the founder female deposited at least 50 eggs in a similar fashion to her first reproduction on May 1993 in the artificial aquifer. Five eggs were removed to facilitate close observations of larval development.

We believe these three ovipositions in the artificial aquifer represent the "normal" reproductive mode of this species and may explain the difficulty of observing their eggs in nature. This propagation technique is now being tested by the U.S. Fish and Wildlife Service in an attempt to reproduce the closely related, but endangered San Marcos salamander, *Eurycea nana*.

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Collecting and Feeding Harvester Ants (*Pogonomyrmex* spp.) to Captive Horned Lizards (*Phrynosoma* spp.)

Although ants, especially harvester ants of the genus *Pogonomyrmex*, are consumed in large numbers by many species of *Phrynosoma*, or horned lizards (Montanucci 1989a; Munger 1984a, b; Pianka and Parker 1975; Rissing 1981; Sherbrooke 1981, 1987; Whitford and Bryant 1979), ants are not a nutritional prerequisite for these lizards (Sherbrooke 1987). Other insects are part of the natural diet of horned lizards and may be accepted by captive animals. Nevertheless, including ants as a major component of the diet can facilitate the feeding and maintain the health of horned lizards in captivity (Baur 1973; Montanucci 1989b, c, d; personal observ.). Difficulties are frequently encountered both in procuring sufficient numbers of ants and in presenting the ants to the lizards in a fashion that ensures that they can be captured and eaten. Such difficulties have thwarted *Phrynosoma* research, and efforts to exhibit and maintain captive lizards.

In this report I describe hazards and precautions one should take when collecting harvester ants, as well as three successful methods of collecting *Pogonomyrmex* in large numbers. Also, I explain methods for feeding harvester ants to horned lizards in indoor and outdoor enclosures. The *Pogonomyrmex* species most commonly collected near Tucson and Portal, Arizona, were *P. rugosus*, *P. occidentalis*, and *P. desertorum*.

Caution must be exercised in handling *Pogonomyrmex* ants as they are capable of inflicting severe stings (Schmidt 1986), to which some people may have an allergic reaction. People with known allergic reactions to hymenopterans should not try to collect *Pogonomyrmex* ants. Harvester ants defend attacks on their colonies by orienting toward and climbing tall objects. If this is the collector, they will sting. Frequent stamping of the feet effectively dislodges ants from shoes (sandals/thongs should not be worn). By exposing skin on the legs, wearing shorts or rolling up long pant legs, one can feel or see climbing ants on the bare skin and quickly brush them off before they bite or sting. I was occasionally stung on the finger while picking up ants, usually when an ant managed to get between digits. Rubber gloves reduce this risk.

The first technique is used to collect surface-foraging workers that are returning to the entrance of a large colony. Large numbers of individual seed-harvesting ants are active on the surface in the morning and afternoon, depending on climatic conditions. A small depression in the soil (2–5 cm diam) is created at the colony nest entryway, the downward extended tunnels of which are plugged with soil to prevent subterranean escape of trapped ants. Returning ants fall into the depression, where they are trapped in the inverted cone in a fashion similar to that seen in an antlion trap. Continuously arriving ants accumulate in a writhing mass, digging, trying to climb the walls, and attacking each other. Every few minutes I collect ants by swiftly picking up the mass of ants with the tips of my first three fingers and thumb of one hand and quickly drop the ants into a glass jar with a screened lid, from which they can not escape. The procedure is repeated when a sufficient number of arriving forager ants have again gathered at the plugged tunnel entrance. During periods of peak harvester ant activity, hundreds to thousands of ants can be captured in a short time. A person may work several colonies simultaneously by allowing ants to accumulate at one colony entrance while collecting ants at the entrance of a nearby nest. Ants collected in this fashion should be fed to lizards the same day or they will die, probably because of desiccation. Dead ants are not accepted as food by horned lizards.

The second collecting technique is used to capture subsurface workers, and can be employed whether colonies are active or inactive on the surface. Since it involves excavation with a pointed shovel, the selection of site (amount of rocks and compaction of soil) will influence the difficulties encountered in capturing large numbers of ants. A hole is dug 10–30 cm deep in the colony entryway forming a cone-shaped pit, again roughly similar in form to an antlion trap. As defending ants exit from tunnels they are trapped in the pit. They collect in the bottom, trying to climb the walls. The ants can then be scooped up with a shovel, along with loose soil, and dumped into a portable container. Clean 5-gallon (18.9 L) plastic buckets work well, as the ants have difficulty climbing the smooth sides. The goal to keep in mind is to maximize the number of ants and minimize the amount of soil/rocks per shovelful/bucketful. The buckets should not be more that three-quarters filled with soil and ants. It is frequently possible to work several colonies in one area simultaneously, leaving each colony to gather more ants between shoveling bouts. Keep ants from each colony in separate buckets to avoid intercolony strife.

When moisture levels are high at the soil surface numerous subterranean workers may be encountered very near the surface. Frequently brood chambers are unearthed. Seasonally these yield large numbers of workers, alates, some callows, and brood (which are not usually eaten by the horned lizards). Sometimes ant activity in these near-surface chambers can be stimulated by flooding the soil with water, where feasible, several days in advance of digging. Advantage can be taken of the climbing behavior of colony-defending ants by scooping up ants congregating at the tops of piles of soil. Again, the collector needs to constantly be on the alert to avoid ant stings.

For transport in an automobile, buckets can be covered to prevent ant escape. If being transported in the back of a pickup truck this is not necessary, but the soil in each bucket should be shaded

to prevent long exposure to direct sunlight and desiccation of ants on the surface.

The third technique takes advantage of seasonal windfalls of alate ants congregating at lek sites. This requires knowing the timing, climatic stimuli, and lek siting of particular species of *Pogonomyrmex* (Hölldobler 1976). Flying, alate harvester ants of high caloric value can be netted with an insect net. When large numbers of reproductives are collected they can be refrigerated to extend the period of use as live food.

Lizards maintained indoors should be in enclosures at least one meter square, and equipped with proper heating and ultraviolet lighting (Sherbrooke 1987). A sand substrate facilitates burrowing by the lizards. Because excited ants prefer to climb, an elevated "hill" away from the sides and towards one end of the cage serves to keep ants more or less concentrated at one location in the cage during feeding. The concentration of ants, and the maintenance of ant-free areas are critical to stimulating feeding by the lizards. Initially, lizard feeding behavior may be inhibited by the presence of an observer, but after several days the lizards associate the observer with ants, alleviating the problem.

The rate of introduction of ants into the enclosure is critical, and is dependent on the rate of consumption of ants by the lizards. Initially only small numbers of ants (5–10) should be introduced, then following ingestion by the lizards, they can be replaced and augmented. The number of ants in a cage should never be so great that their activity results in ants becoming dispersed throughout the cage. When ants surround lizards on all sides the lizards may stop feeding, and may attempt to escape the enclosure. Non-feeding lizards may become objects of ant attack, and, although they have resistance to ant stings (Schmidt et al. 1989), mandibular bites appear to cause the lizards some discomfort.

Feeding can be facilitated, especially of ants dug up with soil, by maintaining lizards in outdoor enclosures. This eliminates the need for artificial lighting and heating in areas and seasons where the climate is appropriate. Enclosure walls must be buried deeply enough and be high and smooth enough to prevent lizard escape. In addition, enclosures must be protected from predators (wire mesh enclosure covers work well), and large enough to allow entry for feeding and other care of the lizards. In recent years I have used a 4.5 m x 5.5 m x 2.2 m high cage, divided into four 2.65 m x 2.13 m compartments, each surrounded by 0.6 m high sheet metal (28 gauge) walls. A 0.3 m cement footing-wall prevents subterranean escape of lizards and entry of predators.

These large enclosures are ideal for feeding ants mixed with soil in 5-gallon (18.9 L) buckets. The contents of the bucket, or several buckets (depending on numbers of ants and lizards) can be dumped on the center of the cage floor, building an elevated hill over time (which eventually must be removed). Lizards learn to approach this rise and feed on descending ants, while still having the entire periphery of the cage as a retreat. Ants frequently begin building burrows into the loose soil of the mound and, once established below the surface level, live for several days or longer without dying of desiccation. Ants in buckets can be maintained for a few days if the soil is kept damp and the buckets are not in direct sunlight.

Utilizing harvester ants with other foods (other ants, crickets and mealworms), I have maintained in captivity all seven species of horned lizards that occur in the United States for periods of weeks, months, and even several years. The best dietary mix varies with species of *Phrynosoma* (Montanucci 1989a; Pianka and Parker 1975). The numbers of lizards held was usually between fifty and one hundred, mainly for season-long behavioral studies, particularly with *P. cornutum*, after which they have been released at sites of capture. Thus, I have maintained large numbers of horned lizards in excellent condition for long periods of time and with most animals gaining significant weight. Occasionally individual animals do not adapt well to captivity in spite of these methods.

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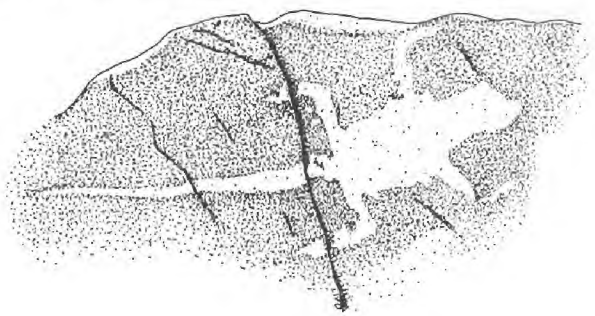

Captive Breeding of Two Species of *Eleutherodactylus* (Anura: Leptodactylidae) from Puerto Rico, with Notes on Behavior in Captivity

Frogs of the genus *Eleutherodactylus* comprise an extremely successful and speciose group in the tropical Americas and the Caribbean. While the biology of several of the 500-plus known species has been investigated, little or nothing is known of the majority of these frogs, and new species are regularly being reported (e.g., Flores 1993; Hedges and Thomas 1992; Wiens and Coloma 1992). As a tool for the study of *Eleutherodactylus*, methods are described here which have been used to successfully breed in captivity two common species from Puerto Rico, *E. coqui* and *E. cochranae*.

Eleutherodactylus coqui is an ecological generalist occurring nearly island-wide in Puerto Rico, on adjacent islands, and in small introduced populations in Florida and Louisiana (Conant and Collins 1991; Rivero 1978; Schwartz and Henderson 1991). *Eleutherodactylus cochranae* is a much smaller and relatively unstudied frog, apparently restricted to the lowlands of Puerto Rico and several of the Virgin Islands (Rivero 1978; Schwartz and Henderson 1991). Both species were collected from backyards and gardens in the coastal town of Dorado, Puerto Rico during 1991–1993. Typical habitats in the collecting area consisted of moist bromeliads and ferns in cultivated gardens.

In captivity, frogs were housed in 10-gallon glass aquaria—51 cm (length) x 26 cm (width) x 32 cm (height)—with special provisions for the presence of suitable retreat sites, moisture, heat, and light. The substrate of the cages consisted of a single, level layer of approximately 1 cm diam natural stream pebbles, partially covered by ca. 1 cm of moist, untreated peat moss, both of which were obtained from local pet or garden supply stores. Smaller diameter pebbles were avoided as they posed a danger of ingestion during feeding. Retreat sites were provided by placing one or more small, locally purchased, potted bromeliads in each tank (*Guzmania* or *Vriesea* species). Care was taken to wash the bromeliads thoroughly to remove any pesticide or fertilizer residue prior to their placement in the aquaria. Cages were kept at a high level of humidity by both mist spraying and direct watering of the bromeliads with bottled spring water. Spraying and watering were performed as necessary to provide small puddles of water in the bases of the bromeliad leaves and to maintain a moist, but not wet, substrate. Humidity was retained by covering the screen cage top with a sheet of plastic wrap. Minimum cage temperatures were kept above 22°C by inserting a submersible 50 or 75 watt aquarium heater into a narrow-mouthed, 1 L plastic bottle filled with water and taped shut to prevent evaporation. These heating devices provided a "soft" heat source which did not present a burn or desiccation hazard. They were placed in the corner of tanks to provide a thermal gradient across the enclosure. Fluorescent lights (15 watt, General Electric) placed directly on the top of each cage raised the maximum temperature during the day to 25–27°C. The lights were placed on a timer to provide a 12 h diel cycle.

An attempt was made to provide as diverse a diet as possible to the frogs. During warm weather, adult frogs were fed a variety of moths attracted to outdoor lights, various hand caught spiders, grasshoppers, termites, and other easily captured insects. During the winters, the diet consisted almost entirely of locally purchased crickets (*Acheta domesticus*), house flies (*Musca domestica*), and locally cultured fruit flies (*Drosophila melanogaster*). While activity continued year round for both species, frogs showed decreasing interest in any one food type after prolonged feeding in the absence of other varieties. Feeding frequency was adjusted to accomodate the relative hunger level of each frog. For general maintenance this usually consisted of a sufficient quantity of items to equal approximately one fifth the frog's weight, twice a week.

In captivity, both species of frogs appeared to call normally and engage in apparently typical behaviors. Male advertisement calling, satellite behavior, and territory and retreat defense, as well as mating and parental care were all observed. Male *E. coqui* and *E. cochranae* both gave advertisement calls similar to those previously described (Drewery and Rand 1983). However, the calls of *E. coqui* collected at Dorado were of higher frequency than those previously reported from frogs at El Yunque (Drewery and Rand 1983; Narins and Capranica 1976; Stewart and Rand 1992). This is in agreement with the observed altitudinal variation in call frequency reported by Narins and Smith (1986). During aggressive interactions and territorial and retreat defense in captivity, *E. coqui* males gave multi-note extensions of their mating call, similar to those reported by Stewart and Rand (1991, 1992) and Stewart and Bishop (1994). Female *E. coqui* in captivity also gave occasional aggressive calls as previously described (Stewart and Rand 1991). Aggressive physical interactions observed between *E. coqui* consisted of butting and biting behaviors also previously described (Stewart and Rand 1991; Townsend et al. 1984). In contrast, male *E. cochranae* in captivity used a very different behavior during physical encounters. This consisted of "shoveling" under the opponent and attempting to dislodge the opponent from the substrate. This may be an adaptation making use of the flattened morphology of *E. cochranae*. Also unlike *E. coqui*, both sexes of *E. cochranae* gave a retreat defense call differing in pitch and timing from the typical male *E. cochranae* advertisement call.

Both species showed extreme satellite male behavior in captivity. Extra males placed within a tank with a mating pair caused disturbances in the normal mating activities. The extra males engaged in aggressive calling and physical interactions with the resident male. These behaviors usually prevented courtship and nesting. However, on several occasions more than one male was found in a nesting retreat attempting to amplex the female. Females occasionally deposited eggs in these circumstances (as evidenced by thinness and the lack of egg masses seen through the skin the following day), but the eggs were always eaten in those circumstances, apparently by the competing males. Conspecific cannibalism has been reported in *E. coqui* (Townsend et al. 1984), but mating interference as a satellite male strategy has not. However, mating interference has been observed in dense populations of *E. johnstoni* in Barbados (Ovaska and Hunte 1992). It is likely that these behaviors in captivity are a consequence of the confined conditions.

During courtship and mating, males of both species produced soft, repetitive calls similar to those mentioned previously for *E. coqui* (Townsend and Stewart 1986). These calls apparently served to attract the female to the nesting site and initiate amplexus. In captivity, amplexus was maintained by pairs of both species until the following day and undisturbed males remained with the eggs in the nest site during development and for as long as 5 days after hatching of the young frogs, as reported by Townsend et al. (1984) and Townsend and Stewart (1986). In captivity, male frogs protected their egg clutches in a manner similar to previous reports (Taigen et al. 1984; Townsend et al. 1984). During dry periods the fathers moved to other leaf axils containing water, then back to

the nest to rehydrate the eggs. Fathers defended their nests vigorously against intrusion from other frogs, insects, or inanimate objects. Eggs in the care of a male frog seldom developed bacterial or fungal infections: however, removing the eggs to another location nearly always produced infections.

During two years of captivity over 30 *E. coqui* clutches and over 20 *E. cochranae* clutches were observed. Breeding activity took place year-round. *E. coqui* laid 12–30 eggs per clutch (mean = 23), which took 15–33 days to hatch (mean = 22). The much smaller *E. cochranae* laid 5–10 eggs per clutch (mean = 8) which took 16–20 days to hatch (mean = 18). The eggs of both species were of approximately the same size (4–6 mm at hatching, mean = 5, N = 10 for each species). For females of both species, the time between each mating and oviposition was dependent on food supply. In one instance, it took only six days for a female *E. coqui* to lay a new clutch. Seven and eight-day intervals between clutches were not uncommon for either species when food was supplied in sufficient quantity. Since female *E. coqui* have been reported to deposit all of their mature eggs at each oviposition (Townsend and Stewart 1986), these times are indicative of the minimum maturation time for a clutch of ova, and thus the minimum breeding interval. If retreat sites, not food supply, limit natural populations (Stewart and Pough 1983), female eleutherodactylids may be able to produce clutches nearly three times faster than males can incubate them. This minimum breeding interval is considerably faster than the 58-day average interclutch interval reported from three female frogs at El Yunque (Townsend and Stewart 1994).

Similar to reports for *E. coqui* in the field (Townsend et al. 1984), males of both species in captivity rarely moved from their eggs during incubation, and appeared uninterested in insects as food items during brooding. However, fathers regularly consumed a small number of eggs during the course of the incubation. It is not clear whether this is a biologically significant behavior or an artifact of captivity, as males often ate their entire clutches if they or their nests were disturbed. Females of both species were voracious feeders, and appeared capable of consuming nearly their own weight in food items in a single evening, especially after egg deposition.

Hatchling frogs of both species measured 4–6 mm SVL (mean = 5, N = 10 for *E. coqui* and 5 for *E. cochranae*). They remained in the nest, guarded by the father for several days after hatching, at which point they began to disperse. The fathers of hatchling frogs remained uninterested in most insect food items, and did not attempt to eat the young frogs. On the other hand, the mothers were a significant source of predation if left in the same aquarium with hatchlings.

A major problem arose in feeding the juvenile frogs, as they were generally too small to eat even fruit flies (Woolbright and Stewart 1987). Oddly, juveniles of the smaller species, *E. cochranae*, were often capable of taking larger food items than juveniles of *E. coqui* of the same age and size. Without a consistent supply of tiny food items, mortality at the hatchling stage was high, generally greater than 95%. Froglets that were capable of eating fruit flies were raised in moss-filled 150 mm x 20 mm petri dishes placed under the plastic wrap on top of the adult frog aquaria until they were approximately 10 mm SVL. They were then transferred to an aquarium and fed pin-head crickets and small house flies. Information on adult *E. cochranae* raised under these conditions is lacking as juveniles of this species began to develop unidentified neurological problems at 10–15 mm SVL. Symptoms included inability to capture food items, unsteady movements, muscle spasms, and a soft enlargement of the head between the eyes. No captive born *E. cochranae* has survived long enough to reproduce. The reasons for this defect in development are unclear. However, juvenile *E. coqui* developed without difficulty and males reached sexual maturity in approximately 5–6 months, as evidenced by calling. Female *E. coqui* grew to a larger size than males, developed egg masses, and bred at approximately 12 months. Second generation captive *E. coqui* have also bred and produced normal offspring. The oldest frog in captivity was a male *E. coqui* that was collected as an adult in September 1991, and died in July 1994. This individual called somewhat atypically in 1993 and 1994, but was otherwise active and healthy, with no obvious cause of death.

Artificial environments of this type should prove useful for the propagation and study of other species of *Eleutherodactylus*. While the biological significance of observations made in artificial settings must be confirmed in the natural habitat, interesting behaviors noted in captivity can provide excellent direction towards the design and interpretation of field experiments. Captive breeding of these species has allowed intimate observations to be made during evidently normal behavior. These observations have indicated likely differences in biology between these two species, including differences in development, clutch size, call patterns, and aggressive interactions. In addition, captive breeding may be useful for conservation of drastically endangered species, since many species of *Eleutherodactylus* inhabit extremely restricted ranges that have been negatively affected by human activities.

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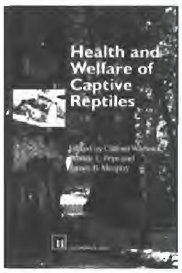

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NATURAL HISTORY NOTES

The **Natural History Notes** section (formerly Life History Notes) is analogous to Geographic Distribution. Preferred notes should 1) focus on observations with little human intrusion; 2) represent more than the isolated documentation of developmental aberrations; and 3) possess a natural history perspective. Individual notes should, with few exceptions, concern only one species, and authors are requested to choose a keyword which best describes the nature of their note (e.g., Reproduction, Longevity, Morphology, etc.). Use of figures to illustrate any data is encouraged, but should **replace** words rather than embellish them. The section's intent is to convey information rather than demonstrate prose. Articles submitted to this section will be reviewed and edited prior to acceptance. Send two copies of manuscripts, double-spaced, directly to the appropriate section co-editor (addresses on inside front cover). Manuscripts concerning reptiles should be sent to Lee A. Fitzgerald; those concerning amphibians should be sent to Charles W. Painter.

Standard format for this section is as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins (1990. *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*, 3rd ed., Herp. Circ. 19:1–41; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herp. Circ. 23:1–113), KEYWORD. DATA on the animal. Place of deposition or intended deposition of specimen(s), and catalog number(s). Then skip a line and close with SUBMITTED BY (give name and address in full—spell out state names—no abbreviations). (NCN) should be used for common name where none is recognized. References may be briefly cited in text (refer to this issue for citation format).

Recommended citation for notes appearing in this section is: Lemos-Espinal, J., and R. E. Ballinger. 1994. *Rhvacosiredon leorae*. Size. Herpetol. Rev. 25:22.

CAUDATA

AMBYSTOMA TEXANUM (Smallmouth Salamander). **MAXIMUM SIZE**. On 22 March 1993, between 2000 and 2100 h, CST, a gravid female *Ambystoma texanum* was collected during a rain shower on the Lake Kinkaid Spillway Road (SW1/4, Sec. 4, T9S, R3W), Jackson County, Illinois. As measured alive (chlorotone anesthetized), the specimen was: SVL = 106 mm; TL = 191 mm (SIUC H-4432, Herpetology Collection, Southern Illinois University at Carbondale). Conant and Collins (1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin, Boston, Massachusetts, 450 pp.) report the record size for this species as 178 mm (TL). Smith (1961. The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28(1):1–298) reported a 171 mm (TL) specimen as the largest *A. texanum* from Illinois.

Submitted by **MICHAEL REDMER**, 21 West 103 Par Lane, Itasca, Illinois 60143, USA.

AMBYSTOMA TIGRINUM (Tiger Salamander). **REPRODUCTION**. Nussbaum et al. (1983. Amphibians and Reptiles of the Pacific Northwest. Univ. of Idaho Press, Moscow, p. 57.) reports that little is known about the life history of tiger salamanders in the Pacific Northwest, and gives an account of eggs being found in April in Medical Lake, Spokane Co., Washington. On 26 March 1994 we found approximately 75 eggs attached to stems of spikerush (*Eleocharis* sp.) and fallen branches in a roadside swale on the N side of the Frenchman Hills, Grant Co., Washington; SE 1/4 Sec.16, T17N, R26E (Verified by R.A. Nussbaum, UMMZ 205809). Of almost 20 eggs examined, all embryos were at stage 38 (Duellman and Trueb 1985. Biology of Amphibians. McGraw-Hill Book Company, New York, p. 131), indicating they had been deposited approximately two weeks earlier. All eggs had been attached singly, although it was common to see several eggs beside

one another on the same stem or branch. The eggs were found in water ranging between 5 and 30 cm deep. This record demonstrates that breeding may occur in early to mid-March in the Lower Columbia Basin.

