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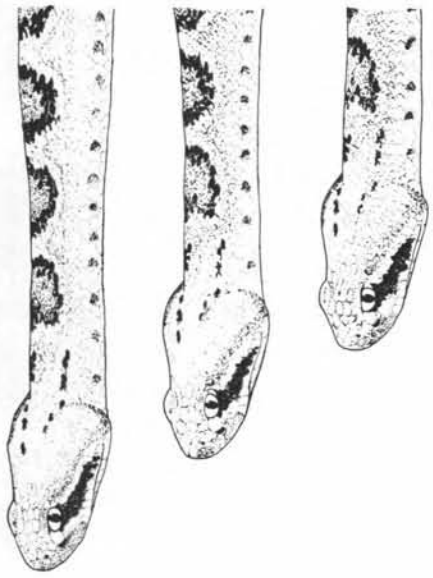

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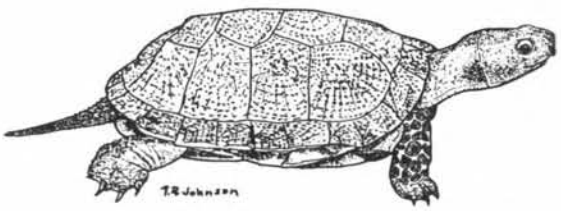

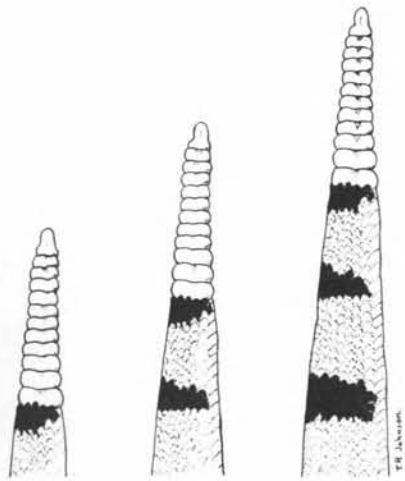

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HERPETOLOGY AT THE UNIVERSITY OF CALIFORNIA-BERKELEY

Herpetological research and education at Berkeley date from the first decade of this century. William Ritter conducted life history studies of salamanders and sponsored such students as Loye Miller. When Joseph Grinnell founded the Museum of Vertebrate Zoology in 1908, that unit became the local center for studies of ecology and systematics. Grinnell was principally an ornithologist, but he conducted research on amphibian and reptilian distribution and sponsored a number of students. Tracy Storer, Charles Camp, Jean Linsdale, Henry Fitch, and Tom Rodgers were students who later served in a variety of staff and faculty positions at Berkeley. Camp's interests shifted from living to fossil lower vertebrates, and in time he became Professor of Paleontology and Director of the Museum of Paleontology on this campus.

David Wake, whose duties as Director of the Museum of Vertebrate Zoology keep him from using his microscope.

The Museum of Vertebrate Zoology continues to be the principal center of herpetological research at Berkeley. The collections now include about 150,000 catalogued specimens, with major emphasis on western North America, Mexico, and Central and South America. Robert Stebbins was the first permanent faculty curator of the herpetological collection, and following his appointment the level of research and teaching activity in herpetology increased greatly. A second faculty curator, David Wake, joined the University in 1969 and is now Director of the Museum. A third faculty member associated with the Museum is Marvalee Wake, Associate Research Morphologist. The Museum has a wide variety of special collections and research facilities, including a fully developed laboratory for biochemical genetics under the supervision of Curatorial Associate Richard Sage. A special feature of the Museum is a large, fully catalogued frozen tissue collection which is made available to qualified investigators. The Museum operates the Hastings Natural History Reservation, a 2,000 acre reserve with laboratories and residences located in the Upper Carmel Valley near Monterey and Salinas, California. John Davis, an ornithologist who also conducts studies of lizard ecology, is the resident in charge of the Reservation.

Robert Stebbins (wearing hat), Professor of Zoology and Curator in Herpetology, graduate student, Ted Pappenfuss, and Research Associate Nate Cohen barter with local collectors in Baja California for Bipes, the subject of Ted's doctoral thesis.

Affable Paul Licht must resort to intimidation to earn the respect of his students, Duncan MacKenzie, a comparative endocrinologist, Martin Feder, who recently completed his doctoral thesis on the physiological ecology of tropical salamanders, and postdoctoral student Antonella Gallo.

Robert Stebbins has conducted studies of the ecology, physiology, systematics and conservation of amphibians and reptiles. Currently, he is deeply involved in conservation efforts associated with off-road vehicle damage to the southwestern deserts. David Wake is studying the evolutionary biology of salamanders, with emphasis on comparative and functional morphology, systematics, and distributional ecology. Marvalee Wake emphasizes morphological studies of the reproductive system in lower vertebrates, and the evolutionary biology of caecilians. O.P.

Marvalee Wake, Associate Professor of Biology and Zoology and Associate Research Morphologist in the Museum, happily contemplates caecilians.

Pearson, retired Director of the Museum, maintains an active research program, including studies of the ecology of South American lizards. Paul Licht, Professor and Chairman of Zoology, is a physiological ecologist and comparative endocrinologist, currently involved in studies of the pituitary hormones of reptiles and amphibians. Other faculty members in Zoology who conduct research on amphibians and reptiles or sponsor students in these areas, or both, include Richard Eakin (comparative embryology, photoreceptor ultrastructure), Robert Colwell (community ecology), and Howard Bern (comparative endocrinology).