Submitted by **WILLIAM P. LEONARD**, Washington Department of Natural Resources-Natural Heritage Program, P.O. Box 47046, Olympia, Washington 98504–7046, USA, and **DAVID M. DARDA**, Department of Biological Sciences. Central Washington University, Ellensburg, Washington 98926, USA.

PLETHODON GLUTINOSUS (Slimy Salamander). **MORPHOLOGY**. On 29 June 1992, while collecting salamanders as part of a long-term capture recapture study, I collected a juvenile *Plethodon glutinosus* 2.5 km W Hwy 160 near Big Black Mountain Ridge Road in Harlan County, Kentucky. The salamander exhibited extreme scoliosis but otherwise appeared in good health. Based on SVL (41 mm from tip of snout to posterior angle of vent), the age of this individual was estimated to be 2 or 3 yrs (Semlitsch 1980. Herpetologica 36:6–16). This estimate may be conservative since the SVL measurement did not include bends in the vertebral column. The salamander was photographed and released. On 20 July 1993 I recaptured this individual (identity verified by spot pattern record) about 1.5 m from the capture point of the previous year. I photographed the salamander (Fig. 1, top) and recorded its SVL (50 mm). It still appeared in good health. A radiograph confirmed external observations that the vertebral column exhibited extreme lateral arches which were most severe behind the forelimbs (Fig. 1, bottom). Thus, the vertebral column abnormality apparently did not inhibit growth or survival under natural conditions. I thank R. G. Wilson for providing the radiograph and C. McCallister for providing photographs.

FIG. 1. Juvenile *Plethodon glutinosus* exhibiting extreme scoliosis (top); (bottom) radiograph of same individual.

Submitted by **GLENN A. MARVIN**, Department of Zoology, University of Oklahoma, Norman, Oklahoma 73019, USA.

ANURA

BUFO TERRESTRIS (Southern Toad). **OOPHAGY**. On 28 March 1993 I observed a congregation of tadpoles feeding on a dead adult female *Bufo terrestris*. I collected the female and tadpoles (N = 114) to examine the nature of the feeding. I also found a second dead female nearby; however, no tadpoles were feeding on it. I collected this female and an additional 200 tadpoles to determine whether the tadpoles would eventually feed on the second female. After 3 days with the carcass and no other food supply, no feeding was observed.

I haphazardly selected 10 tadpoles captured with the first female and measured SVL and stage. Tadpoles were between 6 and 9 mm SVL, and stages 29 to 31 (Gosner 1960. Herpetologica 16:183–190). The first female toad was missing the right front and rear legs (jagged bones were exposed) and her stomach cavity was open. Tadpoles concentrated feeding activity around the opened venter. Within the body cavity the intestines and stomach were intact, but the female was gravid and many eggs were loose. I inspected 10 tadpoles to determine if they were feeding on the eggs. The presence of eggs in 3 of the tadpoles confirmed that the tadpoles were feeding on the eggs.

Cannibalism or oophagy by tadpoles has been documented in numerous species (Crump 1983. Am. Nat. 121:281–287; Polis and Myer 1985. J. Herpetol. 19:99–107). In some species, cannibalism or oophagy can be an important and regular feature of tadpole life history, while in others it may simply be an opportunistic food source. This observation represents the latter, as this type of oophagy is probably rare for *Bufo terrestris* tadpoles.

Submitted by **KIMBERLY J. BABBITT**, Department of Wildlife and Range Sciences, University of Florida, Gainesville, Florida 32611, USA.

HYLODES PHYLLODES (NCN). **PREDATION**. Picinguaba (23°22'S 48°45'W), southeastern Brazil, embraces an area of Atlantic slope rainforest. The small diurnal leptodactylid frog *Hylodes phyllodes* Heyer and Cocroft (SVL 27.5-35.5 mm) is commonly found on or among rocks and roots along small overgrown streams. The pisaurid spider, *Trechalea keyserlingi* F.O. Pickard-Cambridge, is predominantly nocturnal with diurnal activity being restricted to shadowed areas in cracks and under rocks, and is frequently associated with flowing water.

On 9 December 1991, between 1630 and 1700 h, we observed a subadult *T. keyserlingi* (13.8 mm body length) vertically positioned upside down on the side of a rock next to a stream. This spider caught a young *H. phyllodes* (17. 2 mm SVL) by one of its hind limbs as it passed on the leaf litter about 50 cm below. The frog tried unsuccessfully to get away but was eventually immobilized by the spider's toxin. At that moment both were collected and preserved. The spider was placed in the Instituto Butantan Collection (IBU 5319) and the frog in the Museu de Zoologia da Universidade de São Paulo (MZUSP 69850).

The frequency of predation on *H. phyllodes* by *T. keyserlingi* is unknown but may be common, because both species appear to occupy the same microhabitat. Also, since both species attain larger sizes, predation might include adult frogs. Other pisaurid spiders eat fish and tadpoles (McCormick and Polis 1982. Biol. Rev. 57:29–58) suggesting that this species also could prey on *Hylodes* larvae.

Although spiders are often cited as important predators of small frogs, few published records simultaneously identify predator and

prey species (McCormick and Polis, *op. cit.*). We found no literature concerning such interactions for Atlantic forest species.

Submitted by **LUIS CESAR SCHIESARI, FLORA ACUÑA JUNCÁ** and **GUSTAVO DE MATTOS ACCACIO,** Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, 20520, 01452-990, São Paulo-SP, Brazil.

LEPTODACTYLUS ALBILABRIS (Caribbean White-lipped Frog). **LARVAL DIET**. *Leptodactylus albilabris* is a common frog throughout Puerto Rico. It produces foam nests and its tadpoles occur in a variety of still and slowly flowing waters (Schwartz and Henderson 1991. Amphibians and Reptiles of the West Indies, Descriptions, Distributions, and Natural History. Univ. of Florida Press, Gainesville. 720 pp.). Little is known of the larval biology of this species and nothing has been reported of the dietary habits of the tadpoles. On 19 May 1994, we observed *L. albilabris* tadpoles of sizes from approximately 6 mm (newly emerged from a nearby foam nest) to 13 mm in a shallow (<5 cm deep) stream at the bottom of a steep ravine in relatively undisturbed wet forest at an elevation of 700 m in the Reserva Forestal Carite (Guavate), Sierra de Cayey, Commonwealth of Puerto Rico (66°02'30"N, 18°05'45"W). Larger tadpoles in two separate pools in the stream were feeding. In one pool larvae were feeding on a dead earthworm (length ca. 100 mm). In the other they were removing flesh from the nearly fully skeletonized carcass of an anole (estimated intact SVL 60 mm). Features of the lizard's skull were consistent with those of *Anolis gundlachi*, which was abundant in the vegetation surrounding the stream. The only other anole observed near the stream was *A. evermanni*. Although few tadpole species are obligate carnivores (Bragg 1965. Gnomes of the Night, the Spadefoot Toads. Univ. of Pennsylvania Press, Philadelphia. 127 pp.), facultative carnivory is more widespread and can occur in species showing no obvious morphological feeding specializations (Heyer et al. 1975. Biotropica 7:100–111). Documentation of tadpole predation or scavenging on vertebrates is rare, but *Leptodactylus pentadactylus* preys on the tadpoles of other anurans (Heyer et al., *op. cit.*; Kluge 1981. Misc. Publ. Mus. Zool. Univ. Michigan 160:1–170). Scavenging of terrestrial vertebrates by larvae is less well-documented, but *Lechriodus fletcheri* tadpoles have been observed to feed on adults of the same species (Martin 1967. Aust. Nat. Hist. 15:326–330). Although the observation of scavenging on a terrestrial vertebrate carcass by *Leptodactylus albilabris* tadpoles is an isolated event, it suggests that facultative carnivory may be more widespread among members of the genus *Leptodactylus* than previously recognized. Further, it highlights the dietary plasticity and opportunistic feeding behavior capable by relatively generalized tadpoles.

Submitted by **RICARDO LEBRON, A. TINA BATRA, JAMES BONTEMPO, CHRISTIAN BUCKLEY, MITCHELL CRON, LINDA FENSTERMACHER, CHRISTINA MAHONEY, LAURA SCHMITT,** and **AARON M. BAUER**, Biology Department, Villanova University, 800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA.

PELTOPHRYNE GUENTHERI (NCN). **PARASITISM**. In the course of a dietary study of the endemic Hispaniolan toad, *Peltophryne guentheri*, we examined the stomach contents of 204 specimens. In three adult males from different sites in Haiti (Arbonite, near Los Poteaux) and the Dominican Republic (Independencia, near Lago Enriquillo; Monte Cristi, near Copey), we found immature nematodes (*Skrjabinoptera* sp., Physalopteroidea) admixed with ingesta. Prevalence was 1.5% (3 of 204 specimens examined). Intensities ranged from 1–4 (mean = 2.0) parasites per host. Total lengths of nematodes ranged from 1.7–2.4 mm (mean = 1.93 mm), maximum diameter from 14–15 μ (mean = 14.3 μ).

Skrjabinoptera has not been found previously in any amphibian (Baker 1987, Mem. Univ. Newfoundland Occ. Pap. Biol. No. 11), but *S. leiocephalorum* has been found in Hispaniolan lizard hosts. This parasite was originally described from *Leiocephalus schreibersii* and *L. barahonensis* (Greve and Powell 1989, J. Parasitol. 75:677–679; Powell et al. 1990, J. Helminthol. Soc. Washington 57:75–77). Powell et al. (1990. Herpetol. Rev. 21:60–61) noted its occurrence in *L. semilineatus*. Fobes et al. (1992. Carib. J. Sci. 28:200–207) and Moster et al. (1992. Bull. Maryland Herpetol. Soc. 28:150–161) found *S. leiocephalorum* in *Anolis cybotes* and *A. brevirostris*, respectively. That so many diverse lizards support this parasite suggests that a common prey item is the vector (probably one or more species of insect). *Peltophryne guentheri* may feed on the same prey. However, the low prevalence and the fact that all parasites were juveniles may reflect the inadequacy of *P. guentheri* as a final host.

We thank William E. Duellman and John S. Simmons, University of Kansas Museum of Natural History, for access to speci-

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mens in the Albert Schwartz Field Series. Specimens in the Bobby Witcher Memorial Collection at Avila College, Kansas City, Missouri, were collected with the help of many colleagues and students over the years. Sixto and Yvonne Incháustegui, Grupo Jaragua, Jose A. Ottenwalder, United Nations Development Program, and Andreas Schubert, Servicio Alemán and Departamento de Vida Silvestre, often have facilitated our opportunities for field research in the Dominican Republic. Permits were provided by Emílio A. Bautista M., Departamento de Vida Silvestre, República Dominicana.

Submitted by **KEELY J. PARSONS** and **ROBERT POWELL**, Department of Natural Sciences, Avila College, Kansas City, Missouri 64145, USA, and **JOHN H. GREVE**, Department of Veterinary Pathology, Iowa State University, Ames, Iowa 50011, USA.

PSEUDACRIS REGILLA (Pacific Chorus Frog). **REPRODUCTION**. On 28 and 29 August 1993, I observed *Pseudacris regilla* tadpoles in weakly brackish (~1.0%) ('brackish' sensu Remane and Schlieper 1971. Biology of Brackish Water. Wiley, New York. 327 pp.) supratidal pools on Frank Island and at South Beach, west-central Vancouver Island, British Columbia, Canada. Some inland populations of *P. regilla* frequent and presumably breed in brackish water (Brues 1928. Proc. Am. Acad. Arts Sci. 63:138–228; Brues 1932. Ibid. 67:184–303; Murray 1958. Herpetologica 11:33–48), but reproduction in brackish supratidal pools has not previously been reported. The Vancouver Island breeding pools appear similar to those used by *Bufo calamita* in Sweden (Andrén and Nilson 1985. Amphibia-Reptilia 6:137–142): pools are small (<3 m^2), shallow (<45 cm), and not connected to the ocean. At high tide they are no higher than 4 m above sea level and as close as 5 m to the water's edge. Salt spray and inundation of sea water during storms apparently adds salt water to these pools, but heavy rainfalls and surface runoff probably maintain salinities at dilute levels.

Although at least seven other amphibian species are sympatric with *Pseudacris regilla* across west-central Vancouver Island (Nussbaum et al. 1983. Amphibians and Reptiles of the Pacific Northwest. Univ. Press of Idaho, Moscow. 332 pp.), I found only *P. regilla* tadpoles and aquatic arthropods in the supratidal pools. Tadpoles ranged in density from one to about 25 individuals per pool and stages 28 to 42 of Gosner (1960. Herpetologica 16:183–190). The late stage larvae suggest that metamorphosis successfully occurs; however, I failed to locate any metamorphosed frogs. I deposited seven voucher tadpoles from Frank Island in the University of Alberta Museum of Zoology (UAMZ 3001), Edmonton, Alberta.

I thank Josie Cleland (Clayoquot Biosphere Project, Tofino) for bringing the Frank Island tadpole pools to my attention, Dick Pereschitz for conveying a relevant paper, Gertie Hutchinson (Univ. Alberta) for salinity testing, and my wife, Joan Marklund, for tolerating my field studies while we were vacationing.

Submitted by **JAMES D. GARDNER**, Department of Biological Sciences, University of Alberta, Edmonton, Alberta, T6G 2E9, Canada.

PSEUDACRIS STRECKERI ILLINOENSIS (Illinois Chorus Frog). **BURROWS**. The fossorial chorus frogs *Pseudacris ornata* and *P. streckeri illinoensis* both use their forelimbs to burrow in the substrate (Brown et al. 1972. Herpetologica 28:325–328; Brown and Means 1984. Amphibia-Reptilia 5:261–273). Forward burrowing is unusual: most fossorial frogs dig backwards with their hind feet (Brown and Means, *op. cit.*). In *P. streckeri* this behavior is associated with subterranean feeding (Brown 1978. Herpetologica 34:212–216), and in both species with reduction of the intercalary phalanges in the forelimbs (Paukstis and Brown 1987. Brimleyana 13:55-61; Paukstis and Brown 1991. Can. J. Zool. 69:1297–1301). Few details about the burrows of free ranging chorus frogs of either species are available (Axtell and Haskell 1977. Nat. Hist. Misc. 202:1–8). We herein document the construction of burrows by newly transformed *P. s. illinoensis*, and add a further record of a burrow occupied by an adult male frog.

We observed a population of *P. s. illinoensis* in Madison County, Illinois (4.8 km SW Edwardsville, T4N, R9W, sec. 29). Soils in this area are Oakville fine sand and Bloomfield loamy fine sand (Goddard and Sabata 1986. Soil survey of Madison County, Illinois. U. S. Dept. Agriculture, Soil Conservation Service, U. S. Government Printing Office, Washington, D. C., 254 pp.), and are consistent with soils used by *P. s. illinoensis* from the lower Illinois River (Brown and Rose 1988. Illinois Nat. Hist. Surv. Biol. Notes 132:1-13).

On 20 April 1993 at 2230 h we dug one adult male (35 mm SVL) from a burrow 2.9 m from a breeding pond. This burrow was 45 cm long and 11 cm below the soil surface at its terminus. It appeared to be level with depth being produced by its location on a slope. The opening was semi-oval in shape (2.2 cm wide and 1.4 cm high) with a loose sand apron. Apparently, the loose sand was pushed from the burrow. The terminus consisted of a slightly enlarged chamber with damp but not saturated sand. The frog was well hydrated and active. We heard no calling from the vicinity of the burrow. Underground calling has been reported for *P. ornata* (Brown and Means, *op. cit.*).

The burrow was in an area of unvegetated sand. We excavated similar burrows (38), but found no other frogs. No excavated burrows were within 5 cm of plants. Some burrows could have been made by toads; choruses of *Bufo americanus* and *B. woodhousii fowleri* were present. Three male *B. americanus* were also dug from two burrows the same night. The larger burrows occupied by toads differed from the burrow made by the chorus frog in that their openings were circular with sand pushed up all around the margin of the opening. Toad burrows also dipped at a steeper angle. One toad burrow was 18 cm long and 12 cm deep; the other was 20 cm long and 10 cm deep.

Axtell and Haskell (*op. cit.*) reported that burrows of *P. s. illinoensis* dipped at a steep angle (20 cm depth with 10 cm lateral displacement) or were nearly vertical (2 of 3 burrows). The openings of those three burrows were similar to the one that we observed. The depths of the four (3 from Axtell and Haskell and one we report) known burrows of *P. s. illinoensis* averaged 15.2 cm (range 11–20 cm). Axtell and Haskell (*op. cit.* p. 2) also noted that burrows containing frogs were located in areas devoid of vegetation. These details are important because excavation of likely-looking burrows in vegetation-free areas in suitable sandy habitats is a useful method for locating specimens of the highly secretive *P. s. illinoensis* both at choruses (our record) and away from breeding sites (Axtell and Haskell's report).

Between 24 May and 12 June while conducting a survey of the site for transforming chorus frogs, 42 burrows containing newly transformed froglets were excavated in a wheat field near the natal pond. Twenty-three of these were in bare sand, but 19 were within 0.5 cm of wheat plants. No burrows were in heavy vegetation at the margins of the wheat field or between the wheat field and natal pond. Most burrows were less than 2 cm long (mean =

3.8 cm, range 1.2–15 cm, N = 22) and shallow, but one was 15.0 cm long and 4 cm deep at its terminus. Many froglets were seen at the mouth of burrows. When we approached, froglets usually fled by hopping into the open rather than into the burrow. All burrows were excavated during daylight and may have been temporary refuges constructed to avoid desiccation during a post-transformation migration.

Burrows containing either adult or newly transforming frogs were not found in heavy vegetation. Our observations support the hypothesis that sod or compacted soils are incompatible with the frog's burrowing life history (see Brown et al., *op. cit.*; Axtell and Haskell, *op. cit.*). If these contentions are true, vegetation in habitats used by *P. s. illinoensis* should be managed to prevent thickening or sod formation. Compaction of sandy soils by human or natural means may be detrimental to the persistence of the frog.

We thank K. Brockmeier, Brockmeier Sod Farms, for allowing unrestricted access to his property to conduct this study. L. E. Brown, D. Moll, G. L. Paukstis, and G. B. Rose read drafts of this paper. C. H. Theiling allowed us to use Long Term Resource Monitoring program facilities. G. Kruse expedited the granting of permits necessary for this research. This research was supported by Illinois Department of Transportation contract 1-5-90179 with the Illinois Natural History Survey, J. K. Tucker and D. P. Philipp, Co-Principal Investigators.

Submitted by **JOHN K. TUCKER, JAMES B. CAMERER**, and **JAMES B. HATCHER**, Illinois Natural History Survey, 1005 Edwardsville Road, Wood River, Illinois 62095, USA.

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RANA CATESBEIANA (Bullfrog). **DIET**. True toads (Bufonidae) are infrequently reported in the diet of *Rana catesbeiana* (see review by Bury and Whelan 1984. U.S. Dept. Interior Fish and Wildlife Serv. Res. Pub. 155). On 31 July 1992 (2100 h), I collected two adult female bullfrogs (180 mm and 156 mm SVL, respectively) in a temporary roadside pool formed by overflow from a permanent irrigation pond, 12 km ESE of Hermanas, Luna County, New Mexico. Chorusing males of *Scaphiopus couchii*, *Spea multiplicata*, *Bufo cognatus*, *B. debilis*, and *Gastrophryne olivacea* were also present in this or nearby pools. The stomach of the larger bullfrog contained a *B. cognatus* (70 mm SVL), a *B. debilis* (42 mm SVL), and two tenebrionid beetles. The second frog had eaten an anuran, a mouse (both unidentifiable), a centipede (*Scolopendra* sp.), and several beetles. The *B. debilis* had been only recently ingested, whereas the *B. cognatus* probably had been eaten the previous night as it was partially digested.

Brown (1974. Southwest. Nat. 19:335–336), and Tucker and Sullivan (1975. Trans. Illinois State Acad. Sci. 68:167) noted that *Bufo* are apparently unpalatable to bullfrogs due to their toxic parotoid gland secretions which may cause regurgitation of the prey item or even immobilization of the predator. I shot both bullfrogs and therefore could not determine if the larger specimen exhibited symptoms of poisoning. It is noteworthy, however, that this frog, perhaps due to its large body mass, was able to consume the *B. debilis* after ingesting and partially digesting the *B. cognatus*. Similar observations of ingestion and digestion of *Bufo valliceps* by bullfrogs were reported recently by Platt and Fontenot (1993. Bull. Chicago Herpetol. Soc. 28:189–190).

The bullfrogs were collected under permit from the New Mexico Department of Game and Fish and are deposited (with stomach contents) in the Museum of Southwestern Biology, University of New Mexico (MSB 54999-55000). I thank W. G. Degenhardt, R. D. Jennings, and C. W. Painter for comments.

Submitted by **JAMES N. STUART**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

RANA TEMPORALIS (Golden Frog). **ECOLOGY**. Five adult (SVL 35.0–73.5 mm; mean = 53.80 ± SE 7.36 mm) *Rana temporalis* (Günther 1864) were collected 28 August 1990, from a forest in the vicinity of Tirunelveli (8° 25'-35' N, 77° 25'-35' E), Tamil Nadu State, India. The frogs were found on boulders along an intermittent stream bed. Two were males with enlarged testes (SVL 41.6 and 51.4 mm) and three were females with developed ovaries (SVL 67.5, 35.0 and 73.5 mm). Two of the females were gravid, one with SVL 67.5 mm contained 838 eggs (1.81% of body weight; mean = 0.07 mm, N = 3), another SVL 73.5 mm contained 1225 eggs (7.38% of body weight; mean = 0.14, N = 3).

Little data are available on the diet of this species. Abdulali (1962. J. Bombay Nat. Hist. Soc. 59:228–237) found three frogs, including a *Rana limnocharis*, in the stomachs of two *R. temporalis*. These *R. temporalis* contained food in their stomachs, constituting 0.20–1.46%, respectively, of the total body weight. A total of ten prey items were recovered from the five frogs reported here. Prey length ranged between 1.60–7.90 (mean = 4.66 ± SE 1.01) mm, and included two dipterans (including a stalk-eyed fly), two spiders, two cockroaches, two termites, and two unidentifled insects (one with eggs). The average number of prey items was 2 (SE 0.45, range 1–3 items).

Submitted by **INDRANEIL DAS**, Centre for Herpetology, Madras Crocodile Bank Trust, P.O. Bag 4, Mamallapuram, Tamil Nadu 603 104, India.

TESTUDINES

CHRYSEMYS PICTA BELLI (Western Painted Turtle). **FEEDING BEHAVIOR**. *Chrysemys picta* is typically omnivorous (e.g., Ernst and Barbour 1989. Turtles of the World. Smithsonian Institution Press, Washington, D.C., 313 pp.; Raney and Lachner 1942. Copeia 1942:83–85). Although there is anecdotal information concerning painted turtles feeding on crustacean zooplankton (e.g., Brown 1992. J. Elisha Mitchell Sci. Soc. 108:38–54), the importance of zooplankton to turtle diets is poorly known (Knight and Gibbons 1968. Amer. Midl. Nat. 80:558–562; MacCulloch and Secoy 1983. Can. Jour. Zool. 61:1499–1509). This report examines the behavior of juvenile *C. p. belli* feeding on cladoceran zooplankton.

A juvenile *C. p. belli* (60 mm plastron length) was collected on 9 April 1993 while it was basking on a log in the littoral zone of Lone Star Lake (a 79 ha reservoir 20 km from Lawrence, Douglas Co., Kansas). The turtle was brought back to the laboratory, placed in a 19 L aquarium filled to a depth of 15 cm, and left overnight. A student placed a mixture of zooplankton in the aquaria and noticed that the turtle began to feed immediately. On 17 April 1993, I conducted an experiment to look at feeding behavior. After withholding food for 24 h, I placed 50 lab-cultured Daphnia magna (2–2.5 mm) in the aquarium (density = 5/L; water temperature = 20.5°C). I then observed the turtle for 5 min and counted the number of attacks and the number of successful attacks. Ten minutes after the trial was completed, I added 15 additional prey items of the same size to estimate the distance at which the turtle could locate *Daphnia*.

The turtle reacted immediately to the presence of prey, and attacked 39 *Daphnia* during the 5 min trial with a capture success of 92% (feeding rate = 7.2/min). During a typical feeding sequence, the turtle located a *Daphnia* while swimming underwater, oriented toward it, swam to within ca. 2 cm, retracted the head, and immediately lunged the head forward (termed a "head-lunge" by Brown, op. cit.) to capture the prey. The mean distance at which the turtle located *Daphnia* was 10 cm (range 4–11.5 cm). The turtle was released at the site of capture on 18 April 1993. I thank Thomas Berendonk for his initial observations.

Submitted by **ERIC F. MAURER**, Department of Systematics and Ecology, University of Kansas, Lawrence, Kansas 66045, USA.

ERETMOCHELYS IMBRICATA (Hawksbill). **PREDATION**. Records of shark predation on sea turtles are scarce, especially on the hawksbill (Witzell 1983. FAO Fish. Sinop. 137, Rome, 77 pp.). In the tropical eastern Atlantic Ocean the tiger shark, *Galeocerdo cuvier*, is a major predator on hawksbills (Cadenat 1977. Inst. Fr. Afr. Noire 19 (1):274–294). Here we report on a hawksbill eaten by a tiger shark in the western Atlantic Ocean, between Nova Viçosa and the Parcel de Abrolhos (18° 00' S, 39° 02' W), Bahia, eastern Brazil. On 2 March 1994 a whole juvenile hawksbill with carapace 34 cm long and 27 cm wide (curved measurements) was found by fishermen in the stomach of a shark with body mass 120 kg (estimated total length 250 cm, diameter of the jaws 31 cm) caught near reefs at a depth of about 15-20 m. The Nova Viçosa fishermen informed us that they frequently find sea turtles in the stomachs of tiger sharks. Predation on hawksbills by tiger sharks may be common, since both the turtle and the shark are associated with reefs and shallows (Böhlke and Chaplin 1968. Fishes of the Bahamas and adjacent Tropical Waters, Livingston Publ., Wynnewood, 771 pp.; Witzell, *op. cit.*). The turtle carapace and pieces of the shark jaws are deposited at the Museu de História Natural, Universidade Estadual de Campinas (ZUEC 1693 and 1960).

We thank I. Verjovsky, A. Batalha, and P. Bonino for introducing us to the fishermen of Nova Viçosa, G. de Jesus for information on tiger sharks, M. Martins for comments on the manuscript, and the CNPq for financial support.

Submitted by **JOÃO LUIZ GASPARINI**, Departamento de Biologia, Universidade Federal do Espírito Santo, 29040-090 Vitória, Espírito Santo, Brazil, and **IVAN SAZIMA**, Departamento de Zoologia, Universidade Estadual de Campinas, 13081-970 Campinas, São Paulo, Brazil.

HYDROMEDUSA MAXIMILIANI (Maximilian's Snake-necked Turtle). **JUVENILE MORPHOLOGY**. *Hydromedusa maximiliani* occurs in southeastern Brazil, from Espírito Santo to São Paulo (Ernst and Barbour 1989. Turtles of the World. Smithsonian Institution Press, Washington, D.C. 313 pp), living in shallow streams inside rain forests in mountainous regions. Although adults have been described in detail (Ernst and Barbour, *op. cit.*) there is no information on hatchling or juvenile morphology of this species.

From June to December 1993, several specimens (hatchlings, juveniles and adults) of *H. maximiliani* were observed and measured in the wild at Carlos Botelho State Reserve, São Paulo (24° 03' S; 47° 59' W). The mean carapace length of hatchlings and juveniles was 89.7 mm (N = 33; SD = 20.7 mm; range = 47.3–122.5 mm) and their mean mass was 78.2 g (N = 33; SD = 40.6 g; range = 15.0–160.5 g). Adult carapace length was 160.1 mm on average (N = 52; SD = 17.9 mm; range = 129.0–197.5 mm). The plastron color of hatchlings and juveniles was either completely dark with a yellowish bridge or yellowish with peripheral dark spots. The carapace was uniformly brown or dark gray, with the lower border of marginal scutes yellowish, with black sutures in some animals. Maxilla and mandible were blackish or yellowish (in adults, jaws are cream to yellow). The iris was black in all individuals. Dorsal and lateral parts of the head and neck and dorsal side of the limbs were brown or olive gray; ventral side of the limbs was yellowish or cream colored, similar to adults.

The main feature of the carapace morphology in juveniles is the marginal scutes, which from the seventh scutes posteriorly makes a serriform shape of the carapace rim. This characteristic disappears as the animal grows. None of the traits that exhibit sexual dimorphism in adults (Guix et al. 1992. Bol. Asoc. Herpetol. Esp. 3:23–25) was found to differ between male and female juveniles.

I thank to Dr. Bento V. M. Neto and Instituto Florestal for logistical support, Dr. A. S. Abe and an anonymous reviewer for commenting on the manuscript, and CNPq (grant 132400/93-6).

Submitted by **FRANCO LEANDRO DE SOUZA**, Universidade Estadual Paulista, Departamento de Zoologia, 13506-900 Rio Claro, SP, Brazil.

HYDROMEDUSA TECTIFERA (South American Snake-necked Turtle). **PREDATION**. On 12 November 1990, I observed a giant otter, *Pteronura brasiliensis* eating an adult (25 cm carapace length) *Hydromedusa tectifera*. The animals were in a 10 X 15 m, 3 m deep pool formed by a moderately fast-flowing, 10 m wide

river located inside Tropical Atlantic Forest in southern São Paulo State, Brazil (25°03'S, 48°04'W), elevation 150 m. The otter held the turtle with its paws, keeping itself partly in the pool, while biting the anterior part of the turtle's carapace mainly around its borders. Upon detecting me, the otter left the carcass and disappeared. The turtle's head, neck and legs had been eaten. About 1.5 km downstream I found a turtle plastron 15 cm long which had been gnawed by an otter. There is no published information on the natural enemies of eastern Brazil *Hydromedusa* (Ernst and Barbour 1989. Turtles of the World. Smithsonian Inst. Press, Washington, D.C., 313 pp.). The rare giant otter has been observed, in the Atlantic Forest, to disturb dead leaves which accumulate at the bends of rivers, a favorite habitat for *H. tectifera* (pers. obs.). These observations suggest that otters may be an important predator of *H. tectifera* in southeastern Brazil.

I thank F. Olmos for comments on the first draft of the manuscript.

Submitted by **PAULO MARTUSCELLI**, Instituto Florestal de São Paulo, Calxa Postal 194, Peruibe, SP, 11750-970, Brazil.

LACERTILIA

CARLIA* CF. *FUSCA (NCN). **BEHAVIOR.** Although introduced *Carlia* cf. *fusca* (hereafter referred to as *Carlia*) has been implicated as a causal factor in declines of native scincids on Guam, Mariana Islands (Case and Bolger 1991. Evol. Ecol. 5:272–290; McCoid 1993. Herpetol. Rev. 24:1–17; Rodda and Fritts 1992. J. Herpetol. 26:166–174; Rodda et al. 1991. Micronesica 24:195–210), few corroborative data exist. Rodda and Fritts (*op. cit.*) presented retrospective museum data indicating a decline in native scincids while *Carlia* exhibited a reciprocal increase. These data, coupled with field observations, led these investigators to label *Carlia* as an aggressive kleptoparasite that displaced native scincids. It was routinely observed that *Carlia* would approach *Emoia caeruleocauda* that were foraging and either directly steal food or displace them from a foraging area. Herein, I provide additional observations and suggest that *Carlia* is also displacing native scincids by overt aggression and predation.

The most common native scincid on Guam is *Emoia caeruleocauda*; its distribution was probably island-wide at one time. Habitats with the current highest densities are primary and secondary forests, although enclaves of *E. caeruleocauda* can be found throughout the island in association with reasonably lush patio gardens and relict forest patches. In contrast, *Carlia* is now the most abundant scincid on Guam and is common in all habitats, including highly urbanized areas. *Emoia caeruleocauda* on Guam reaches a maximum SVL and mass of 54 mm, 3.3 g, while *Carlia* is longer and more robust (65 mm SVL, 6.3 g).

While trapping *Boiga irregularis* (brown tree snakes) on Guam (1989–1990), G. Rodda and I noticed that when adult *Hemidactylus frenatus* used as bait were released, they were frequently attacked by *Carlia*. On many other occasions, *Carlia* was observed on the forest floor chasing *E. caeruleocauda* for at least several meters. Often, *E. caeruleocauda* would escape *Carlia* by climbing vegetation where *Carlia* would rarely pursue higher than 1 m. On Guam, *E. caeruleocauda* appears to be more arboreal than on islands that lack *Carlia* (e.g., Rota, Mariana Islands) (pers. obs.). While using 'sticky traps' to collect lizards (Rodda et al. 1993. Herpetol. Rev. 24:99–100), I retrieved adult *Carlia* from traps with subadult *E. caeruleocauda* in their jaws on at least three occasions. It is likely the *Carlia* were attracted to the trapped skinks. On three occasions, the approach of an *E. caeruleocauda* to a *Carlia* in a basking site elicited a chase by the *Carlia*. In all three instances, the approaching *E. caeruleocauda* head-bobbed at a *Carlia* less than 1 m distant. The *Carlia* then head-bobbed and pursued. Despite being larger and heavier, size of the *Carlia* may not be important in agonistic interactions; a subadult *Carlia* (ca. 40 mm SVL) was observed chasing an adult male *E. caeruleocauda* (ca. 50 mm SVL). *Carlia* has also been seen to pursue, capture, and break off and devour a tail of an *E. caeruleocauda*. Pursuit of *Carlia* by *Emoia* has never been observed on Guam.

Recently, Petran et al. (1993. Science 259:354–358) concluded that behavioral exclusion by *Hemidactylus frenatus* affected local distributions of the native *Lepidodactylus lugubris*. McCoid and Hensley (1993. Herpetol. Rev. 24:87–88) augmented this portrait, using the same species, with observations of predation. It seems likely that local distributions of native scincids on Guam are being affected by introduced *Carlia* through similar competitive mechanisms. Behavioral exclusion, aggression, and predation on native scincids by *Carlia* probably all are important in altering the distribution of *E. caeruleocauda* on Guam.

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Submitted by **MICHAEL J. McCOID**, Division of Aquatic and Wildlife Resources, P. O. Box 2950, Agana, Guam 96910, USA. Current Address: Caesar Kleberg Wildlife Research Institute, Texas A&M University, Kingsville, Texas 78363, USA.

GALLOTIA GALLOTI (Canary Islands Lizard). **NECTAR FEEDING.** All four species of *Gallotia* (Lacertidae) currently living in the Canary Islands have been reported to eat a substantial amount of vegetable food (Kreffl 1950. Zool. Anz. 145(Suppl.):426–444; Molina-Borja 1991. Vieraea 20:1–9; Molina-Borja and Barquin 1986. Vieraea 16:233–236; Naranjo et al. 1991. Rev. Esp. Herp. 6:45–48). Plant parts consumed include leaves, flowers, flower buds, fruits and seeds, but there are no published accounts of any *Gallotia* feeding on nectar. In fact, observations of nectarivory in lizards are scarce and only a handful of species, mostly geckos, are known to regularly visit flowers to feed on nectar (Whitaker 1987. N. Z. J. Bot. 25:315–328). Here we report observations of nectar feeding in *G. galloti*, a medium-size lacertid (145 mm maximum SVL) inhabiting the westernmost islands of the Canarian archipelago (Barbadillo 1987. La Guia de Incafo de los Anfibios y Reptiles de la Peninsula Iberica, Islas Baleares y Canarias. Incafo, Madrid, 694 pp.).

Observations were conducted in Loro Parque, a privately owned zoological park located in the Punta Brava district of Puerto de la Cruz (Tenerife, Canary Islands). *Gallotia galloti* occur at relatively high densities throughout the park, but they are most conspicuous alongside the walkways in plots dominated by cacti and palm trees (*Phoenix* sp.), with no ground cover. The lizards are relatively undisturbed and tolerate close-range inspection by an observer. Adult *G. galloti* were seen carrying dates and other fruit in their mouths and occasionally picking up handouts provided by the visitors. Between 1400 and 1500 h on 23 August 1992 we noticed several *G. galloti* climbing through a hedgerow of crown of thorns (*Euphorbia milii* (= *E. splendens*), Euphorbiaceae), a thorned, woody-stemmed spurge from Madagascar. As many as five lizards were observed clinging to the shrubs, some ca. 50 cm from the

ground, sequentially lapping the nectar from several flowers. All the lizards foraging for nectar were juveniles; the dense branching and the sharp thorns may limit access to the flowers to all but the smallest individuals. Although *E. milii* is an exotic ornamental, the Canarian flora is rich in indigenous Euphorbiaceae that may be exploited as a natural source of nectar. Previous reports described adults of *G. galloti* feeding on leaves and flowers of *Euphorbia balsamifera* (Molina-Borja 1981. Doñana, Acta Vertebrata 8:43–78), adult *G. stehlini* from the island of Gran Canaria eating buds of *E. obtusifolia* and dry leaves of *Ricinus comunis* (Molina-Borja 1986. Vieraea 16:23–26), and juvenile *G. simonyi* from El Hierro Island taking flowers of *E. obtusifolia* (Machado 1985. Bonn. Zool. Beitr. 36:429–470).

Most observations of lizard nectarivory have occurred on islands (e.g., geckos: Whitaker, *op. cit.*; *Cnemidophorus murinus:* Dearing 1993. J. Herpetol. 27:111–114). Among lacertids, nectar feeding has been described in *Podarcis dugesii*, the Madeiran lizard (Elvers 1978. Botaniska Notiser 131:159–160), and *P. lilfordi* from Nitge (Menorca, Balearic Islands) (Brown et al. 1992. Oecologia 91:500–504). This note documents nectar feeding in another insular lizard species and reiterates the ability of *Gallotia galloti* to exploit a variety of food sources. We thank Matt Kramer, Statistical Research Division, U.S. Bureau of the Census, for his comments on this manuscript.

Submitted by **ENRIQUE FONT** and **MARIA JOSE FERRER**, Departamento de Biologia Animal, Universidad de Valencia, 46100 Burjasot, Valencia, Spain.

KENTROPYX ALTAMAZONICA (NCN). **COLOR**. Museu de Zoologia da Universidade de São Paulo, numbers 57891-57892. The "*calcarata*" group within the teiid genus *Kentropyx* have bright green stripes on the head and forebody at hatching which gradually become fainter with age. Adults are patterned with shades of brown, black, or grey which camouflage them among leaf litter (*K. calcarata* and *K. pelviceps*) or muddy river banks (*K. altamazonica*). In contrast, *K. striata*, which occurs in savannas and islands on the lower reaches of the Amazon River, has bright green coloration along the posterior dorsal surface of the body (Gallagher and Dixon 1992. Bolletin Museo regionale di Scienze naturali-Torino 10(1):125–171). Here we report the color of *K. altamazonica* which were encountered in flooded grasslands on islands in the central part of the Amazon River near Manaus Amazonas, Brazil (3°05'S, 60°00'W). At least 4 lizards were seen 16 June 1981 and two were shot with an air rifle and one was photographed to allow an accurate description of its color. The adult male had a brownish grey head with a faint green mid-dorsal stripe. Its flanks were grey with faint blue-green blotches. A rich brown dorsolateral stripe commencing at the hind legs broke up into large black blotches at mid-body and faded out so that it was barely distinguishable at the level of the forelimbs. Its extension to the eye was only discernable from tiny black irregularly distributed black blotches and a faint green stripe along its lower edge. The dorsal surface of the hindlimbs was brown with white blotches. The dorsal surface of the body lacked stripes and blotches. The nape of the neck was sky blue, becoming lime green at the level of the forelimbs. The lime green extended onto the tail about as far as the knee reaches when the hindlimb is extended backwards. The rest of the tail was light brown.

Scalation indicated that the lizard was definitely a *K. altamazonica* or, if a new cryptic species, at least a member of the "*calcarata*" species group. The sky blue on the nape of the neck has no equivalent among other species of *Kentropyx* but the generally uniform green dorsal surface is much more similar to that of *K. striata* than other members of the "*calcarata*" group. We speculate that the occupation of islands with flooded grassland habitat has resulted in color convergence between some populations of *K. altamazonica* and *K. striata*.

Submitted by **WILLIAM E. MAGNUSSON** and **ALBERTINA P. LIMA**, Departamento de Ecologia, Instituto Nacional de Pesquisas da Amazônia, CP 478, 69011-970 Manaus AM, Brazil.

PSAMMODROMUS ALGIRUS (Large Psammodromus). **PHONOTAXIS**. *Psammodromus algirus* is distributed throughout Iberia and parts of south western France. It is a medium-sized lacertid (8 cm SVL) with a robust body and large head (Arnold and Burton 1978. A Field Guide to the Reptiles and Amphibians of Britain and Europe. Collins, London, 272 pp.).

Seven adult male *P. algirus* were released into an enclosure at the Museo de Ciencias Naturales Field Station at El Ventorrillo, Madrid province (1000 m above sea level) in the Sierra de Guadarrama, central Spain. This enclosure was 65 m^2 and contained vegetation typical of the area (brooms; *Cytisus scoparius*, *Genista florida* and 'jara,' *Cistus laurifolius*) and in all respects reflected a normal habitat for *P. algirus*. These lizards are known to eat a wide variety of insects (Salvador 1985. Guia de Campo de los Anfibios y Reptiles de la Peninsula Iberica, Islas Baleares y Canarias. Unigraf, Madrid, 212 pp.) and I observed them eating two of the commoner species of orthopterans found at the site: *Oedipoda caerulescens* (Acrididae) and *Steropleurus stali* (Tettigoniidae). *S. stali* is a plump, flightless bushcricket about 2.5 cm long. The song of a male *S. stali* is a chirp of 252–305 ms duration with a frequency of 9700 Hz (Hartley et al. 1974. Anim. Behav. 22:382–389). The sound pressure level is about 70 dB at one meter and there is an inter-chirp interval of four to eight seconds (Bateman, unpubl.).

The following experiments were done on successive days in September 1993. All trials were carried out twice. 1) A recorded song of a male *S. stali* was played from a speaker situated in the center of the enclosure at ground level. 2) The song was played from the center of a bush approximately 30 cm above the ground. 3) This experiment was the same as experiment 1 except that a clear plastic container with four non-calling female *S. stali* was placed on top of the speaker. 4) This experiment was the same as experiment 2 except that a clear plastic container with four non-calling female *S. stali* was placed on top of the speaker. 5) The plastic container with the females (silent) was placed on the ground without the speaker. 6) Finally, three singing males were put in a small gauze box placed at ground level. In all cases speaker and/or bushcrickets were left for 30–40 minutes and if no reaction by the lizards was noted in that time the trial was terminated.

In experiments 1, 2, 3, and 4 there was a positive reaction to both trials. A male *P. algirus* was observed circling in towards the speaker when it was at ground level and circling in towards the base of the bush when the speaker was playing from above ground. The movement of these lizards appeared to be quite different from their behavior at other times when they were mostly making short runs into, or out of, shade. The lizard approached the speaker with the female bushcrickets on it more closely (within 10 cm) than the speaker without the bushcrickets (>20 cm). There was no reaction

to experiment 5 with the silent females and there was a single reaction to experiment 6 when a male again circled the gauze box and approached to within 10 cm before retreating again.

Several studies show that acoustic signallers run the risk of exposing themselves to predators, including calling gryllid crickets being hunted by herons (Bell 1979. New York Ent. Soc. 87(2):126–127) and calling tropical bushcrickets being hunted by bats (Belwood and Morris 1987. Science 238:64–67). In Britain the frequency range of the call of the bushcricket *Leptophyes punctatissima* overlaps that of shrews (Soricidae) and four species of foliage-gleaning bats and thus all are potential predators (Robinson 1990. *In* W. J. Bailey and D. C. F. Rentz (eds.), The Tettigoniidae: Biology, Systematics and Evolution, pp. 112–119. Crawford House Press, Bathurst).

These experiments demonstrated that an acoustic signal from a *Steropleurus* is evidently used by eavesdropping *P. algirus*. *Psammodromus algirus*, therefore, appear to use auditory cues in hunting acoustic prey, and may also use visual or olfactory cues at closer range.

I thank the directors of the El Ventorrillo Field Station, Drs. Alfredo Salvador, Luisma Carrascal, and Eulalia Moreno.

Submitted by **PHILIP W. BATEMAN**, Animal Behaviour Research Group, Department of Biology, The Open University, Walton Hall, Milton Keynes, MK7 6AA, U.K.

TUPINAMBIS TEGUIXIN (Tegu Lizard). **AQUATIC BEHAVIOR.** On 5 November 1993, while snorkeling in search of freshwater fish in a mountain creek pool about 300 m elevation at Ilhabela State Park, São Sebastião Island, Brazil (23°50'S, 45°20'W), I discovered a sleeping *Tupinambis teguixin sebastiani* Müller 1968 (Die Herpetofauna der Insel von São Sebastião, Saarbrucken Zeitung Verlag u. Druckrei Gmb H., 68 pp.) about 1 m TL and 30 cm SVL, on the bottom of the pool, 1.8 m deep. The lizard lacked the enlarged neck typical of adult males and showed a bright, new skin. The pool was located in rugged terrain covered by old second-growth and primary Atlantic forest, and was fed by a clear water creek 4-6 m wide that ran over sand and rocks. The day was sunny with air temperatures between 25–30°C, and water temperature between 15–18°C.

After watching the lizard for 10 min, without it ever moving, I lightly pulled its tail, which caused it to open its eyes, stare at me for a while, and close them again. After another pull, the lizard walked toward a pile of dead leaves that accumulated on the otherwise sand and gravel bottom and partly buried itself. Moments later it walked along the bottom towards an emerging rock, which it climbed until its head was above the water. I avoided further disturbing the lizard, and after about 10 min of watching me, it dove towards a submersed rock 1.1 m deep and laid itself by the rock's side, closing its eyes and not moving for 12 min, when it again walked along the bottom and positioned itself under a rock 0.5 m under the water. After another 10 min, disturbed by my attempts of following and measuring it, the tegu dove to deeper waters, this time half walking, half swimming with lateral strokes of its tail, and I was unable to find it again.

Why a tegu, regarded as a terrestrial lizard, would choose to sleep underwater in a cold stream (despite using a wet suit I was shivering after half an hour in the water) has no easy explanation. Although it may be a strategy to evade predators, the many boulders on shore would also offer shelter. It seems unlikely that the lizard was just taking a break after searching for food, as the stream was notably poor on fish, crabs, and crayfish that could be prey for a tegu. Perhaps the cold water offered a thermally comfortable environment for the lizard, but as the area is entirely covered by humid forest, other opportunities for finding adequate microclimates were likely at hand.

Although my observations may be regarded only as an oddity (but see Achaval and Langguth 1976. Boletin Soc. Zool. Uruguay 2:107) I am aware of two instances of tegus being caught in gill nets set at sea near the rocky shores of São Sebastião Island.

Submitted by **FABIO OLMOS**, Parque Estadual de Ilhabela, r. Morro da Cruz 608, Ilhabela, SP, 11630-000, Brazil.

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SERPENTES

CROTALUS VIRIDIS (Western Rattlesnake). **PHENOLOGY.** Mating in spring is apparently infrequent for *Crotalus viridis*. Spring mating has been reported in *Crotalus v. oreganus* along the Pacific Coast (Fitch 1949. Amer. Midl. Nat. 41:513–579; Fitch and Glading 1947. California Fish and Game 33:103–123; Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind. 2nd ed. Univ. California Press, Berkeley, 1533 pp.) and was assumed to occur in populations of *C. v. oreganus* in Idaho (Diller and Wallace 1984. Herpetologica 40:182–193). However, many investigations involving intensive observation of free-ranging snakes have described midsummer to early fall matings in most *C. viridis* subspecies (see Ernst 1992. Venomous Reptiles of North America, Smithsonian Institution Press, Washington. 236 pp.).

During an investigation of activity patterns and feeding habits of a population of *Crotalus viridis viridis* in the Nebraska Sand Hills (42°15'0"N, 101°07'3"W), males were observed accompanying females five times during the mid-summer to early autumn mating period. Male-male combat was observed once on 1 Au-

gust 1991. Field observations were not conducted between 17 May and 16 July 1991 .

A single episode of courtship was observed in the spring on 6 April 1991 (this was not an observation of "commonly occurring spring mating" as misquoted by Duvall et al. 1992. *In* J. A. Campbell and E. D. Brodie, Jr., (eds.), Biology of the Pitvipers, pp. 321–336, Selva, Tyler, Texas). The female snake measured 835 mm SVL and weighed 428 g while the male measured 730 mm SVL and weighed 338 g. This pair of snakes was found 1 m from a prairie dog (*Cynomys ludovicianus*) burrow, containing the sloughed skin of the courted female. Ten meters away another fresh slough, that of the courting male, was found in the entrance of another prairie dog burrow. Dorsal patterns of slough and snake were matched for positive identification. The position of the skins suggested that they were sloughed as the snakes exited the burrows. Several loops of the male's body fell over the female's body and his tail was curled under and around the female's tail effecting cloacal apposition. The male intensively courted the female for 3.25 h. Sequence and duration of male courtship behaviors were consistent with those described previously for western rattlesnakes (Ernst, *op. cit.*; Hayes 1986. J. Herpetol. 20:246–249). The female was quiescent throughout the period of observation and did not tongue-flick, although she did exhibit the tail-whipping behavior described previously by Hayes (*op. cit.*). The snakes were courting when discovered at 1600 h and continued until 1915 h (sunset), at which time both snakes were collected. The snakes were not copulating at the time of collection. Eversion of the male's hemipenes was not observed, nor was intromission positively determined nor excluded.

Taken as a whole these observations suggest that most mating activity in this population occurs from mid-summer to early fall, consistent with previously published descriptions of mating phenology in this subspecies. While the observation of spring courtship may represent a relatively unusual event in this population, it raises the possibility that mating may occur in the spring as well as the fall for some populations of prairie rattlesnakes. Additionally, this observation agrees with the hypothesis that ecdysis and release of pheromones signalling female sexual receptivity may be linked.

Financial support of this research was provided by the University of Nebraska at Omaha Department of Biology, the University of Nebraska Graduate Student Research Fund, and by Tom and Caroline Holycross.

Submitted by **ANDREW T. HOLYCROSS**, Department of Zoology, Arizona State University, Tempe, Arizona 85287-1501, USA.

DIADOPHIS PUNCTATUS MODESTUS (San Bernardino Ringneck Snake). **DIET**. In April, 1992, a single individual of *Diadophis punctatus modestus* was collected from under a small board just off Redlands Boulevard, 1.0 mile south of San Timoteo Canyon Road in northern Riverside County, California. Examination in the laboratory revealed the snake had consumed a single individual of *Anniella pulchra* (California legless lizard). The lizard was swallowed head-first and most of the anterior portion of the body (including the skull, cervical vertebrae, and perhaps 1 or 2 anterior trunk vertebrae) was digested. Extremely degraded fragments of the left dentary and one or two cervical vertebrae remained. The snake measured 288 mm SVL (360 mm total length), the lizard approximately 130 mm (total remaining length). Neither specimen was weighed. To our knowledge, *Diadophis* has not previously been reported to prey upon *Anniella*. Specimens are curated in the University of California Museum of Paleontology (*Diadophis*, UCMP 140630; *Anniella*, UCMP 140631).

Submitted by **CHRISTOPHER J. BELL**, Department of Integrative Biology and Museum of Paleontology, University of California, Berkeley, California 94720, USA, and **JAMES K. BOWDEN**, Division of Earth Sciences, San Bernardino County Museum, 2024 Orange Tree Lane, Redlands, California 92374, USA.

HIEROPHIS VIRIDIFLAVUS (Western Whip Snake). **COMMUNAL NESTING**. Seasonal aggregations are sometimes observed in viperid (Duvall et al. 1985. Natl. Geogr. Res. 1:80–111; Fitch 1960. Univ. Kansas Mus. Nat. Hist. Publ. 13:85–288; Fukada 1962. Bull. Kyoto Gakugei Univ. Ser. B Math. Nat. Sci. 20:12–19) and colubrid (Henderson et al. 1980. Milwaukee Publ. Mus. Contrib. Biol. Geol. 32:1–9; Swain and Smith 1978. J. Herpetol. 34:175–177) snakes. Aggregations often occur before parturition (i.e., birthing rookeries, see Duvall et al., *op. cit.*). Unfortunately, little is known about the number of individuals in aggregations nor the site fidelity of aggregations across years.

Here we document an aggregation of female *Hierophis viridiflavus* in central Italy. Observations occurred about 50 km N Rome, Oriolo Romano, Province of Viterbo, 450 m above sea level. The site was characterized by a partially dilapidated stony box (5.0 x 3.5 m) bordered by rich spiny vegetation (mainly *Rubus* sp.) and completely surrounded by cultivated fields. We initiated the study in September 1989 when we captured 23 newborn *H. viridiflavus* (18–22 cm total length) in an area of 50 m^2. We regularly surveyed this site during late June 1990, 1991, and 1992. This aggregation of newborn snakes was noteworthy because 1) this species is not commonly encountered in cultivated habitats at the study area, and 2) the number of neonate snakes was greater than could be produced by a single female. Female *H. viridiflavus* normally produce 3–7 eggs per year in this area.

In June 1990 we collected five gravid female *H. viridiflavus* (Table 1). Snakes were measured (total length), marked (using scale clip procedures described in Brown and Parker 1976. J. Herpetol. 10:247–249), radiographed to obtain clutch size information, and released at the site of capture. No males, non-gravid females, nor juveniles were found.

During June 1991 we captured six gravid female *H. viridiflavus*, but still no males, non-gravid females, nor juveniles were observed. Gravid females were processed as before. Four of the six snakes were recaptures.

During June 1992, we captured two gravid females, while no other snakes were observed. Both females had been marked in 1990 and recaptured in 1991. This suggests that reproduction is annual at this site. There was a strong positive correlation between clutch size and female total length($r = 0.82$, Y-intercept = -18.41, slope = 0.198, $F = 22.80$, $P = 0.0005$). Because growth was slow fecundity also increased slowly as snakes aged (see Table 1).

All female *H. viridiflavus* marked during this study were observed near the stony box only during June (i.e., shortly before egg laying; see Luiselli and Rugiero 1990. Herpetozoa (Wien) 2:107–115), while absent during the rest of the year. On the other hand, juveniles were observed from late August to mid September (i.e., shortly after egg hatching), but not seen during other parts of the year.

Based on our observation we formulated preliminary conclusions: 1) The study site was regularly visited by female snakes for egg laying, possibly due to conditions favorable for incubation; 2) Nest site fidelity was high. Females used the site for egg laying in different years. We do not know if females stay in the area of the stone box during other times of the year. A telemetric study could resolve this question. If females use the area around the box only for nesting several questions remain unanswered. 1) How far do females travel from habitats used in other times of the year? 2) What conditions make the area around the stony box suitable as a nest site? 3) How do females navigate and recognize the nest site? We continue to study this phenomenon in order to answer these and other questions. Recently we discovered two other communal nest sites within a few kilometers of the study site, suggesting that communal nesting may be relatively common for *H. viridiflavus*.

TABLE 1. Gravid *Hierophis viridiflavus* captured during June 1990, 1991, and 1992, respectively. Individuals are distinguished by letters (A, B, C, etc.). TL = total length (in cm); CS = clutch size.

Snake	1990		1991		1992	
	TL	CS	TL	CS	TL	CS
A	117.2	4	118.0	4	118.7	4
B	121.3	6				
C	115.8	5	116.9	5		
D	112.9	4	113.4	5	115.2	5
E	126.4	7	127.1	7		
F			110.0	3		
G			115.5	5		

Submitted by **MASSIMO CAPULA** and **LUCA LUISELLI**, Dipartimento di Biologia Animale e dell'Uomo, Università di Roma "La Sapienza," via A. Borelli 50, 00161 Roma, Italia.

LEPTOPHIS MODESTUS (NCN). **MORPHOLOGY**. On 19 July 1991, I collected a specimen of *Leptophis modestus* in Honduras, Departamento Comayagua, Cordillera de Montecillos, 1.6 km N, 0.2 km E Cerro San Juanillo, elevation 1960 m (14°29'44" N, 87°53'03" W). It was active in vegetation 4 m above ground in cloud forest dominated by the trees *Quercus skinneri, Matudea trinervia, Persea americana* var. *nubigena*, and *Podocarpus oleifolius*.

The snake was an adult male, SVL 1201 mm, tail 802 mm, 386 g. Nasal was divided, loreal absent (fused with prefrontal which borders 2nd and 3rd supralabials) preoculars 2; postoculars 2; temporals 1-2; supralabials 8-8 with 4th and 5th entering orbit; infralabials 11-10; ventrals 177; anal divided; dorsal scales in 15-15-11 rows with 1st row smooth and all others strongly keeled. Dorsum was uniform green; keels dirty yellow-green, most conspicuous at midbody; overlapped edges of dorsals blue, posterior tips black; lower, anterior dorsals yellow; midbody and posterior dorsals with black lower and trailing edges; skin between dorsal scales black. Venter bright yellow anteriorly grading to bluish and to pale green posteriorly. Rostral and supralabials yellow with green upper edges; a short, narrow postocular black bar on the upper edges of supralabials 7 L and 7-8 R; chin yellow cream grading to bright yellow on throat; iris golden with brown medial horizontal bar; tongue metallic blue.

Absence of a loreal plate and the presence of two preoculars instead of one adds to the range of morphologic variation reported for this species (Fig. 1). The specimen keys out to *Leptophis ahaetulla occidentalis* (using Peters and Orejas-Miranda. 1970. U.S. Natl. Mus. Bull. No. 297, 347 pp.). While the presence or absence of a loreal is a key character in diagnosing species, most of the species of *Leptophis* (= *Thalerophis*) exhibit variation (Oliver 1948. Bull. Amer. Mus. Nat. Hist. 92(4):160–280). This locality extends the known range 45 km to the east (Wilson et. al. 1986. Milwaukee Publ. Mus. Contr. Biol. and Geol. No. 66, 8 pp). Identification was verified by Gustavo A. Cruz and the specimen is deposited at Universidad Nacional Autonoma de Honduras (UNAH 2747).

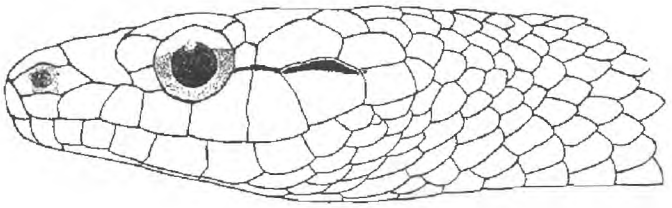

FIG. 1. Profile of *Leptophis modestus*, UNAH 2747.

Submitted by **PETER HOLM**, Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, USA.

LIASIS OLIVACEUS (Olive Python). **ALBINISM**. In March 1993 a female albino olive python (*Liasis olivaceus*) was collected near Woodcutters Mine, 80 km south of Darwin, Northern Territory, Australia. The animal is being kept alive at the Northern Territory University. The mining site is surrounded by small rocky hills dominated by eucalypt forest. At capture this animal was a subadult, ca. 1.5 m SVL (Shine 1992. Australian Snakes: A Natural History. Reed Books Pty Ltd., Balgowlah, 223 pp.). This python bears the pink eyes and tongue characteristic of an albino; however, the dorsal surface is cream-colored rather than white. The ventral surface is white. This is the first known report of albinism in this species.

Submitted by **GAVIN S. BEDFORD**, School of Biological Sciences, Northern Territory University, P.O. Box 40146 Casuarina, N.T., Australia, and **ROB COWARD**, Karama, N.T., Australia.

NERODIA SIPEDON SIPEDON (Northern Water Snake). **FEEDING**. On 24 June 1993 a young-of-the-year northern water snake was observed hunting smallmouth salamander (*Ambystoma texanum*) larvae in a small, shaded, temporary pond near the Charleston side-channel reservoir (NW1/4 Sec. 24, T11N, R9E), Coles Co., Illinois.

The pond (about 10 m long, 1 m wide, and 30 cm deep) was located at the bottom of a forested east-facing slope. A variety of aquatic macrophytes, insects, and *Bufo* larvae also inhabited the pond, but no fish were present.

I observed the water snake for about fifteen minutes. The snake waited at the water's surface supported by the vegetation. Its head

was raised above the water in an s-shape. When the smallmouth salamander larva broke the surface of the water to breath, the snake would strike and grab the salamander. The snake then proceeded to eat it. The foraging sequence was repeated about three times before the larva was captured.

Submitted by **MALCOLM L. McCALLUM**, Department of Zoology, Eastern Illinois University, Charleston, Illinois 61920, USA.

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RHADINAEA LACHRYMANS (NCN). **PREY.** The diet of *Rhadinaea lachrymans* consists mainly of frogs, toads, and salamanders, in addition to terrestrial egg masses of frogs (*Eleutherodactylus*) and salamanders (Myers 1974. Bull. Amer. Mus. Nat. Hist. 153(1):81). Here, we report an observation of *R. lachrymans* feeding on *Bolitoglossa engelhardti*. On 16 April 1992, a juvenile female (MZFC 5967: SVL = 307 mm, TL = 421 mm) was collected by Adolfo Navarro in a cloud forest at El Chiquihuite (Volcan Tacana), Union Juarez, Chiapas, México, 2150 m elevation. Inspection of the stomach contents revealed a *Bolitoglossa engelhardti* (MZFC 5968: SVL = 29.6 mm). The body was intact and its tail had been broken into three pieces (1.6 + 7.6 + 19.0 = 28.2 mm).

Sazima et al. (1992. Herpetol. Rev. 23:120–121) suggested the small size, elongated head, and slender body of *Rhadinaea bilineata* make it well-suited for foraging on amphibians. The same generalizations apply to *Rhadinaea lachrymans*.

We thank Adolfo Navarro, Oscar Flores, and Mario Mancilla for comments on this manuscript and assistance in the field work. Financial assistance was provided by the Direccion General de Asuntos del Personal Academico (DGAPA) proyect IN201789.

Submitted by **FERNANDO MENDOZA QUIJANO** and **ALEJANDRA RENDON ROJAS,** Museo de Zoologia, Facultad de Ciencias, U.N.A.M. Apdo. Postal 70-399, México D.F. 04510, México.

SISTRURUS CATENATUS CATENATUS (Eastern Massasauga). **REPRODUCTION.** Throughout its range, the eastern massasauga (*Sistrurus catenatus*) demonstrates considerable variation in reproductive potential (Reinert 1981. Amer. Midl. Nat. 105:393–395). Mean litter size, for example, ranges from 5.3 in Texas to 11.1 in Wisconsin (Seigel 1986. Biol. Cons. 35:333–346). There are no published accounts of litter characteristics for the species in Ohio, where it is restricted to a few populations and currently recognized as a species of special interest, due largely to habitat loss.

Two pregnant *S. catenatus* were captured on 29 June 1993 at Area C of Wright-Patterson Air Force (WPAFB), Greene Co., Ohio. They were retained in individual enclosures heated to 27°C at the Dayton Museum of Natural History.

On 7 August 1993, the smaller female (500 mm SVL) gave birth to 9 neonates (6 male, 3 female) and 1 infertile ovum. Snout-vent length ranged from 154–190 mm (mean = 182.11, SD = 12.046). Body weight ranged from 7–8 g (mean = 7.556, SD = 0.527). On 21 August 1993 the larger female (565 mm SVL, 209 g) gave birth to 9 males. Snout-vent length ranged from 215–230 mm (mean = 223.667, SD = 5.788). Body weight ranged from 11–14 g (mean = 12.00, SD = 1.118). All neonates were sexed by probing. The offspring of the second female were significantly longer and heavier than those of the first female (ANOVA for SVL: df = 1, f = 87.015, p< 0.01; ANOVA for mass: df = 1, f = 116.364, p< 0.01 respectively). When the effects of body size were removed, there were no significant differences in weight between litters (ANCOVA for mass: df = 1, f = 0.099, p = 0.7571).

The mean litter size of these females is comparable with the mean reported for an Illinois population (mean = 9.5, SD = 3.209; Wright 1941. Amer. Midl. Nat. 25: 659–672). In terms of size at birth, these two litters were similar to the Pennsylvania population with mean for Ohio of 202.9 mm (SD = 23.26) and 206.2 mm (SD = 32.524) for Pennsylvania (Swanson 1933. Copeia 1933:37). Seigel and Fitch (1985. J. Anim. Ecol. 54:497–505) found litter size variation was higher within than between populations, and attributed this to female size differences. In the present case, the adult females differed in body size, but litter size did not. The variation in size at birth, however, could be attributed to difference in female body size, with larger females having larger neonates.

All animals used in this study were marked, photographed for dorsal pattern recognition, and released at the maternal capture site.

I thank T. Lucas and the rest of WPAFB Office of Environmental Management for logistic support and permission to capture rattlesnakes. I am grateful to the Dayton Museum of Natural History for providing lab space. This study was conducted under contract with The Nature Conservancy.

Submitted by **GREGORY J. WATKINS-COLWELL**, Department of Biological Sciences, Edison State Community College, 1973 Edison Drive, Piqua, Ohio 45356, USA.

Scaphiopus h. holbrookii (Eastern Spadefoot). Illustration by Mark C. Erelli.

GEOGRAPHIC DISTRIBUTION

Herpetological Review publishes brief notices of new geographic distribution records in order to make them available to the herpetological community in published form. Geographic distribution records are important to biologists in that they allow for a more precise determination of a species' range, and thereby permit a more significant interpretation of its biology.

These geographic distribution records will be accepted in a **standard format** only, and all authors must adhere to that format, as follows: SCIENTIFIC NAME, COMMON NAME (for the United States and Canada as it appears in Collins 1990, *Standard Common and Current Scientific Names for North American Amphibians and Reptiles, Third Edition*, Herp. Circ. 19:1–41; for México as it appears in Liner 1994, *Scientific and Common Names for the Amphibians and Reptiles of Mexico in English and Spanish*, Herp. Circ. 23:1–113), LOCALITY (use metric for distances and give precise locality data), DATE (day-month-year), COLLECTOR, VERIFIED BY (*cannot* be verified by an author — curator at an institutional collection is preferred), PLACE OF DEPOSITION (where applicable, use standardized collection designations as they appear in Leviton et al., 1985, *Standard Symbolic Codes for Institutional Resource Collections in Herpetology and Ichthyology*, Copeia 1985(3):802–832) and CATALOG NUMBER (required), COMMENTS (brief), CITATIONS (brief), SUBMITTED BY (give name and address in full — spell out state names — no abbreviations).

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Recommended citation for new distribution records appearing in this section is: Painter, C. W., and C. M. Milensky. 1993. Geographic Distribution. *Crotalus tigris*. Herpetol. Rev. 24:155–156.

CAUDATA

AMPHIUMA MEANS (Two-toed Amphiuma). USA: FLORIDA: Taylor Co: Tide Swamp Unit, Big Bend Wildlife Management Area, SE 1/4 Sec. 1, Verified by David L. Auth. Florida Museum of Natural History (UF 91101). One adult caught during drift-fence study in fresh water marsh. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians in Florida. Part Three. The Amphibians. Second ed. Windward Publishing, Miami, Florida. 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

AMPHIUMA PHOLETER (One-toed Amphiuma). USA: FLORIDA: Taylor Co: Spring Creek Unit, Big Bend Wildlife Management Area. 1992. Kristin N. Wood. Verified by David L. Auth. Florida Museum of Natural History (UF 91094). Adult caught in drift-fence array. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part Three. The Amphibians. Second ed. Windward Publishing, Miami, Florida. 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). CANADA: NOVA SCOTIA: Cumberland Co: Emery Meadows, 45°38'30"N, 63°46'W. 16 May 1993. S. C. Friet and M. D. MacDonald. Verified by John Gilhen. Nova Scotia Museum of Natural History (NSM 10248). County record. One adult female found guarding nest of 25 eggs; located in sphagnum and grass along NE edge of small pool at head of Emery Brook, NW corner of Emery Meadows Bog; Ducks Unlimited Canada marsh adjacent to Trans-Canada Highway 114, 45°41'30"N; 63°43'W. 26 June 1993. S. C. Friet and M. D. MacDonald. Verified by J. Gilhen. NSM 10249. One female guarding a nest of 15 eggs; found at the base of a spruce snag in sphagnum at NE edge of marsh. These two records greatly expand the known range in Nova Scotia and may offer a possible range link with New Brunswick.

Submitted by **STEPHEN C. FRIET** and **MICHAEL D. MACDONALD**, Department of Biology, Life Sciences Centre, Dalhousie University, Halifax, Nova Scotia B3H 4J1, Canada.

HEMIDACTYLIUM SCUTATUM (Four-toed Salamander). USA: VIRGINIA: Scott Co: Jefferson National Forest, beaver meadow along Glady Fork, ca. 10 km SE Norton, 2900 feet (884 m). All captures were made at a drift fence/pitfall array operated by the Division of Natural Heritage, Virginia Department of Conservation and Recreation: 11–23 June 1993 (Carnegie Museum of Natural History, CM 140195), 23 June–22 July 1993 (Virginia Museum of Natural History, VMNH 6537) and 22 July–18 August 1993 (VMNH 6538). All verified by Joseph C. Mitchell. New county record; first record from extreme SW Virginia (Tobey 1985, Virginia's Amphibians and Reptiles: A Distributional Survey. Publ. Virginia Herpetol. Soc., Purcellville, Virginia. 114 pp.) Extends range in Virginia ca. 200 km W of record from Buffalo Mountain, Floyd County (J. C. Mitchell and C. A. Pague, unpubl. data) and partially fills in the range gap between Virginia and Kentucky depicted in Conant and Collins (1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **STEVEN M. ROBLE** and **CHRISTOPHER S. HOBSON**, Division of Natural Heritage, Virginia Department of Conservation and Recreation, 1500 East Main Street, Suite 312, Richmond, Virginia 23219, USA.

NOTOPHTHALMUS VIRIDESCENS PIAROPICOLA (Peninsula Newt). USA: FLORIDA: Taylor Co: Spring Creek Unit, Big Bend Wildlife Management Area. 1992. Kristin N. Wood. Verified by David L. Auth. Florida Museum of Natural History (UF 91099). Specimen caught in drift-fence array. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part Three. The Amphibians. Second ed. Windward Publishing, Miami, Florida, 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

ANURA

BUFO PUNCTATUS (Red-spotted Toad). USA: NEW MEXICO: Roosevelt Co: Melrose Bombing Range, 21.6 km S and 8.8 km E

of Tolar, Sheep Canyon. 7 August 1993. C. M. McCain and J. N. Stuart. University of New Mexico Museum of Southwestern Biology (MSB 56517–18, adults), USNM 335065 (lot of 3 tadpoles); 28 August 1993. D. T. Scott. MSB 56477 (lot of 3 juveniles). All verified by W. G. Degenhardt and S. W. Gotte. New county record; extends range SE in New Mexico from known localities in Quay and De Baca counties (W. G. Degenhardt, C. W. Painter, and A. H. Price, *in litt.*) to the western escarpment of the Llano Estacado (Southern High Plains). The paucity of records from on the Llano Estacado proper in eastern New Mexico and western Texas (Dixon 1987, Amphibians and Reptiles of Texas. Texas A & M Press, College Station. 434 pp.) suggests a general lack of suitable habitat for *B. punctatus*, except at the margins of the plain.

Submitted by **JAMES N. STUART** and **DAMIEN T. SCOTT**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA.

HYLA CHRYSOSCELIS (Cope's Gray Treefrog). USA: FLORIDA: Taylor Co: Tide Swamp Unit, Big Bend Wildlife Management Area, NW 1/4 Sec. 28, T8S, R7E. 9 November 1993. Kristin N. Wood. Verified by David L. Auth. Florida Museum of Natural History (UF 91095). One adult caught in a hardwood swamp adjacent to a drift-fence array. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part Three. The Amphibians. Second ed. Windward Publishing, Miami, Florida, 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

RANA CAPITO AESOPUS (Florida Gopher Frog). USA: FLORIDA: Taylor Co: Perry, jct. Osceola Street and Plantation Road, SE 1/4 Sec. 30, T4S, R8E. 30 May 1994. Harry J. Dutton. Verified by David L. Auth. Florida Museum of Natural History (UF 91093). Specimen caught in swimming pool. New county record (Ashton and Ashton 1988, Handbook of Reptiles and Amphibians of Florida. Part Three. The Amphibians. Second ed. Windward Publishing, Miami, Florida, 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

RANA CATESBEIANA (Bullfrog). USA: ILLINOIS: DeKalb Co: Kishwaukee River, City of DeKalb, 41°55.8'N, 88°45.8'W. 10 June 1993. H. D. Walley. Verified by Tom Near. Northern Illinois University (HDW-NIU 1510–1). County record; fills gap between Lee and Cook counties (Smith 1961, The Amphibians and Reptiles of Illinois. Bull. Illinois Nat. Hist. Surv. 28:1–298); LaSalle Co: Paw Paw Creek, Paw Paw, 41°55.8'N, 88°45.8'W, 12 August 1994, H. D. Walley. HDW-NIU 1518. Verified by Tom Near. County record; fills gap between Knox, Fulton and McClean counties (Smith, *op. cit.*).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois University, DeKalb, Illinois 60115, USA.

RANA PALUSTRIS (Pickerel Frog). USA: ILLINOIS: Calhoun Co: Madison Creek, Tepen Hollow Road (NE 1/4 Sec. 17, T12S, R2W). 2 September 1994. J. K. Tucker and J. B. Camerer. Verified by C. Phillips. Illinois Natural History Survey (INHS 11353); Middle Fork of Fox Creek, along Bess Hollow Road, ca. 2.8 km NW jct. with Rt. 96 (NE 1/4 Sec. 1, T9S, R3W). 6 October 1994. M. Redmer. Verified by M. J. Blanford. Department of Zoology, Southern Illinois University at Carbondale (SIU-C H4738–4739). New county record. Jersey Co: Chautauqua (NE 1/4 Sec. 13, T6N, R12W). 3 May 1962. R. Brown. Verified by M. J. Blanford. Department of Biological Sciences, Southern Illinois University at Edwardsville (SIU-E 1598); Chautauqua Resort (Sec. 13, T6N, R12W). 17 April 1968. D. Thompson. Verified by M. J. Blanford. SIU-E 1591. Field tag erroneously places this locality in Madison County; Grafton, 1.8 km N and 1 km E of Rt. 100 and River Road (NE 1/4 Sec. 10, T6N, R12W). 17 April 1971. L. J. LaJeone. Verified by M. J. Blanford. SIU-E 1601–1602; Wooded stream parallel to Rosedale Road, behind Mississippi River State Waterfowl Management Area Headquarters (NW 1/4 Sec. 21, T21N, R1W). 6 October 1994. M. Redmer. Verified by M. J. Blanford. SIU-C H 4740. New county record; Madison Co: base of limestone bluff at edge of creek (Sec. 8, T6N, R10W). 4 April 1967. S. L. Smith. Verified by M. J. Blanford. SIU-E 1592; Alton, 0.4 km N of Mississippi River in swampy area (probably Sec. 5, T5N, R10W). 8 May 1963. G. Thompson. Verified by M. J. Blanford. SIU-E 1592. New county record; These three county records fill a gap in the Illinois distribution of *Rana palustris* between Pike and Greene counties on the north to St. Clair County on the south (Smith 1961, The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28:1–298; Redmer and Ballard 1995, Herpetol. Rev. 26(1):49–53). With the exception of Jackson County, the documented range of this species now includes all Mississippi River border counties from Adams County on the north to Alexander County on the south. All live specimens collected in 1994 had golden yellow flash coloration on their thighs (Redmer and Mierzwa 1994, Bull. Chicago Herpetol. Soc. 29:21–30).

Submitted by **MICHAEL REDMER**, Department of Zoology, Southern Illinois University at Carbondale, Carbondale, Illinois 62901, USA, **JAMES B. CAMERER** and **JOHN K. TUCKER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 4134 Alby Street, Alton, Illinois 62002, USA, and **JEFFERY CAPPS**, Department of Biological Sciences, Southern Illinois University at Edwardsville, Edwardsville, Illinois 62026, USA.

RANA PIPIENS (Northern Leopard Frog). USA: ARIZONA: Mohave Co: Truxton Spring at Truxton Wash. NE 1/4 SE 1/4 Sec. 26, T24N, R13W. 3 August 1994. J. Eric Wallace. Adult male and female. Verified by James E. Platz. Arizona State University Lower Vertebrate Collection (ASU 30214–30215). Only Northern Leopard Frogs found to date in Mohave County. These frogs represent an isolated population 160 km WNW of the nearest known extant population in Arizona.

Submitted by **J. ERIC WALLACE**, Arizona Game and Fish Department, Nongame Branch, 2221 West Greenway Road, Phoenix, Arizona 85023, USA.

SPEA MULTIPLICATA (New Mexico Spadefoot). USA: COLORADO: El Paso Co: erosion control pond adjacent to West Fork of Red Creek, U.S. Army Fort Carson Military Reservation, 13 km NE Penrose, 38°32'55"N, 104°55'58"W. 7 June 1991. Richard L. Bunn. Verified by Hobart M. Smith. UCM photograph 92. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver. 131 pp.). Northernmost known locality in the Arkansas River drainage.

Submitted by **RICHARD L. BUNN**, Wildlife Branch, DECAM, AFZC-ECM-NR, Building 302, Fort Carson, Colorado 80913-5000, USA.

CROCODYLIA

PALEOSUCHUS TRIGONATUS (Schneider's Smooth-fronted Caiman). GUYANA: Region I (NORTH-WEST DISTRICT): Almond Beach near Waini Point (8°23.969'N, 59°45.286'W; cf. Waini Point at 8°23.738'N, 59°48.786'W). 7 July 1993. P. C. H. Pritchard. Verified by David Auth. 109 cm (total length) adult male (tip of tail missing) emerged from sea and rested on beach. Photographed and videotaped. Kodachrome slide deposited in Florida Museum of Natural History (PCHP 002 October 1994). Animal was underweight but seemingly healthy; it was released in a freshwater pond behind the beach. First marine record for species; closest records are from Lower Demerara and Lower Essequibo rivers, Guyana (Medem 1983, Crocodylia de Sur America, Vol. 2:95); closest Venezuela record is from Angostura, Lower Orinoco (Lichtenstein and von Martens 1856, Nomenclatur Reptilium et Amphibium Musei Berolinensis, iv: 48. Berlin).

Submitted by **PETER C. H. PRITCHARD**, Florida Audubon Society, 400 Hwy 436 #200, Casselberry, Florida 32707, USA.

TESTUDINES

APALONE SPINFERA (Spiny Softshell). USA: ILLINOIS: LaSalle Co: 1.75 miles (2.8 km) W Utica, Pecumsaugan Creek, SW 1/4 Sec. 7 T33N, R2E. 10 May 1992, H. D. Walley. Verified by Tom Near. Northern Illinois University (HDW-NIU-1493). County record; fills gap between DeKalb, Kendall and Putnam counties (Smith 1961, The Amphibians and Reptiles of Illinois. Bull. Illinois Nat. Hist. Surv. 28:1–298).

Submitted by **HARLAN D. WALLEY**, Department of Biology, Northern Illinois, DeKalb, Illinois 60115.

CHELYDRA SERPENTINA SERPENTINA (Common Snapping Turtle). USA: COLORADO: Arapahoe Co: South Platte Park, NW 1/4 Sec. 32, T5S, R68W. 17 June 1993. Raymond H. Sperger. Verified by Lauren Livo. UCM color slide 87 of a female that had just laid a total of ca. 50 eggs. First county record and maximum number of eggs recorded in Colorado (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife. Denver. 131 pp.).

Submitted by **RAYMOND H. SPERGER**, Theo. H. Carson Nature Center, 7301 South Platte River Parkway, Littleton, Colorado 80120-2968, USA; **ROSANNE HUMPHREY**, **DAVID CHISZAR**, and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

CHRYSEMYS PICTA BELLII (Western Painted Turtle). USA: COLORADO: Arapahoe Co: South Platte Park on Mineral Avenue between Lake 5 and Cooley Lake, S side of west-bound lanes, SE 1/4 Sec. 30, T5S, R68W. 2 August 1992. Raymond H. Sperger. Verified by Lauren Livo. UCM 57019. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver. 131 pp.).

Submitted by **RAYMOND H. SPERGER**, Theo L. Carson Nature Center, 7301 South Platte River Parkway, Littleton, Colorado 80120-2968, USA; **ROSANNE HUMPHREY**, **DAVID CHISZAR**, and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

DERMATEMYS MAWII (Central American River Turtle). MEXICO: QUINTANA ROO: La Union, Hondo River, 6 km NE La Union town (17°53'47"N, 88°52'34"W). 24 June 1994. Collected by M. Suárez and H. Bahena Basave. Verified by O. Flores-Villela. Museo de Zoologia del Centro de Investigaciones de Zuintana Roo (MZCIQRO 339). New record to Quintana Roo, Yucatan Peninsula, that verifies suspected distribution in Quintana Roo state (Iverson 1992, A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, Indiana. 363 pp.)

Submitted by **HUMBERTO BAHENA-BASAVE**, Dirección de Recursos Naturales, Centro de Investigaciones de Quintana Roo, Chetumal, Quintana Roo 77000, México.

GRAPTEMYS PSEUDOGEOGRAPHICA OUACHITENSIS (Ouachita Map Turtle). USA: MISSISSIPPI: Sunflower Co: Quiver River, 0.8 river km NE of Big Sunflower and Quiver Rivers confluence, Sec. 25, T19N, R4W. 1 September 1994. K. J. Killgore and J. Morrow. Verified by Neil H. Douglas. Northeast Louisiana Univ. Mus. of Zool. (NLU 70490). This voucher represents a new county record and confirms presumed distribution in this area (Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **STEVEN G. GEORGE**, **JACK KILLGORE**, and **SHERRY L. HARREL**, U.S. Army Engineer Waterways Experiment Station, ER-A, 3909 Halls Ferry Road, Vicksburg, Mississippi 39180-6199, USA.

KINOSTERNON SUBRUBRUM (Eastern Mud Turtle). USA: ILLINOIS: Pulaski Co: 2 mi E Karnak. 12 August 1976. L. M. Page and M. A. Morris. Verified by Christopher A. Phillips. Illinois Natural History Survey (INHS 10304). First record for county. Pope Co: 1 mi W New Liberty on Unionville Road, in flooded hardwood forest in a foot of water at the base of a young tree adjacent to a remnant bald cypress swamp. 17 April 1994. K. Jacobson. Southern Illinois University at Carbondale Herpetology Collection (SIUC R-2689, adult male, carapace length 10.2 cm); identifiable plastron and other hard parts on a road adjacent to the same swamp. 2 June 1994. R. A. Brandon and M. Redmer. SIUC R-2672. First voucher specimens from a specific locality in county, although there have been other indications this turtle occurs in there. Cagle (1946, Am. Midl. Nat. 36:690–691) mentioned finding this species in "... a drainage ditch south of Dixon Springs, Illinois," and Smith (1961, Illinois Nat. Hist. Surv. Bull. 28:1–298) placed this locality in Pope County. There is another Pope County specimen (Carnegie Museum of Natural History 108574) collected by Edward Moll in 1971, but it lacks specific locality information.

Submitted by **RONALD A. BRANDON**, Department of Zoology, Southern Illinois University at Carbondale, Carbondale, Illinois 62901, USA, and **KRISTINE JACOBSON**, 276 Cedar Creek Road, Makanda, Illinois 62958, USA.

STAUROTYPUS TRIPORCATUS (Mexican Giant Musk Turtle). MEXICO: QUINTANA ROO: La Union, Hondo River, 6 km NE La Union town (17°53'47"N, 88°52'34"W). 28 January 1993. Collected by H. Bahena Basave. Verified by O. Flores-Villela. Museo de Zoologia del Centro de Investigaciones de Zuintana Roo (MZCIQRO 340). New record for Quintana Roo, Yucatan Peninsula, that verifies and confirm a doubtful record in central part of Quintana Roo state (Iverson 1992, A Revised Checklist with Distribution Maps of the Turtles of the World. Richmond, Indiana. 363 pp.)

Submitted by **HUMBERTO BAHENA-BASAVE**, Dirección de Recursos Naturales, Centro de Investigaciones de Quintana Roo, Chetumal, Quintana Roo 77000, México.

TERRAPENE CAROLINA CAROLINA (Eastern Box Turtle). USA: ILLINOIS: Scott Co: NE 1/4 Sec. 20, T14N, R12W, Winchester Road, 0.2 km N Winchester. 21 August 1994. J. K. Tucker. Verified by Chris Phillips, Illinois Natural History Survey (INHS 11322). New county record, extends documented range 28 km NE of nearest previous documented record (Smith 1961, The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28:1–298) and east of undocumented record for Morgan County (Applegate 1975, Trans. Illinois State Acad. Sci. 68:17). However, location of the latter record is uncertain as township and range cited in paper is actually located in Montgomery County from which Smith (*op. cit.*) reported documented records of the species.

Submitted by **JOHN K. TUCKER** and **JAMES B. CAMERER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 4134 Alby Street, Alton, Illinois 62002, USA.

TERRAPENE ORNATA ORNATA (Ornate Box Turtle). USA: ILLINOIS: Calhoun Co: NE 1/4 Sec. 27, T8S, R2W, 3.7 km N Kampsville on Illinois Rt. 100. 24 May 1994. J. K. Tucker. Verified by C. Phillips, Illinois Natural History Survey (INHS 11323). New county record.

Submitted by **JOHN K. TUCKER** and **JAMES B. CAMERER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 4134 Alby Street, Alton, Illinois 62002, USA.

AMPHISBAENIA

RHINEURA FLORIDANA (Florida Worm Lizard). USA: FLORIDA: Taylor Co: Athena, Josh Ezel Grade. August 1993. Cindy Hunt. Verified by David L. Auth, Florida Museum of Natural History (UF 91089). Collected while excavating in a scrub oak habitat. New county record (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida. Part Two. Lizards, Turtles and Crocodilians. Windward Publishing, Miami, Florida, 191 pp.) and partially fills the range hiatus as shown in Conant and Collins (1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third Ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). Extends the range of this species 40 km NW of the westernmost locality in the state (Meylan 1984, Herpetol. Rev. 15:23–24). There is a record from Liberty County, which is farther west than Taylor County, but it is believed to be based on unreliable data (David L. Auth, pers. comm.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

LACERTILIA

ANOLIS DISTICHUS (Bark Anole). USA: FLORIDA: Monroe Co: Key Vaca, Marathon, small woodland near Mile Marker 50 on U.S. Rt. 1. 29 July 1994. Gregory J. Watkins-Colwell. Verified by E. E. Williams. Animal photographed in the wild. KU 221730. Several adults and juveniles found on utility poles and tree trunks near open areas of the woodland. County and locality record for this introduced species (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida. Part Two: Lizards, Turtles and Crocodilians. Windward Publ., Miami, Florida, 191 pp.; Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Submitted by **GREGORY J. WATKINS-COLWELL**, Department of Biology, Sinclair Community College, 444 West Third Street, Dayton, Ohio 45402, USA, and **KELLIE A. WATKINS-COLWELL**, 2323 North Knoll Drive, Beavercreek, Ohio 45131, USA.

ANOLIS JACARE (NCN). VENEZUELA: ESTADO TACHIRA: Betania, 2150 m. 2 February 1979. Jaime Péfaur. Colección de Vertebrados de la Universidad de Los Andes (CVULA 896). First State record; Estado Merida: Monte Zerpa, 2200 m., 26 October 1990. Amelia Díaz de Pascual. CVULA 1698. Northernmost record for the species. Both verified by Juan Elías García Pérez. These specimens were identified as *Phenacosaurus niceforoi* in CVULA collection and most probably correspond to the localities, without vouchers, of "región de Betania, hacia el Páramo de Tamá, Estado Táchira" and "cercanías de la Ciudad de Mérida" reported for this species by Péfaur and de Pascual (1982, Actas VIII Congreso Latinoamericano de Zoología, Oct. 1980, Mérida, Venezuela:241). Táchira records extends known range ca. 190 km SW of the type locality (Boulenger 1903, Ann. Mag. Nat. Hist. [7]11:482; Williams et al. 1970, Breviora 353:1–15). Based on current evidence, the presence of *Phenacosaurus niceforoi* in the Venezuelan Andes is rejected, and the statement that this taxon is shared by the Cordillera de Mérida and the Colombian Cordillera Oriental (Péfaur and de Pascual 1984:249, 251) remains to be supported.

Submitted by **ENRIQUE LA MARCA**, Universidad de Los Andes, Facultad de Ciencias Forestales, Instituto de Geografía y Conservación de Recursos Naturales, Apartado Postal 116, Mérida 5101-A, Venezuela.

ANOLIS LAEVIVENTRIS (White Anole). MÉXICO: HIDALGO: Municipality of San Bartolo Tutotepec (20°25'N, 98°12'W) near Condege. 22 May 1970. J. Gimate. Verified by Ticul Alvarez Solórzano. Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional (ENCB 6377). First state record; extends known range at least ca. 165 km NW from former records in central Veracruz (Xalapa, Actopan, Mirador, Orizaba, Xicaltepec, and Xico; Smith and Taylor 1950, Bull. U.S. Natl. Mus. 199:1–253).

Submitted by **ADRIAN-NIETO MONTES DE OCA**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045-2454, USA, and **FERNANDO MENDOZA-QUIJANO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, México, Distrito Federal 04510, México.

ANOLIS LEMURINUS BOURGEAEI (Bourgeae's Ghost Anole). MÉXICO: HIDALGO: Municipality of San Bartolo Tutotepec, 3 km N San Bartolo Tutotepec (20°25'N, 98°12'W), 1190 m elev. 3 April 1979. A. Flores. Verified by Ticul Alvarez Solórzano. Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional (ENCB 10881). First state record; extends known range at least ca. 190 km NW from former records in central Veracruz (Huatusco and Orizaba; Smith and Taylor 1950, Bull. U.S. Natl. Mus. 199:1–253).

Submitted by **ADRIAN-NIETO MONTES DE OCA**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045-2454, USA, and **FERNANDO MENDOZA-QUIJANO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, México, Distrito Federal 04510, México.

ANOLIS SERICEUS (Silky Anole). MÉXICO: HIDALGO: Municipality of Huejutla de Reyes, 1 km S Tehuetlán (21°02'N, 98°31'W), 390 m elev. 14 May 1980. M. Rodríguez. Verified by Ticul Alvarez Solórzano. Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional (ENCB 11005). First state record. Lee (1980, Copeia 1980:310–320) provided locality records of the species for the states of Tamaulipas, San Luis Potosí, and Veracruz; Lee (1983, Cat. Am. Amphib. Rept. 340.1–340.2) included eastern Hidalgo and Puebla in his distribution map for the species, but did not provide locality records for these states. This record partly fills the hiatus between Xilitla, San Luis Potosí, ca. 60 km to the northwest, and records from Veracruz to the east and southeast (Lee 1980, *op. cit.*); Municipality of Actopan, 5 km E Actopan (20°16'N, 98°56'W). 8 March 1972. L. Ruiz. Verified by Ticul Alvarez Solórzano. ENCB 7301–04. Extends distribution at least ca. 260 km NW from former records in central Veracruz (vicinity of Córdoba, Lee 1980, *op. cit.*), and represents the inlandmost record for the species in the northern portion of its range.

Submitted by **ADRIAN-NIETO MONTES DE OCA**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045-2454, USA, and **FERNANDO MENDOZA-QUIJANO**, Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Apartado Postal 70-399, México, Distrito Federal 04510, México.

CNEMIDOPHORUS SEXLINEATUS (Six-lined Racerunner). USA: FLORIDA: Taylor Co: Tide Swamp Unit, Big Bend Wildlife Management Area, NW 1/4 Sec. 33, T8S, R7E. 6 October 1993. Kristin N. Wood. Verified by David L. Auth. Florida Museum of Natural History (UF 91098). Specimen caught in drift-fence array. New county record (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida. Part Two. Lizards, Turtles & Crocodilians. Second ed. Windward Publishing, Miami, Florida, 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

COLEONYX BREVIS (Texas Banded Gecko). USA: NEW MEXICO: Lincoln Co: White Sands Missile range, Oscura Mountains, 9 km NE jct. Range Road 7 and Range Road 12; 4.6 km N Range Road 12 to Schist Site; ca. 40 air km E and 35 air km S San Antonio (33°32'10.5"N, 106°20'03.2"W). 30 May 1994. L. K. Kamees and D. W. Burkett. Verified by C. W. Painter. University New Mexico Museum Southwestern Biology (MSB 57268). County record (Degenhardt et al. The Amphibians and Reptiles of New Mexico. In press).

Submitted by **LARRY K. KAMEES** and **DOUGLAS W. BURKETT**, Cortez III Service Corporation, P.O. Box L, White Sands Missile Range, New Mexico 88002-9998, USA.

EUMECES FASCIATUS (Five-lined Skink). USA: FLORIDA: Taylor Co: Spring Creek Unit, Big Bend Wildlife Management Area. 1992. Kristin N. Wood. Verified by David L. Auth. Florida Museum of Natural History (UF 91096). Specimen caught in drift-fence array. New county record (Ashton and Ashton 1991, Handbook of Reptiles and Amphibians of Florida. Part Two. Lizards, Turtles & Crocodilians. Second Ed. Windward Publishing, Miami, Florida, 191 pp.).

Submitted by **KRISTIN N. WOOD**, Florida Game and Fresh Water Fish Commission, 663 Plantation Road, Perry, Florida 32347, USA.

EUMECES FASCIATUS (Five-lined Skink). USA: ILLINOIS: Jersey Co: S 1/2 Sec. 12, T6N, R13W, under tin, at Brussels Ferry, 3.8 km WNW Grafton, near Ill. Rt. 100. 18 May 1994. J. K. Tucker and J. B. Hatcher. Verified by C. Phillips. Illinois Natural History Survey (INHS 11412). New county record.

Submitted by **JOHN K. TUCKER** and **JAMES B. HATCHER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 3134 Alby Street, Alton, Illinois 62002, USA.

HEMIDACTYLUS MABOUIA (Tropical House Gecko). USA: FLORIDA: Monroe Co: Key Vaca, Marathon, under debris in a small woodland near mile marker 50 on U. S. Rt. 1. 25 July 1994. Gregory J. Watkins-Colwell. Verified by J. T. Collins. Juvenile caught under plywood in wooded area. KU 221732. This is a new island record, but not a county record, for this species (Meshaka et al. 1994, Herpetol. Rev. 25:80–81).

Submitted by **GREGORY J. WATKINS-COLWELL** and **KELLIE A. WATKINS-COLWELL**, Biology Department, Sinclair Community College, Dayton, Ohio 45402, USA.

HEMIDACTYLUS TURCICUS (Mediterranean Gecko). USA: FLORIDA: Escambia Co: Santa Rosa Island, Sabine Yacht Club, T3N, R29W. 6 August 1994. John B. Jensen and Jodie B. Jensen. Florida Museum of Natural History (UF 91969); Okaloosa Co: Ft. Walton Beach, apartment complex on South Avenue, 0.5 km west of Eglin Parkway, Sec. 1, T2S, R24W. 23 October 1994. LeAnn West. UF 94152–53. All verified by Paul Moler. New county records for this introduced species (Conant and Collins 1991, A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.). Populations in both counties assumed to be well established based on individuals of various size classes observed.

Submitted by **JOHN B. JENSEN**, Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, USA.

SCELOPORUS GRACIOSUS GRACIOSUS (Northern Sagebrush Lizard). USA: COLORADO: Grand Co: 1.3 km W and 1.3 km S Radium, SE 1/4 SW 1/4 Sec. 28, T1S, R82W. 16 September 1994. G. Horstman. Verified by L. J. Livo. UCM Color Slide 89. New county record; extends range ca. 14 km ENE of nearest records at McCoy, Eagle County (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Div. Wildl. Publ., Denver. 131 pp.).

Submitted by **GREG HORSTMAN**, Colorado Division of Wildlife, 711 Independent, Grand Junction, Colorado 81505, USA.

SCELOPORUS UNDULATUS (Fence Lizard). USA: ILLINOIS: Madison Co: NE 1/4 Sec. 10, T5N, R10W, on rocks near bluff, 0.6 km W Alton, near Ill. Rt. 100. 3 October 1994. J. K. Tucker. Verified by C. Phillips. Illinois Natural History Survey (INHS 11408). New county record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 3134 Alby Street, Alton, Illinois 62002, USA.

SERPENTES

CLONOPHIS KIRTLANDII (Kirtland's Snake). USA: ILLINOIS: Shelby Co: NW 1/4 Sec. 1, T10N, R6E, under cardboard in relictual prairie between ICG railroad and U.S. Rt. 45, 1.2 mi N Sigel. 12 May 1994. J. K. Tucker. Verified by C. Phillips. Illinois

Natural History Survey (INHS 11351). Collected under Illinois Dept. Cons. Permit 94-3S. New county record; fills gap in range between Effingham and Coles counties (Brown et al. 1975, Herpetol. Rev. 6:78–79; Smith 1961, The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28:1–298).

Submitted by **JOHN K. TUCKER** and **JAMES B. CAMERER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 4134 Alby Street, Alton, Illinois 62002, USA.

COLUBER CONSTRICTOR FLAVIVENTRIS (Eastern Yellowbelly Racer). USA: COLORADO: Arapahoe Co: South Platte Park, SE 1/4 Sec. 30, T5S, R68W. June 1991. Raymond H. Sperger. Verified by Lauren Livo. UCM color slide 88. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver. 131 pp.).

Submitted by **RAYMOND H. SPERGER**, Theo L. Carson Nature Center, 7301 South Platte River Parkway, Littleton, Colorado 80120-2968, USA; **ROSANNE HUMPHREY**, **DAVID CHISZAR**, and **HOBART M. SMITH**, University of Colorado Museum, Boulder, Colorado 80309-0218, USA.

COLUBER CONSTRICTOR FOXII (Blue Racer). USA: ILLINOIS: Greene Co: SE 1/4 Sec. 15, T10N, R10W, DOR Ill Rt. 108, 1.1 km W junction U.S. Rt. 67. 7 October 1994. J. K. Tucker. Verified by C. Phillips. Illinois Natural History Survey (INHS 11421). New county record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 3134 Alby Street, Alton, Illinois 62002, USA, and **GARY L. PAUKSTIS**, 2489 Quail Court, Aurora, Illinois 60504, USA.

ELAPHE GUTTATA EMORYI (Great Plains Rat Snake). USA: ILLINOIS: Jersey Co: NE 1/4 Sec. 14, T6N, R12W, DOR Ill. Rt. 100, 0.3 km E Rice Hollow Road; NE 1/4 Sec. 21, T6N, R11W, DOR Ill. Rt. 100, 0.3 km E Elsah Road. 1 October 1994. J. K. Tucker. Both verified by C. Phillips. Illinois Natural History Survey (INHS 11444 and 11445, respectively). Previously reported by Smith (1961, The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Surv. Bull. 28:1–298) from Jersey County based on Principia College specimen (number 490) collected in 1949 which I reexamined to confirm identity. First listed specimen reported herein extends range of subspecies, which is listed as endangered in Illinois, 3.1 km WNW of Principia record.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 3134 Alby Street, Alton, Illinois 62002, USA.

HETERODON NASICUS (Western Hognose Snake). USA: ILLINOIS: Jo Daviess Co: Savanna Army Depot, SW1/4 Sec. 24, T26N, R1E, at the junction of River Road and Burning Grounds Road. 12 July 1994. M. McCallum and E. Moll. Illinois Natural History Survey (INHS color slide 1994-1). Verified by C. Phillips. New county record (male, length = 470 mm).

Submitted by **MALCOLM L. McCALLUM**, 103 Rex Drive, Collinsville, Illinois 62234, USA.

LAMPROPELTIS TRIANGULUM (Milk Snake). USA: ARIZONA: Cochise Co: 31°35'40"N 109°14'19"W. 23 June 1994. Andrew T. Holycross (Arizona Game and Fish scientific collecting permit HLYCR000038). Arizona State University Animal Care Facility (living specimen). Specimen captured in a drift fence/funnel trap array in a tobosa grassland. First county record and first verifiable record in Arizona south of the Mogollon Rim (Williams 1988. Systematics and Natural History of the American Milk Snake, *Lampropeltis triangulum*, 2nd ed. Milwaukee Publ. Mus. 176 pp.). Extends range ca. 320 km south from the nearest known specimen to the north (Charles Lowe, pers. comm.) and ca. 225 km west from the nearest New Mexico locality (Degenhardt et al., in press. The Amphibians and Reptiles of New Mexico. Univ. of New Mexico Press, Albuquerque). The specimen is a male, 70.4 g body weight, 522 mm SVL, 613 mm total length. Confirms unpublished record for same location (UAZ 50283 photographic voucher). James P. Tracey and Dale T. Tracey. 15 July 1988. Verified by Charles Lowe. The Tracey specimen is also a male, 7.8 g body weight, 273 mm SVL, 314 mm total length. Measurements made on 9 September 1988.

Our specimen not only confirms the Tracey record but may lend credence to Yarrow's (1875. Rep. Geog. Geol. Expl. Surv. W 100th Mer., Engineer. Dept. U.S. Army 5:509-584) records from "Camp Apache, Ariz" as discussed by Williams (*op. cit.*). Although Williams (*op. cit.*, p. 92) did not verify these records and suggested that they may be *L. pyromelana*, he later (*op. cit.*, p. 93) states that he has "no reason to doubt" their authenticity. Apache (Cochise Co., Arizona) is apparently the "Camp Apache" of Yarrow (*op. cit.*) and lies ca. 16 km NE of our collection locality.

Another specimen was found subsequent to the previous records in the Animas Valley of New Mexico, ca. 30 km SE of the Holycross specimen. USA: NEW MEXICO: Hidalgo County: 2.4 km N of Cloverdale. 13 September 1994. Jeff Gee and Barney Tomberlin. Verified by Charles Painter. Museum of Southwestern Biology MSB 58186 (shed skin). Found in grassland beneath a board. First county record, first record for the Animas Valley, and fills a gap in the known distribution between the Arizona specimens and the nearest records in New Mexico (see above). The Peloncillo Mountains of Arizona and New Mexico separate the San Bernardino Valley (Arizona specimens cited above) and the Animas Valley (this specimen).

Submitted by **ANDREW T. HOLYCROSS**, Department of Zoology, Arizona State University, Tempe, Arizona 85827-1501, USA, and **CECIL SCHWALBE**, National Biological Survey, Cooperative Park Studies Unit, University of Arizona, Tucson, Arizona 85721, USA.

MICRURUS BROWNI (Brown's Coral Snake). MÉXICO: QUINTANA ROO: La Union, under litter, 0.15 km N La Union town (17°53'47"N, 88°52'34"W). 17 December 1992. Museo de Zoologia del Centro de Investigaciones de Quintana Roo (MZCIQRO 206); 8 km N La Union Town. 6 January 1993. MZCIZRO 209; La Union town. 3 February 1993. MZCIQRO 229; near Hondo River, 4 km NE La Union town. 20 February 1993. MZCIQRO 245; La Union town. 29 March 1993. MZCIQRO 253. All collected by Humberto Bahena Basave and verified by O. Flores-Villela. New record for Quintana Roo state and the Yucatan Peninsula (Lee 1980, Univ. Kansas Nat. Hist. Mus. Misc. Publ. 67:1–75).

Submitted by **HUMBERTO BAHENA-BASAVE**, Dirección de Recursos Naturales, Centro de Investigaciones de Quintana Roo, Chetumal, Quintana Roo 77000, México.

OPISTHOTROPIS KUATUNENSIS (Striped Stream Snake). HONG KONG TERRITORY: LANTAU ISLAND (Tai Yue Shan): Tei Tong Tsai, ca 300 m elev. Michael Lau. 19 May 1993. Verified by Stephen Karsen. Museum of Comparative Zoology (MCZ A 11991). First island voucher. Known distribution peculiarly dis-

continuous: known from southeastern (Fujian, Jiangxi, and Zhejiang) and south-central (Guangxi) China, but not Hunan or Guangdong in between (Zhao and Adler 1993, Herpetology of China. SSAR Contrib. Herpetol. 10:248). Also well known from the Hong Kong New Territories adjacent to Guangdong, but not Hong Kong Island (Karsen, Lau, and Bogadek 1986, Hong Kong Amphibians and Reptiles. Urban Council, Hong Kong: 100). Karsen et al. (idem.) mention Lantau Island, but Karsen reports (pers. comm.) that was a sight record.

Submitted by **JAMES LAZELL**, The Conservation Agency, 6 Swinburne Street, Jamestown, Rhode Island 02835, USA.

PITUOPHIS CATENIFER DESERTICOLA (Great Basin Gopher Snake). USA: COLORADO: Grand Co: 0.7 km W and 1.0 km S Radium, NW 1/4 SW1/4 Sec. 27, T1S, R82W. 16 September 1994. G. Horstman. Verified by L. J. Livo. UCM Color Slide 90. New county record; extends range ca. 41 km NE of nearest record near Eagle, Eagle County, in the Colorado River drainage and is the easternmost record of this subspecies in the state (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver. 131 pp.).

Submitted by **GREG HORSTMAN**, Colorado Division of Wildlife, 711 Independent, Grand Junction, Colorado 81505, USA.

RHINOCHEILUS LECONTEI TESSELLATUS (Texas Longnose Snake). USA: OKLAHOMA: Texas Co: 0.45 km W Guymon. 15 October 1973. Collector unknown. Verified by Richard L. Holland. UCM 57039. First county record (Webb 1970, Reptiles of Oklahoma. Univ. Oklahoma Press, Norman, 370 pp.).

Submitted by **KURT SCHAEFER**, Department of Biology, Panhandle State University, Goodwell, Oklahoma 73939, USA; **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA; and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

SISTRURUS CATENATUS TERGEMINUS X EDWARDSII (Massasauga). USA: COLORADO: El Paso Co: school yard at Edison. September-October 1987 or 1988. Stephen T. Pegler. Verified by Richard L. Holland. UCM 57099. First county record (Hammerson 1986, Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver. 131 pp.). The first author's experience indicates that until 1989 the species was moderately common in El Paso County, but thereafter became rare and now approaches extirpation in that general area. As an isolated population (Conant and Collins 1991, A Field guide to Reptiles and Amphibians of Eastern and Central North America. Third ed. Houghton Mifflin, Boston, Massachusetts. 450 pp.) it merits the protection already afforded by the Colorado Division of Wildlife, and stronger measures should be considered.

Submitted by **STEPHEN T. PEGLER**, Denver Seminary, 3401 South University Boulevard, No. 202, Englewood, Colorado 80110, USA; **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado, 80309-0345, USA; and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado, 80309-0334, USA.

TANTILLA CUCULLATA (Blackhood Snake). USA: TEXAS: Terrell Co: ca. 8 mi E Sanderson on U.S. Rt. 90 (AOR). 8 June 1991. Observed and photographed by John C. Fraser. KU Color Slide 11135. County record; fills hiatus between Pecos and Val Verde (as mapped by Dixon 1987, Amphibians and Reptiles of Texas. Texas A&M Univ. Press, College Station, 434 pp); Val Verde Co: 3 mi S Loma Alta on U.S. Rt. 277 (AOR). 4 June 1991. Observed and photographed by John C. Fraser. KU Color Slide 11134. Both verified by John E. Simmons. Although not a county record, both this and the Terrell County specimen exhibit narrowly broken neck rings (characteristic of *Tantilla cucullata*), and the Val Verde County example, from an area on the E edge of the range of *T. diabola*, makes untenable the continued recognition of the Devil's River Blackhead Snake as a distinct taxon.

Submitted by **KELLY J. IRWIN**, 2218 West 2nd Street, Topeka, Kansas 66606, USA; and **JOSEPH T. COLLINS**, Natural History Museum, University of Kansas, Lawrence, Kansas 66045-2454, USA.

THAMNOPHIS PROXIMUS PROXIMUS (Western Ribbon Snake). USA: ILLINOIS: Greene Co: NE 1/4 Sec. 21, T9N, R13W, DOR on Co. Rd. 325E, 0.2 km N junction with Co. Rd. 630N. 17 October 1994. J. K. Tucker. Illinois Natural History Survey (INHS 11426). Calhoun Co: SE 1/4 Sec. 29, T8S, R3W, DOR on Ill. Rt. 96 at jct. with Co. Rd. 3180N (Infidel Hollow Road). 19 October 1994. J. K. Tucker. INHS 11428. Verified by C. Phillips. Illinois Natural History Survey (INHS). New county records.

Submitted by **JOHN K. TUCKER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 3134 Alby Street, Alton, Illinois 62002, USA.

THAMNOPHIS SIRTALIS PARIETALIS (Red-sided Garter Snake). USA: OKLAHOMA: Beaver Co: Slapout. 17 March 1974. Collector unknown. Verified by Richard L. Holland. UCM 57037. First county record (Webb 1970, Reptiles of Oklahoma. Univ. Oklahoma Press, Norman, 370 pp.) and a westward range extension of ca. 48 km from Ft. Supply, (Woodward County) for the subspecies in Oklahoma.

Submitted by **KURT SCHAEFER**, Department of Biology, Panhandle State University, Goodwell, Oklahoma 73939, USA; **DAVID CHISZAR**, Department of Psychology, University of Colorado, Boulder, Colorado 80309-0345, USA; and **HOBART M. SMITH**, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0334, USA.

THAMNOPHIS SIRTALIS SIRTALIS (Eastern Garter Snake). USA: ILLINOIS: Scott Co: NE 1/4 Sec. 20, T14N, R12W, Winchester Road, 0.1 km N Winchester. 21 August 1994. J. K. Tucker. Verified by Chris Phillips, Illinois Natural History Survey (INHS 11350). New county record.

Submitted by **JOHN K. TUCKER** and **JAMES B. CAMERER**, Illinois Natural History Survey, Long Term Resource Monitoring Program, 4134 Alby Street, Alton, Illinois 62002, USA.

TRETANORHINUS NIGROLUTEUS (Orangebelly Swamp Snake). MÉXICO: QUINTANA ROO: La Union, in Hondo River, 3 km NE La Union town (17°53'47"N, 88°52'34"W). 27 January 1993. H. Bahena Basave. Museo de Zoologia del Centro de Investigaciones de Quintana Roo (MZCIQRO 223); in Hondo River, La Union town, 31 March 1993. H. Bahena Basave. Both verified by O. Flores-Villela. MZCIQRO 258. New record to Quintana Roo, Yucatan Peninsula.

Submitted by **HUMBERTO BAHENA-BASAVE**, Dirección de Recursos Naturales, Centro de Investigaciones de Quintana Roo, Chetumal, Quintana Roo 77000, México.

New Island Records from Panay, Philippines

Even though the island of Panay ranks seventh in size in the Philippine Archipelago, until recently few faunal surveys had been done there (Gonzales and Kennedy 1990). From 1983 through 1989 the National Museum of the Philippines (PNM) sponsored several expeditions to Panay, the last being co-sponsored by the Cincinnati Museum of Natural History (CMNH). Fourteen new island records of amphibians and reptiles are reported below with specimens being deposited at either CMNH or PNM. Common names were taken from Alcala (1986) when available. Records were checked in Alcala (1986) and against the catalogs of the following collections: California Academy of Sciences, Carnegie Museum of Natural History, Field Museum of Natural History, National Museum of the Philippines, The Rabor Collection (University of the Philippines at Los Banos), U.S. National Museum of Natural History, and an unpublished list compiled by Ronald I. Crombie. Identifications were verified by Ronald I. Crombie.

ANURA

Rana everetti (Everett's Frog). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 210 m elev. 4 October 1989. J. W. Ferner. CMNH 3153. Island record.

Rana leytensis (Leyte Frog). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy. February 1987. R. Sison and L. Pelayo. PNM 1114. Island record.

Platymantis guentheri (Guenther's Forest Frog). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 950 m elev. 17 October 1989. J. W. Ferner. CMNH 3166. Island record.

SAURIA

Draco sp. (Flying Lizards). Aklan Province: Ibajay Municipality: Barrio Bugtong-bato. August 1983. CMNH 3237–3239 (PNM Field Nos. 367–370, 373, 375); Antique Province: Barbasa Municipality: Barrio Igapalge. August 1989. PNM Field Nos. 338-343; Iloilo Province: Viejo Municipality: Barotac Viejo, Sitio San Francisco. March 1988. CMNH 3240-3241 (PNM Field Nos. 344-346). R. Sison. Island record for genus. Currently, specific names are not reliable in this genus based on taxonomic revisions underway (R. I. Crombie, pers. comm.).

Hemidactylus stejnegeri (Stejneger's House Gecko). Iloilo Province: Dingle Municipality: Barrio Moroboro, Bulabog-Puti-an National Park, 100 m elev. 19 October 1989. R. Sison. CMNH 3225. Island record.

Gekko mindorensis (Mindoro Narrow-disked Gecko). Iloilo Province: Dingle Municipality: Barrio Moroboro, Bulabog Putiraan National Park, 100 m elev. 22 October 1989. R. Sison. PNM Field No. 2500. Island record.

Gonyocephalus sp. (Anglehead Lizards). Aklan Province: Libacao Municipality: Barrio Danao. February 1987. PNM 1130–1132. R. Sison and L. Pelayo. Island record for genus. Currently, specific names are not reliable in this genus based on revisions underway (see Ross and Gonzales 1991).

Mabuya indeprensa. Iloilo Province: Mt. Baloy. February 1987. CMNH 3247 (PNM 1151-1152). R. Sison and L. Pelayo. Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 200 m elev. 4 October 1989. PNM Field No. 97. J. W. Ferner. Island record.

Sphenomorphus fasciatus (Banded Sphenomorphus). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 1200 m elev. 13 October 1989. CMNH 3248. R. Kennedy. Island record.

Tropidophorus grayi (Spiny Waterside Skink). Antique Province: Valderrama Municipality: Barrio Binanogan. 24 May 1989. PNM Field No. 96. R. Sison. Island record.

SERPENTES

Chrysopelea paradisi (Paradise Snake). Aklan Province: Ibajay Municipality: Barrio Bugtong-bato. 8 July 1983. PNM 1050. R. Sison. Island record.

Oligodon modestus (Spotted-bellied Short-headed Snake). Aklan Province: Libacao Municipality: Barrio Jamindang. March 1987. PNM 1066. R. Sison and L. Pelayo. Island record.

Dendrelaphis caudolineatus (Lined Slender Arboreal Snake). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 200 m elev. 1 October 1989. CMNH 3254. R. Sison. Island record.

Pseudorhabdion mcnamarae (McNamara's Burrowing Snake). Antique Province: Valderrama Municipality: Barrio San Agustin, Mt. Baloy, 950 m elev. 14 October 1989. PNM Field Nos. 163 and 209. R. Sison. Island record.

Acknowledgments.— We thank R. I. Crombie for his patient assistance as we became more familiar with Philippine herpetofauna. The logistical support for this project provided by R. S. Kennedy is greatly appreciated. Thanks to R. S. Kennedy, J. Cabalquinto, E. Canada, M. Ebreo, R. Fernandez, J. Lasugas, M. Manuel, and V. Samarita and numerous other assistants for their aid in the field. Financial support was generously provided by the Cincinnati Museum of Natural History and Thomas More College.

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New Distributional Records of Amphibians and Reptiles from New Hampshire

As part of on-going surveys of the amphibians and reptiles of New England (Klemens 1993), a small collection of preserved amphibians and reptiles from New Hampshire was accumulated, representing both my efforts as well as those of several colleagues. Collections were deposited at the American Museum of Natural History (AMNH) and significantly augment Taylor's (1993) distribution maps of New Hampshire's herpetofauna. Identifications were verified by Darrel R. Frost.

CAUDATA

Ambystoma maculatum (Spotted Salamander). Sullivan Co: Cornish, pond E of Chase Cemetery near Rt. 12-A. 20 April 1986. R. P. Cook. AMNH 128996. First record from Sullivan County, documenting Taylor's (1993:23) unconfirmed "sighting reports."

Desmognathus f. fuscus (Northern Dusky Salamander). Rockingham Co: Seabrook, E of U. S. Rt. 1, S of Seabrook Station. 29 March 1986. R. P. Cook. AMNH 128997. First record from Rockingham County and first documentation of this species' occurrence in New Hampshire's coastal region (Taylor 1993:26).

Plethodon cinereus (Redback Salamander). Sullivan Co: Cornish. 15 May 1986. R. P. Cook. AMNH 129021. First record from Sullivan County (Taylor 1993:29).

ANURA

Hyla versicolor (Gray Treefrog). Sullivan Co: Cornish, pond E of Chase Cemetery near Rt. 12-A. 25 May 1986. R. P. Cook. AMNH 129050. First record from Sullivan County (Taylor 1993:36).

Pseudacris c. crucifer (Northern Spring Peeper). Sullivan Co: Cornish, E of Rt. 12-A, ca. 0.25 mi. N Chase Cemetery. 18 April 1986. R. P. Cook. AMNH 129048–49. First record from Sullivan County documenting Taylor's (1993:37) unconfirmed "sighting reports."

TESTUDINES

Chelydra s. serpentina (Common Snapping Turtle). Grafton Co: Landaff, trib. to Pearl Lake, 1020 feet elev. 27 June 1982. M. W. and N. S. Klemens. AMNH 124936. Extends New Hampshire range 15 miles NNE from Grafton County record mapped by Taylor (1993:46).

Chrysemys picta (Painted Turtle). Grafton Co: Landaff, Chandler Pond, 1100 feet elev. 27 June 1982. M. W. and N. S. Klemens. AMNH 124937–38. Extends New Hampshire range 30 miles NNE from southern Grafton County record mapped by Taylor (1993:50).

SERPENTES

Lampropeltis t. triangulum (Eastern Milk Snake). Carroll Co: ca. 5 mi. N Center Sandwich on Maple Ridge Road. 17 June 1967. H. J. Greer. AMNH 100394. First record from Carroll County documenting Taylor's (1993:61) unconfirmed "sighting report."

Lampropeltis t. triangulum (Eastern Milk Snake). Grafton Co: Landaff, near Merrill Mountain Road. 29 June 1982. E. Twaronite. AMNH 124942. First record from Grafton County (Taylor 1993:61).

Nerodia s. sipedon (Northern Water Snake). Merrimack Co: Warner, near wooded inlet stream to Ballard Brook above Joppa Road. 5 February 1991. D. Carroll. AMNH 137472. Extends New Hampshire range 25 miles W from record near Rockingham-Merrimack county line mapped by Taylor (1993:54).

Acknowledgments.—David Carroll, Robert P. Cook, Mary Hake, Josephine Kelleher, Nicole S. Klemens, and Eugene Twaronite provided specimens and/or assistance with New Hampshire field work. All collections were made under the provisions of scientific collecting permits issued by the New Hampshire Fish and Game Department.

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Recent Distribution Records for Amphibians and Reptiles in Illinois

Since Smith's (1961, Bull. Illinois Nat. Hist. Surv. 28:1–298) comprehensive work on the amphibians and reptiles of Illinois, a number of short articles have reported new information on the distribution of some Illinois species. Many of these articles treated individual species, frequently those uncommon in the state or secretive (e.g., *Hemidactylium scutatum, Scaphiopus holbrookii, Ophisaurus attenuatus, Clonophis kirtlandii*). Several short articles provided blocks of new distribution information for multiple species, for example, Holman (1966, Trans. Illinois State Acad. Sci. 59:298–300), Moll (1962, Herpetologica 18:207–209), Moll et al. (1977, Herpetol. Rev. 8:85), Morris (1976, Herpetol. Rev. 7:126–127), Munyer and Parmalee (1967, Trans. Illinois State Acad. Sci. 60:200–202), Schramm and Nordgren (1977, Trans. Illinois State Acad. Sci. 70:243) and Thurow and Sliwinski (1991, Bull. Chicago Herpetol. Soc. 26:129–132). The bibliography of Illinois herpetological literature from 1960 to 1980 (Morris et al. 1983, Bull. Illinois Nat. Hist. Surv. 33:123–138) included distribution records during that period.

Some Illinois counties for which Smith had few records have remained poorly known. Even some species considered to be com-

mon statewide or common in surrounding regions are undocumented for those counties (e.g., Boone, Clinton, Fayette, and JoDaviess).

This article includes new county records and recent records for several species in disjunct portions of their Illinois ranges. Several vouchers are included to confirm literature records not previously documented. Vouchers have been deposited in the herpetology collections of the following institutions: Illinois Natural History Survey (INHS, verified by C. Phillips); Milwaukee Public Museum Photo Collection (MPM, verified by G. S. Casper), and Southern Illinois University at Carbondale, Department of Zoology (SIUC, verified by R. A. Brandon).

CAUDATA

Ambystoma laterale (Blue-spotted Salamander). DuPage Co: Wood Dale Grove Forest Preserve, North Conservation Area (NW 1/4 Sec. 22, T40N, R11E). 14 April 1987. M. Redmer. INHS 10800. Darien, near 91st Street and Rt. 83 (SW 1/4 Sec. 2, T37N, R11E). 4 June 1989. M. Redmer. SIUC H-3805. Specimens confirm previous literature records (Jessup 1981, Bull. Chicago Herpetol. Soc. 16:44–46; Mierzwa 1987, Bull. Chicago Herpetol. Soc. 22:121; Ludwig et al. 1992, Trans. Illinois State Acad. Sci. 85:187–199) in which no vouchers were mentioned.

Ambystoma maculatum (Spotted Salamander). Monroe Co: 5.8–7.1 km N Randolph County line on Prairie du Rocher/Valmeyer Road (T4S, R10W). 3 April 1991. R. A. Brandon and S. R. Ballard. SIUC H-4265–69. Pinkle's Woods along Bluff Road (NE 1/4 Sec. 22, T3S, R11W). 23 March 1993. M. Redmer. SIUC H-4435. New county record.

Ambystoma t. tigrinum (Eastern Tiger Salamander). Boone Co: pond near Kishwaukee River at Lawrenceville Road (SW 1/4 Sec. 30, T44N, R4E). 30 July 1988. M. Redmer. INHS 10804. New county record.

Eurycea longicauda melanopleura (Dark-sided Salamander). Jersey Co: Pere Marquette State Park, tributary of Graham Hollow (northern Sec. 7, T6N, R12W). 4 July 1991. R. A. Brandon, D. Brandon, S. R. Ballard and J. Howard. SIUC H-4437. New county record.

Siren intermedia nettingi (Western Lesser Siren). Fayette Co: 0.8 km E Hurricane Creek on County Road 800N (SW 1/4 Sec. 19, T5N, R1W). 8 May 1993. S. R. Ballard, A. Jones, B. Jones. SIUC H4448-49. New county record.

ANURA

Scaphiopus h. holbrookii (Eastern Spadefoot). Pope Co: New Liberty, 0.6 km NW jct. Unionville Road on Bay City Road (NE 1/4 Sec. 17, T16S, R7E). 31 July 1993. M. Redmer. SIUC H-4440. Documents county record of Thompson et al. (1968, Trans. Illinois State Acad. Sci. 61:427) for which no vouchers exist (R. A. Brandon, pers. comm.). Williamson Co: Wolf Creek, on Wolf Creek Road, 1.1 km S Palestine Church (NW 1/4 Sec. 36, T10S, R1E). 20 September 1992. M. Redmer. SIUC H-4150. New county record; northernmost record for central Shawnee Hills.

Gastrophryne carolinensis (Eastern Narrowmouth Toad). Pope Co: small pond NE of Golconda (SE 1/4 Sec. 9, T12S, R7E). 11 August 1992. D. Spivey. SIUC H-4103. 1.6 km W New Liberty (western Sec. 17, T16S, R7E). 22 June 1991. S. J. Karsen. SIUC H-4107. New county record.

Bufo a. americanus (Eastern American Toad). Boone Co: Kishwaukee River at Piscasaw Creek (SW 1/4 Sec. 30, T44N, R4E). 30 July 1988. M. Redmer. INHS 10810-811. New county record; Lee Co: Green River Conservation Area, S shore of Atkinson Road Marsh (NW 1/4 Sec. 13, T19N, R8E). Pump Factory Road, across flooded field from Area 6 parking lot (SE 1/4 Sec. 18, T19N, R9E). 7 April 1991. M. Redmer. SIUC H-4082 and H-4075, respectively. Franklin Creek State Park, NW portion, Twist Road across from park office (NE 1/4 Sec. 33, T22N, R10E). 6 April 1991. M. Redmer. SIUC H-4080. New county record.

Hyla chrysoscelis (Cope's Gray Treefrog). Lee Co: Nachusa Grasslands, fen area (NW 1/4 Sec. 21, T22N, R10E). 15 May 1988. M. Redmer, J. Levell. MPM P-148. New county record identified by sonogram (on file at MPM).

Hyla cinerea (Green Treefrog). Massac Co: Mermet Lake Conservation Area (NW 1/4 Sec. 35, T14S, R3E). 17 June 1989. S. J. Karsen. SIUC H-3777. New county record; Pope Co: ca. 1.6 km W New Liberty on Unionville Road (SW 1/4 Sec.17, T16S, R7E). 22 July 1993. M. Redmer, R. A. Brandon, M. Bavetz. SIUC H-4450. Next to Barren Creek on Bay City Road just west of bridge (NE 1/4 Sec. 35, T14S, R6E). 31 July 1993. M. Redmer. SIUC H-4442. Smithland Locks and Dam Road, 0.1–0.3 km W Army Corps buildings (SE 1/4 Sec. 33 T15S, R7E). 31 July 1993. M. Redmer. SIUC H-4443–47. New county record; SE most records in state; Williamson Co: Crab Orchard National Wildlife Refuge, Spillway Road swamp (SW 1/4 Sec. 4, T10S, R1E). 10 July 1992. M. Redmer. SIUC H-4102. New county record; extends range ca. 17–20 km NE of previous records in SW Jackson County.

Hyla versicolor (Gray Treefrog). DuPage Co: Waterfall Glen Forest Preserve, Bluff Road Pond (SW 1/4 Sec. 11, T37N, R11E). 21 May 1988. M. Redmer. MPM P-149. Identified by sonogram (on file at MPM); confirms previous literature record for county (Ludwig et al. 1992, Trans. Illinois State Acad. Sci. 85:187–199).

Pseudacris c. crucifer (Northern Spring Peeper). Franklin Co: ca. 2 km SW Zeigler (NW 1/4 Sec. 26, T7S, R1E). 28 March 1989. M. Redmer. SIUC H-3430. New county record; Lee Co: Nachusa Grasslands fen (NW 1/4 Sec. 21, T22N, R10E). 15 May 1988. M. Redmer. MPM P-150. Franklin Creek State Park, NW side, Twist Road pond (NE 1/4 Sec. 33, T22N, R10E). 6 April 1991. M. Redmer. SIUC H-4067–68. New county record; continues sporadic distribution in northern Illinois; Massac Co: S of New Columbia (SW 1/4 Sec. 16, T14S, R4E). 25 March 1989. M. Redmer. SIUC H-3435–36. New county record; Perry Co: Pyramid State Park (NW 1/4 Sec. 14, T6S, R3W). 24 March 1989. M. Redmer. SIUC H-3431–32. New county record; Washington Co: Washington County Conservation Area (SE 1/4 Sec. 7, T2S, R2W). 24 March 1989. M. Redmer. SIUC H-3433–34. New county record.

Pseudacris t. triseriata (Western Chorus Frog). Lee Co: Green River Conservation Area, flooded field at Hunting Area 3 (NW 1/4 Sec. 18, T19N, R9E). 5 April 1991. M. Redmer. SIUC H4071–72. Franklin Creek State Park, Twist Road Pond (NE 1/4 Sec. 33, T22N, R10E). 6 April 1991. M. Redmer. SIUC H-4070. New county record.

Rana catesbeiana (Bullfrog). Boone Co: Kishwaukee River at Piscasaw Creek confluence (SW 1/4 Sec. 30, T44N, R4E). 18 July 1988. M. Redmer. INHS 10807–08. New county record; Marshall Co: 0.8 km N Woodford/Marshall County line on Rt. 26 (NE 1/4 Sec. 34, T29N, R3W) and 1.8 km N Woodford/Marshall County line on Rt. 26 (NE 1/4 Sec. 27, T29N, R3W). 19 and 20 June 1990. S. R. Ballard. SIUC H-3948–49 respectively. New county record.

Rana clamitans melanota (Green Frog). Marshall Co: 0.8 km N Woodford/Marshall County line on Rt. 26 and along RR Tracks (NW 1/4 Sec. 35, T29N, R3W). 20 June 1990. S. R. Ballard and D. Ferrari. SIUC H-3950–52. New county record; Randolph Co: Kaskaskia Island, in Old River under St. Mary's Bridge (SE 1/4 Sec. 8, T7S, R10E). 30 April 1989. M. Redmer. SIUC H-3437. New county record; first Illinois record from west of the Mississippi River.

Rana palustris (Pickerel Frog). Randolph Co: 0.4 km S Monroe/Randolph County line on Prairie du Rocher-Valmeyer Road. 11 April 1991. S. R. Ballard. SIUC H-4270. New county record; St. Clair Co: Imbs Road, ca. 1.8 km SW Zion Church and 2.5 km NE Phelps (NW 1/4 Sec. 26, T1N, R10W). 7 April 1993. M. Redmer. SIUC H-4428. Verifies old literature record (Hurter 1893, St. Louis Acad. Sci. Trans. 6:251–261, cited by Smith 1961, Bull. Illinois Nat. Hist. Surv. 28:1–298).

TESTUDINES

Chelydra s. serpentina (Common Snapping Turtle). Lee Co: Rt. 26, 1.1 km N of Union Road (SE 1/4 Sec. 4, T19N, R9E). 23 June 1991. M. Redmer. SIUC R-2349. New county record; Stephenson Co: Le-Aqua-Na State Park, Waddams Creek at picnic area (NW 1/4 Sec. 17, T28N, R6E). 28 July 1991. M. Redmer. SIUC R2302. New county record.

Sternotherus odoratus (Common Musk Turtle). Franklin Co: ca. 2 km SW Zeigler (NE 1/4 Sec. 27, T7S, R1E). 28 September 1988. M. Redmer and S. J. Karsen. SIUC R-2081. New county record; Pulaski Co: 2 km SSE Perks (Sec. 14, T14S, R1E). 13 May 1986. R. A. Brandon and M. A. Morris. SIUC R-2122. New county record; Whiteside Co: Mississippi River, ca. 3 km upstream from Lock and Dam 13 (NE 1/4 Sec. 2, T22N, R3W). 3 September 1987. M. Redmer. SIUC R-2475. New county record; confirms presence in NW Illinois (Conant and Collins 1991, A Field Guide to the Reptiles and Amphibians of Eastern and Central North America. 3rd Edition. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.).

Kinosternon subrubrum (Eastern Mud Turtle). Gallatin Co: 2.4 km N Saline Mines (northern Sec. 23, T10S, R9E). 25 March 1991. S. R. Ballard and R. A. Brandon. SIUC R-2476. New county record; Perry Co: 2.2 km E DuQouin on RR tracks in Reese Creek Bottoms (NE 1/4 Sec. 15, T6S, R1W). 7 April 1993. S. J. Karsen. SIUC R-2481. New county record.

Chrysemys picta (Painted Turtle). Boone Co: Genoa Road at Kishwaukee River (SW 1/4 Sec. 30, T44N, R4E). 30 July 1988. M. Redmer. INHS 10816. New county record; Greene Co: Rt. 108, 6.1 km W jct. Rt. 267 (NW 1/4 Sec. 19, T10N, R12W). 24 July 1993. S. R. Ballard. SIUC R-2480. New county record; Lee Co: Rt. 26 at Union Road (SW 1/4 Sec. 10, T19N, R9E). 19 May 1991. M. Redmer. SIUC R-2337. Franklin Creek State Park, NW portion, on Twist Road (NE 1/4 Sec. 33, T22N, R10E). 22 June 1991. M. Redmer. SIUC R-2454. New county record; Perry Co.: 3.2 km E DuQuoin on Rt. 14 (NW 1/4 Sec. 27, T6S, R1W). 2 October 1988. R. G. Weck. SIUC R-2143. New county record; fills in gap between Randolph, Washington, Jefferson, Franklin and Jackson counties.

Graptemys geographica (Common Map Turtle). DuPage Co: Warrenville Grove Forest Preserve, below dam (NE 1/4 Sec. 3, T39N, R9E). 17 July 1989. M. Redmer. SIUC R-2482. Confirms literature record (Ludwig et al. 1992, Trans. Illinois State Acad. Sci. 85:187–199).

Terrapene c. carolina (Eastern Box Turtle). Randolph Co: 3.2 km N of Rockwood on Rt. 3 (SW 1/4 Sec. 2, T8S, R6W). 22 July 1988. R. G. Weck. SIUC R-2232. New county record; fills in gap between Monroe and Jackson counties.

Apalone s. spinifera (Eastern Spiny Softshell). Lee Co: Green River at Rt. 26 bridge (NW 1/4 Sec. 4, T19N, R9E). 4 May 1991. M. Redmer. SIUC R-2315. New county record; fills gap between Whiteside, Ogle, and Bureau counties.

SAURIA

Cnemidophorus s. sexlineatus (Six-lined Racerunner). Pulaski Co: near Karnak (NE 1/4 Sec. 15, T14S, R2E). 12 July 1989. S. Karsen. SIUC R-2169. New county record.

SERPENTES

Coluber constrictor (Racer). Hardin Co: Karber's Ridge Road, 1.5 km NE jct. Rt. 34 (SE 1/4 Sec. 11, T11S, R7E). 26 May 1990. S. R. Ballard. SIUC R-2221. New county record, fills gap between Pope and Gallatin counties; Lee Co: Green River Conservation Area Hunting Area 2 (SE 1/4 Sec. 7, T19N, R9E). 4 June 1991. M. Bavetz, R. Flick, M. Redmer, R. A. Brandon. SIUC R-2339. New county record; Madison Co: Sand Road in Poag, just E jct. with Poag Road (SW 1/4 Sec. 18, T4N, R8W). 5 October 1993. S. R. Ballard. SIUC R-2492. New county record.

Elaphe v. vulpina (Western Fox Snake). Boone Co: ca. 2 km NW Caledonia, Greenlee Road at RR Tracks (NW 1/4 Sec. 17, T45N, R3E). 5 September 1988. M. Redmer. INHS 10809. New county record; JoDaviess Co: 0.5 km N Carroll/JoDaviess County line on Rt. 84 (SW 1/4 Sec. 36, T26N, R2E). 26 May 1989. M. Redmer. SIUC R-2207. New county record and NW most record in state; Lee Co: Green River Conservation Area, Maytown Road 0.3 km E Pump Factory Road (SW 1/4 Sec. 17, T19N, R9E). 20 May 1991. M. Redmer. SIUC R-2343. New county record; Warren Co: 2 km NE Roseville on County Road 900N at R. Killy Farm (south-central Sec. 16, T9N, R2W). 5 June 1993. M. Redmer. SIUC R-2471. New county record.

Farancia abacura reinwardtii (Western Mud Snake). Pope Co: 1.2 km W New Liberty (center of Sec. 17, T16S, R7E). 13 July 1991. S. J. Rarsen. SIUC R-2474. New county record.

Heterodon platirhinos (Eastern Hognose Snake). Whiteside Co: Fulton-Thompson Sand Prairie Nature Preserve, 4.5 km N Fulton (NW 1/4 Sec. 1, T22N, R3E). 3 September 1987. M. Redmer.

MPM P-131. New county record; St. Clair Co: Milstadt. May 1979 and May 1981. R. Young and R. Besse. SIUC R-1862–63 respectively. New county record.

Lampropeltis c. calligaster (Prairie Kingsnake). Johnson Co: Goreville (Sec. 22, T11S, R2E). 3 October 1989. S. Henning. SIUC R-2213. Confirms literature record (Klimstra and Hutchison 1965, Trans. Illinois State Acad. Sci. 58:151–156) for which no vouchers exist (R. A. Brandon, pers. comm.). Fills gap between Union, Williamson, Pope and Massac counties.

Lampropeltis t. triangulum (Eastern Milk Snake). Woodford Co: 1.6 km E Rt. 26, off upper Spring Bay Road, near Woodford/Tazewell county line (eastern Sec. 36, T27N, R4W). D. Holmes. SIUC R-2483. New county record.

Nerodia r. rhombifer (Diamondback Water Snake). Gallatin Co: cypress ditch 5 km W Shawneetown (NW 1/4 Sec. 20, T9S, R9E). 10 June 1989. S. J. Karsen. SIUC R-2214. New county record.

Nerodia sipedon pleuralis (Midland Water Snake). Massac Co: Mermet Lake Conservation Area (NW 1/4 Sec. 35, T14S, R3E). 17 June 1989. S. J. Karsen. SIUC R-2215. New county record; fills gap between Pulaski, Johnson and Pope counties.

Nerodia s. sipedon (Northern Water Snake). Boone Co: at confluence of Kishwaukee River and Piscasaw Creek (SW 1/4 Sec. 30, T44N, R9E). 3 July 1989. M. Redmer. SIUC R-2412. New county record; Whiteside Co: S entrance to Morrison-Rockwood St. Park (south-central Sec. 16, T21N, R2W). 5 June 1993. M. Redmer. SIUC R-2470. New county record.

Opheodrys aestivus (Rough Green Snake). Massac Co: Mermet Lake Conservation Area, W side of lake (Sec. 35, T14S, R3E). 6 May 1988. W. D. Robinson. SIUC R-2024. New county record; Pulaski Co: Belknap Road at Cache River, N of Karnak (NE 1/4 Sec. 15, T14S, R2E). 16 June 1988. R. A. Brandon, R. G. Weck and S. R. Ballard. SIUC R-2009. New county record.

Opheodrys vernalis (Smooth Green Snake). Lee Co: Green River Conservation Area, dirt road 0.5 km W Hunting Area 2 parking lot (SE 1/4 Sec. 7, T19N, R8E). 20 May 1991. M. Redmer. SIUC R2340. Franklin Creek State Park, Twist Road Pond (NE 1/4 Sec. 33, T22N, R10E). 22 June 1991. M. Redmer. SIUC R-2346. New county record.

Pituophis catenifer sayi (Bullsnake). Marshall Co: 0.8 km N Woodford/Marshall County line along RR tracks at Rt. 26 (NW 1/4 Sec. 35, T29N, R3W). 18 June 1992. S. R. Ballard. SIUC R-2479. New county record.

Regina septemvittata (Queen Snake). Ogle Co: White Pines Forest State Park, NW tributary to Pine Creek (NE 1/4 Sec. 8, T23N, R9E). 14 July 1991. M. Redmer. SIUC R-2300. Third record from Rock River Drainage, first record W of Rock River and NW most record in range of the species in Illinois (Smith 1961, Bull. Illinois Nat. Hist. Surv. 28:1–298; Anton and Redmer 1991, Herpetol. Rev. 24:26).

Storeria dekayi wrightorum (Midland Brown Snake). Boone Co: Riverside Road at Beaver Creek (SE 1/4 Sec. 5, T44N, R3E). 30 July 1988. M. Redmer. INHS 10815. New county record; Carroll Co: Mississippi Palisades State Park, near RR tracks (SW 1/4 Sec. 21, T25N, R3E). 26 May 1989. M. Redmer. SIUC R-2209. New county record and NW most record in state; Clinton Co: Eldon Hazlet State Park, DOR on blacktop road 0.4 km E park office (NW 1/4 Sec. 33, T3N, R2W). 16 October 1993. S. R. Ballard. SIUC R-2493. New county record; Fayette Co: DOR on County Road 450N, 0.08 km W jct. with County Road 60E (central Sec. 7, T4N, R1W). 23 October 1993. S. R. Ballard. SIUC R-2496. New county record; Lee Co: Nachusa Grasslands, oak savanna (NW 1/4 Sec. 21, T22N, R10E). 15 May 1988. M. Redmer. MPM P-153. Franklin Creek State Park, NW portion along Twist Road, 0.4 km N park office (NE 1/4 sect33, T22N, R10E). 22 June 1991. M. Redmer. SIUC R-2295. Green River Conservation Area, Maytown Road at Parking Area 10 (SE 1/4 Sec. 13, T19N, R8E). 29 June 1991. M. Redmer. SIUC R-2341. New county record; Pope Co: 5 km SW New Liberty (NW 1/4 Sec. 35, T16S, R7E). 17 June 1989. S. J. Karsen. SIUC R-2216. New county record; fills gap between Johnson and Hardin counties.

Storeria o. occipitomaculata (Northern Redbelly Snake). Carroll Co: Mississippi Palisades State Park near RR tracks (SW 1/4 Sec. 21, T25N, R3E). 26 May 1989. M. Redmer. SIUC R-2210. New county record, NW most locality in state, and confirms presence of species in NW Illinois (Smith 1961, Bull. Illinois Nat. Hist. Surv. 28: 1–298; Conant and Collins 1991, A Field Guide to the Reptiles and Amphibians of Eastern and Central North America. 3rd Edition. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.); Jersey Co: Pere Marquette State Park, Trail 9 (NE 1/4 Sec. 10, T6N, R13W). 22 June 1991. R. A. Brandon, D. Brandon, S. Ballard and J. Petzing. SIUC R-2473. New county record.

Thamnophis r. radix (Eastern Plains Garter Snake). Boone Co: along Lawrenceville Road near confluence of Kishwaukee River and Piscasaw Creek (SW 1/4 Sec. 30, T44N, R4E). 30 July 1988. M. Redmer. INHS 10812. New county record.

Thamnophis s. sirtalis (Eastern Garter Snake). Clinton Co: DOR on County Road 1840E, 1.1 km N jct. with County Road 1430N (central Sec. 7, T2N, R2W). 23 October 1993. S. R. Ballard. SIUC R2497. New county record; Johnson Co: ca. 1.6 km E West Vienna on Rt. 146 (east-central Sec. 33, T12S, R2E). 19 May 1988. R. A. Brandon and S. R. Ballard. SIUC R-2148-49. New county record, filling gap between Union, Williamson, Pope and Pulaski counties; Saline Co: 0.8 km SE Eldorado (Sec. 27, T8S, R7E). 12 October 1974. M. Anderson and K. Anderson. SIUC R-1860. New county record.

Agkistrodon contortrix mokasen (Northern Copperhead). Saline Co: 1.6 km W Horseshoe (Sec. 34, T10S, R7E). 22 September 1990. S. J. Karsen. SIUC R-2477. New county record. Franklin Co: (SE 1/4 Sec. 33, T5S, R4E). 20 August 1992. R. Hutchcraft. SIUC R-2478. New county record.

Crotalus horridus (Timber Rattlesnake). Pope Co: nine-day trail ride to One Horse Gap Lake (SE 1/4 Sec. 32, T11S, R7E). 18 May 1990. E. Steward Work Camp Crew. SIUC R-2220. New county record; fills gap between Johnson and Hardin counties.

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BOOK REVIEWS

Biology of Whiptail Lizards (Genus *Cnemidophorus*), John W. Wright and Laurie J. Vitt (editors). 1993. The Oklahoma Museum of Natural History: i–xiv + 417 pp. Hardcover. US $29 plus shipping. ISBN 1-883090-01-6.

This volume is the outcome of a symposium devoted to the teiid genus *Cnemidophorus*. The symposium—conceived and organized by John W. Wright and held at the University of Oklahoma in August 1984 during the joint annual meetings of the American Society of Ichthyologists and Herpetologists, the Herpetologists' League, and the Society for the Study of Amphibians and Reptiles—brought together a diverse assemblage of over 50 specialists who presented 30 papers on a broad spectrum of topics related to *Cnemidophorus*. The resulting volume (The Herpetologists' League Special Publication No. 3), containing 15 separate papers by 22 authors, is dedicated to Charles H. Lowe and Richard G. Zweifel. Contributions have been revised and updated with additional findings through September 1992. The individual papers are not grouped under subject headings, but the topics covered include systematics, reproduction, physiology, behavior, ecology, and community level analyses. Not surprisingly, a pervasive topic is the differences and similarities between unisexual and bisexual species in aspects of their biology.

The preface by John Wright and Laurie Vitt explains that the decision to produce this volume was not reached until after the symposium, and that some of the symposium presentations were already in press or committed to be published elsewhere by that time. Included in the preface is a list of the authors and titles of all 30 papers that were presented at the symposium, as well as a list of 12 symposium papers that were published elsewhere and are thus not included in the present volume.

The first chapter is an introduction by Charles H. Lowe which provides an historical review of taxonomy and systematics of *Cnemidophorus* organized to cover three time periods from 1830 to 1990. Lowe's chronological presentation recounts the considerable difficulties and confusion experienced by workers attempting to discriminate taxa and discusses the major contributions during each time period that led to our current understanding of the genus. In the author's opinion, one of the most significant breakthroughs in discriminating *Cnemidophorus* taxa was the description of *C. neomexicanus* by Lowe and Zweifel (1952). For the first time, in addition to appearance in life and ecological information gathered in the field, discrimination of a *Cnemidophorus* species was based on statistical analysis of quantitative meristic data. The author further reviews the impact on *Cnemidophorus* research of the discovery of parthenogenesis in *Lacerta* by Darevsky, and more recently, the high level of taxonomic resolution achieved through chromosomal and molecular studies.

In Chapter 2, John W. Wright provides a summary of the evolutionary relationships of *Cnemidophorus* and a taxonomic arrangement partitioned into six species groups. The composition of each group is discussed and distribution maps and color photographs of representative taxa are provided. Wright reviews the origin and evolution of parthenogenesis in *Cnemidophorus* as well as the controversies surrounding nomenclature of parthenogenetic taxa. The lineages of parthenogenetic taxa are reviewed by species group, with particular reference to the results of mitochondrial DNA analyses. An alphabetical listing of the groups and their respective members, which contains over 100 taxa and includes over a dozen undescribed forms, differs substantially from the recent taxonomic arrangement of Maslin and Secoy (1986).

The next five papers present results of field investigations and literature reviews on the interrelated subjects of foraging ecology, thermoregulation, activity patterns, and locomotion.

Roger Anderson investigated foraging ecology of *Cnemidophorus tigris* at a six-hectare site in the Sonoran Desert of Riverside County, California, through systematic time-constrained field observations of foraging animals and quantitative assessments of vegetation, prey availability, and stomach contents. At this site, *C. tigris* was determined to be a wide forager that depended primarily on chemoreception to detect fossorial and hidden prey, but relied on vision to choose foraging pathways between and within patches of widely dispersed microhabitats. The results indicate that successful foraging in *C. tigris* is clearly not the result of opportunistic success during random wanderings.

Using experimental chambers, Richard Bowker explored questions relating to the brief daily activity periods of *C. exsanguis* and *C. velox* and the costs of their wide-foraging lifestyles by examining temperature regulation and the influence of water loss on activity times. Bowker discusses the relationships between maintaining precisely regulated body temperatures, the costs of activity, and the increase in water loss with increase in body temperature. The activity experiments indicated that water loss was proportional to length of activity, and Bowker concludes that water may be an important factor limiting daily activity in these animals.

Gustavo Casas-Andreu and Marco Gurrola-Hidalgo report on the comparative ecology of *C. communis* and *C. lineatissimus* at a tropical deciduous forest site in Jalisco, México. Average body temperatures for both species are slightly lower than those reported in a number of studies on *Cnemidophorus* from the southwestern United States, and daily activity patterns were unimodal, with greatest activity at mid-day during the entire year. Similar unimodal activity patterns have been found for other species of tropical tei-

ids, whereas bimodal activity patterns are reported for lizards from the southwestern United States.

Kay Etheridge and Lawrence Wit examine the comparatively short active season and the resulting long inactive period of adult *C. sexlineatus* in Alabama and discuss evidence from the literature and their own field work regarding the factors affecting this activity cycle. They conclude that the short annual activity period of *C. sexlineatus* can be attributed to a lack of territorial behavior, their wide-ranging foraging behavior and high foraging efficiency, avoidance of negative energy returns when food is scarce, and reduction of the risk of predation.

Locomotor performance and activity metabolism of *C. tigris* are reviewed by Theodore Garland and compared to the available quantitative data for other species of lizards. Results from the laboratory work reported here show that the endurance capacity of *C. tigris* is exceptionally high in comparison to that of other lizards, and appears to exceed what is required for foraging alone. Garland concludes that while the primary adaptive significance of high endurance capacity in *C. tigris* is unclear, a variety of activities other than foraging that may require high endurance capacities must be considered. Garland points out that the available comparative information is very limited and that additional data on other arid habitat *Cnemidophorus* are needed. Also, performance capacities demonstrated in the laboratory need to be compared to findings from the field.

The contributions by Vitt and Breitenbach, Trauth and Fagerberg, and Crews and Moore provide information on reproduction in *Cnemidophorus*. Laurie Vitt and Gary Breitenbach present an exhaustive review and synthesis of literature on reproduction and life histories of *Cnemidophorus*, emphasizing ecological aspects of reproduction. They compiled literature information on reproductive characteristics of 17 species of *Cnemidophorus* and a list of over 50 *Cnemidophorus* populations from which the reproductive data were obtained. The authors examine the available information on clutch size and egg mass, seasonality in reproduction and clutch frequency, geographic and temporal variation in reproduction, and female investment to provide support for five postulated differences in reproductive characteristics that would be expected between *Cnemidophorus* and typical wait-and-ambush lizard species.

Stanley Trauth and Wayne Fagerberg looked at eggshell ultrastructure of oviducal eggs from the hybrid species *C. laredoensis* compared with the eggshell morphology of *C. sexlineatus*, one of its parent species. In light of the results, the authors discuss the potential application of stereological methods for resolving eggshell ultrastructure in order to detect inter- and/or intraspecific differences in eggshells and as a means of correlating local environmental conditions of nest sites.

The paper by David Crews and Michael Moore provides an update on the ongoing investigations into the psychobiology of parthenogenetic whiptails and describes the relationship between pseudocopulatory behavior, hormonal correlates, and the ovarian cycle in *C. uniparens*. The authors also defend their interpretations of the causes and functions of pseudocopulatory behavior in parthenogenetic *Cnemidophorus* in light of contentions that pseudocopulation is an artifact of crowding in captivity and that reproductive condition is not associated with behavioral roles during pseudocopulation.

Thyroid activity and metabolic rate in *C. sexlineatus* were studied by Lawrence Wit and Jeffrey Sellers using animals caught from the wild over a 16-month period in Alabama and Georgia. They suggest that the lowered metabolic rate and elevated plasma thyroxine titers found in hibernating animals are not simply consequences of the animals becoming dormant in response to cold temperatures. The authors conclude that the increase in plasma thyroxine is due to decreased peripheral use of the hormone, as indicated by oxygen consumption, rather than increased production.

Beth Leuck's analysis of aggressive behavior between sympatric diploid and triploid *C. tesselatus* represents an insightful approach designed to investigate the effects of genetic relatedness on aggressive behavior. Under experimental conditions, lizards in mixed diploid and triploid trials had significantly more aggressive acts towards each other than those of the same ploidy level. Based on these results, Lueck concludes that diploid and triploid *C. tesselatus* appear able to distinguish genetic relatedness.

Three papers focus on competitive interactions and resource partitioning in communities with bisexual and parthenogenetic whiptail species. Joseph Schall studied a community of five *Cnemidophorus* species, two parthenogenetic and three bisexual, in southwestern Texas to test the hypothesis that all-female species should use a broader range of habitats and resources, have more patchy distributions, and live in more disturbed areas. The two parthenogenetic species, *C. exsanguis* and *C. tessealatus*, had microhabitat niche breadths approximately 25% larger than the three bisexual species and were found in a much broader range of macrohabitat types, but they were most common in disturbed areas. However, he found no evidence of a difference in diet between the bisexual and parthenogenetic species.

The remaining two papers report on field studies in southern New Mexico that employed experimental population manipulations to examine mechanisms of coexistence between *C. tigris* and a sympatric unisexual whiptail. As part of a nine-year study, Orlando Cuellar monitored the immigration of *C. tigris* into an open sandy field from which *C. uniparens* was being systematically removed. The density of *C. tigris* at the site increased after removal of *C. uniparens* but decreased when the latter was no longer being removed. Cuellar concludes that the parthenogenetic species was excluding the bisexual through competition, and that parthenogenetic and bisexual whiptails coexist by inhabiting neighboring but distinct microhabitats.

Andrew Price, Joseph Lapointe, and Wirt Atmar removed *C. tigris* from one of three study grids and *C. tesselatus* from another, with the third grid serving as a control. Because there was no change in habitat use, their results indicated no microhabitat segregation between the two species. Further, there was no measurable response by the parthenogenetic *C. tesselatus* through either recruitment or increased reproduction to the removal of *C. tigris*.

The book measures 6 x 9 inches and is printed on nonreflective paper in easy-to-read, single column format. It contains numerous text figures, six distribution maps, and 48 color photographs of representative taxa in six *Cnemidophorus* species groups, including some not previously illustrated. Literature citations are placed at the end of each paper, whereas an index to subject matter and scientific names was compiled for the entire volume.

The book suffers from a number of flaws in editing and production. There are numerous typographical errors in the text. In addition, there are egregious omissions and errors with respect to tables and figures. The most obvious omissions include a reference to table 2 on p. 57 when only table 1 is present in chapter 2. Also, table 3 is absent from chapter 8 although it is referenced once on p. 221 and twice on p. 225. In chapter 2, the legends for figures 5, 7, 9, 11, and 13 all refer to figure 2 for specimen references but none are provided with figure 2; the legend for figure 3

does give information for specimens from the Natural History Museum of Los Angeles County, but does not have museum information for the acronyms listed in the other figure legends. An incorrect legend was placed with figure 8 on p. 272. The editors subsequently distributed to book purchasers a corrected legend for this figure.

These criticisms aside, I have high praise for this uniquely important book. It represents a culmination of efforts that started with John Wright's inspiration to organize and carry to fruition the first symposium on *Cnemidophorus*. The book provides superb summaries of evolutionary and ecological research that will prove indispensable for future work on whiptails, as well as especially useful to anyone doing field research on lizards in general. The extensive bibliographies will provide the reader the opportunity to become familiar with the primary literature on virtually any aspect of whiptail biology. I highly recommend the book to those interested in technical work on lizards. At $29, it represents a welcome bargain during times of ever-increasing book prices.

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The Amphibians and Reptiles of Alberta, by Anthony P. Russell and Aaron M. Bauer. 1993. Copublished by The University of Calgary Press, 2500 University Drive, N.W., Calgary, Alberta, T2N 1N4 and The University of Alberta Press, Athabasca Hall, Edmonton, Alberta, T6G 2E8, Canada. ISBN 1-895176-20-4, 264 pp. CAN $24.95 paperback, $29.95 hardcover. [Outside Canada prices are in US $.]

How do you build a full length layman's book out of a herpetofauna of only 18 species? The Russell-Bauer solution is to incorporate much more than just a local field guide into their book. *The Amphibians and Reptiles of Alberta* is really a compact general herpetology text, with special focus on the problems of prairie poikilotherms. The subtitle (printed inside, but strangely not on the cover) accurately describes this volume as both a "field guide" and a "primer of boreal herpetology."

The field guide, i.e. the Keys and Species Accounts, is the smaller portion of the book. The greater portion, the primer, is distributed among assorted chapters with titles such as "Characterization of Amphibians and Reptiles," "Zoogeography of the Alberta Herpetofauna," "Coping with the Cold," and "The Challenge of Aridity."

The scope of this book will make it a valuable addition to every high school and college library in Alberta. In the high school setting this book should help raise student interest in herpetology. In this regard, Tony Russell and Aaron Bauer deserve particular praise for including in their Keys and Species Accounts *Ascaphus truei, Chelydra serpentina, Coluber constrictor*, and *Charina bottae*. None of these species is yet reported in Alberta, but all could be there given their known ranges and ecology. By including these yet-to-be-found species in their book, Russell and Bauer challenge their readers to go out and find them. I can't imagine a better stimulus for neophyte herpetologists—in an admittedly herpetologically depauperate place like Alberta—than a chance to be the first to document a species' presence in the province.

To help the neophyte along, the field guide portion of this book is comprehensive, with good descriptions, keys, maps, natural history notes, glossary, etc. The authors include not just adults, but also eggs and larvae in their keys for amphibians. The Bibliography is much larger than in most existing state or provincial field guides. The color photographs by Wayne Lynch are first rate. They are esthetically pleasing and at the same time clearly reveal the features that distinguish the species.

On the negative side, too many of the line drawings are amateurish. All of the people involved in producing this book should—in good Canadian fashion—apologize to each other for the bizarre drawing on page 8, which shows a tadpole with gills growing out of its rump. Then they should agree to correct the drawing immediately, before any more copies of the book are printed.

In a similar vein, I was amused by two overly simplistic survivorship curves used to demonstrate the difference between r– and K–selection (Fig 7.5). The cartoon sketches of a frog (i.e., r–selected) and *Phrynosoma* (i.e., K–selected), incorporated in that figure, lead the reader to assume that "time," on the X-axis, is minimally one generation. However, if that were true, then we are very lucky not to be buried in short-horned lizards!

There are other problems with production. For example, my review copy of the paperback version had pages 119–126 printed twice.

In future editions the glossary should be expanded. Right now it includes only herpetological terms. But if readers need a definition for "tadpole," they probably need one for "taiga." And if "herpetofauna" deserves definition, then surely so does the "hypothalamus."

The couplet #9 in the Key to Larval Amphibians of Alberta has the word "anterior" where it should be "posterior." The correct information, however, is in the Species Accounts.

All of these flaws are minor and can be cleaned up in future editions. Overall, this is an important book that helps direct attention to boreal herpetology. Given the currently high public interest in a possible global decline of amphibians, this book is particularly timely. For if the issue of global decline is going to be rigorously assessed, we need to be especially attentive to shifts in the distribution of herps near the edges of their range. By informing the public of what is and is not known about the distribution of amphibians and reptiles at their northern limits, this book not only serves the people of Alberta but may ultimately help the 18 species of amphibians and reptiles that try to live up there with them.

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The Natural History of West Indian Boas, by Peter J. Tolson and Robert W. Henderson. R&A Publishing, Ltd., Taunton, Somerset, England. 125 pp., 72 color photographs. Hardcover US$75.00. ISBN 1-872688-04-7. Available in U.S. from Eric Thiss, Serpent's Tale Books, 464 Excelsior, Minnesota 55331, USA.

The boid fauna of the West Indies is unique and diverse, and includes some of the first species of reptiles to be recognized as endangered. Tolson and Henderson have produced an important and critically needed text on this subject. This book is a comprehensive, authoritative, and exhaustive analysis of these snakes, addressing their natural history, paleoherpetology, conservation status, and phylogeny.

The first section of the book addresses the natural history, geology, and geography of Greater and Lesser Antilles, with an analysis of each island group. The accounts of the geology and natural history of the Islands are interesting and provide an important framework for understanding the natural history of the boid taxa. The various habitats and biotopes are well illustrated by photographs and descriptive text. The chapter on the phylogeny of the boid fauna is thorough and accurate. The original hypotheses of relationship within this group proposed by Tolson have subsequently been corroborated by Kluge. A chapter on the zoogeography of the boid fauna reviews the fossil record and the phylogeny of this group with respect to the plate tectonics of the region. This information facilitates understanding of the modern distribution of these snakes.

The second section is a species account type of review. In addition to the strictly systematic information, the authors include range maps, natural history notes, food habits (both field observations and husbandry information) as well as reproductive husbandry information. Finally, notes on the conservation status of many of the taxa are included.

The third section is a review of the reproductive biology of *Epicrates* and *Tropidophis*, but does not include reproductive behavior of the two *Boa* taxa. This is not an exhaustive review, but includes interesting observations on captive behavior as well as some of Tolson's seminal studies on the relationships between climate and male-male interactions and testosterone levels.

The fourth section addresses the conservation issues of this group. Interestingly, the authors note that historical errors in population assessments led to incorrect assumptions on the relative scarcity of some taxa. The authors also note that the deleterious effect of the mongoose has been exaggerated.

This text is a superb overview of the boid taxa of the West Indies. Additionally, it is an excellent summary of the geology and natural history of this region, making it useful reading for herpetologists interested in other organisms of this region. The breadth and scope of the authors' analysis make this book fascinating and pleasurable reading, and it is a welcome departure from the traditional boiler-plate herpetology texts.

It is unfortunate that the publisher has priced this book at $75.00. It is also unfortunate that the quality of the illustrations is generally substandard. Many of the color photographs appear to have been improperly separated. The layout of the book is faulty; the top and bottom margins are crowded, and there is excessive white space in many areas. A glossary would have been helpful for those unfamiliar with some of the geologic terms.

These criticisms notwithstanding, this is an essential text for the student of herpetological natural history. It is easy and enjoyable reading, and is the definitive text on this subject.

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PUBLICATIONS RECEIVED

Australia's Reptiles [Volume 1: Snakes and Monitors] is based on the book of the same title by Wilson and Knowles. This new CD-ROM contains over 260 photographs of Australian monitors and terrestrial snakes; the full text of every species; distribution maps; scientific and common names; and notes on the current status of most species, and more.

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The CD-ROM is designed for herpetologists, schools, libraries, herpetological societies, and naturalists with an MPC standard IBM-type personal computer with CD-ROM drive.

Volume I is available for US$49 plus $3 shipping from Satronics Communications, P.O. Box 52261, Philadelphia, Pennsylvania 19115-7261, USA. Volume II was planned for issue by November 1994 and contains nearly 800 images of skinks, geckos, and dragons.

For additional information, please write or send Internet mail to: mmiller@tjuvm.tju.edu.

Life on the Edge. A Guide to California's Endangered Natural Resources: Wildlife. Edited by Carl G. Thelander (with 200+ contributors). 1994. Biosystems Books, 303 Potrero Street, Santa Cruz, California 95060-2719, USA (tel. 1-800-983-5433). Format 9x12 inches, 550 pages (500+ pages in color), hardcover (also available in softcover). US $75.00. ISBN 0-930588-66-5.

This hefty (ca. 5 lbs.) volume presents 115 individual species accounts for rare and endangered taxa (fish, amphibians, reptiles, birds, mammals, and invertebrates). Species of herps profiled by individual accounts include seven salamanders (*Ambystoma macrodactylum croceum, Plethodon stormi, Batrachoseps aridus, B. simatus, B. stebbinsi, Hydromantes shastae*, and *H. brunus*), one anuran (*Bufo exsul*), the desert tortoise (*Gopherus agassizii*), four lizards (*Coleonyx switaki, Uma inornata, Gambelia sila*, and *Xantusia riversiana*), and four snakes (*Charina bottae umbratica, Masticophis lateralis euryxanthus, Thamnophis sirtalis tetrataenia*, and *T. gigas*). Interviews with prominent conservationists (such as Robert Stebbins and Kenneth Norris) and essays are included. The connections of Native American legends to wildlife are examined and illustrated. Although herpetologists are not likely to find much new information about their favorite animals here, this is a visually impressive volume that effectively conveys the magnitude of conservation problems facing Californians and their wildlife.

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