Faculty members in other departments who are actively involved in research on lower vertebrates and who sponsor students in certain aspects of herpetology include Allan Wilson in Biochemistry (anuran evolution), Vincent Sarich in Anthropology (lizard evolution), Joseph Gregory in Paleontology (lower vertebrate paleontology), E.R. Lewis in Electrical Engineering and Computer Sciences (structure of anuran inner ear), and Carl Nicoll in Physiology-Anatomy (endocrinology of prolactin).

Sam Sweet, who works with spring and cave salamanders of the Edwards Plateau, finds microscopes useful in telling dorsal from ventral sides of snakes. Sam will be Assistant Professor of Biological Sciences at the University of California, Santa Barbara, starting this fall.

Ray Huey, basking momentarily, will join the University of Washington this Fall as an Assistant Professor of Zoology.

There is an active post-doctoral program at Berkeley sponsored principally by the Miller Institute for Basic Research in Science. Miller Fellowships are two years in length and offer a generous stipend as well as research support. Ray Huey is a current Miller Fellow, and other recent fellows in this program include such herpetologists as George Gorman, Steve Arnold, and Al Bennett. Other current postdoctoral students in herpetology include Antonella Gallo and Ellen Daniel (both comparative endocrinology) and Craig Gundy (lizard photoreceptors).

Research Associate Anita Pearson applies ultrastructure techniques to the study of endocrine organs. Gloria Wurst studies developmental endocrinology and collaborates with David Wake in studies of evolutionary genetics of salamanders.

Curatorial Associate Gloria Wurst works with the Museum's herpetological collection, but the electrophoresis lab is her first love.

Since 1970 a number of students have been awarded Ph.D. degrees in some aspect of herpetology, including Kristin Berry, Charles Brown, Allan Brown, Dennis Bramble, Pille Bunnell, Bruce Bury, Susan Case, James Edwards, Eduardo Fuentes, Joseph Crim, James Lynch, Linda Maxson, Virginia Maiorana, Charles Muller, John Ruben, Judy Stamps, James Stewart, and Hing Wo Tsui.

Pedro Alberch, second year graduate student from Barcelona, is enthralled with x-rays of South American salamanders.

Graduate students who have just completed their degree work include Martin Feder, Steve Ruth (comparative lizard demography), Lynne Houck (reproductive biology of tropical salamanders), and Sam Sweet. Current graduate students include Pedro Alberch, Kay Yanev, Julie Feder (hybridization of Bufo), Tom Hetherington (salamander photoreception),

Kay Yanev has lost part of her head over her computer output. She is presently completing her doctoral thesis on genetic and morphological diversification of Batrachoseps.

Ted Papenfuss, Kristine Tollestrup, Duncan MacKenzie, Ron Marlow, John Cadle (salamander evolutionary genetics and snake systematics), Jim Hanken (genetic and morphological studies of Thorius), David Dobkin (lizard ecology), Bill Rainey (sea turtle evolution and biology), Jacques Gauthier (anguinomorph lizard paleontology, comparative anatomy and evolution). Undergraduates often are involved in various research projects, and currently Brad Shaffer (who will be a graduate student at the University of Chicago this fall) and Paul Elias, both working with Guatemalan salamander biology, are the most actively involved.

Curatorial Associate Dick Sage, on right, and gradute students Kristine Tollestrup and Ron Marlow are studying the Santa Cruz Long-toed Salamander. Their main interests are the evolutionary genetics of the Rana pipiens complex, ecological studies of Crotaphytus, and the biology of desert tortoises, respectively.

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A CASE OF GONADAL ATROPHY IN LISSEMYS PUNCTATA PUNCTATA (BONNT.) (REPTILIA, TESTUDINES, TRIONYCHIDAE)

During our studies on gonadal cycles in some fresh water turtles, we captured a normal-appearing adult female Lissemys punctata punctata (Cat. No. JUBR-57, deposited in the Museum of the Department of Bio-Sciences, University of Jammu) on 2 March 1976 from a shallow pond near Ranbirsingh Para, Jammu (India). The turtle was measured, weighed and cut open (measurements and other data are provided in Table 1). Based on our observations of gonads in this species, this specimen's gonads presented an appearance entirely different from normal ovaries. The structures did not resemble normal testes either. The specimen was definitely a female. The literature available on gonadal abnormality in chelonians (Cagle, 1950; Hansen, 1943; Risley, 1941) makes no mention of the gonadal condition observed here.

The gonads, along with their ducts, were excised, measured and weighed (see Table 1). They were washed in physiological saline and fixed in dichromate-formalin-acetic acid fixative. A small piece of the fixed material from gonads and associated ducts was processed for sectioning and staining. Sections were cut at 7 micra, stained with Mallory's trichrome stain and microphotographed.

In all its external features, the turtle appeared a normal, mature female. The gonads, here considered "ovaries", occupied the normal position in the abdominal cavity and were whitish in color and spongy in consistency. These ovaries were lobulated with deep interlobular grooves and sharp marginal notches (Fig. 1). Normal ovaries in females of comparable measurements are yellowish in color and blistered in appearance due to numerous developing follicles of varying diameters. No follicles of any size were to be seen in these structures in our specimen. Moreover, in this specimen, these ovaries were considerably lighter in weight than normal ones.

The ducts associated with these ovaries, here considered "oviducts" (Fig. 1), were not fully developed, and were shorter and lighter in weight than normal oviducts in specimens of comparable size and weight. The anterior portion of each oviduct was attached to its gonad, which is also abnormal. Not only are normal oviducts free from the ovaries and open into the abdominal cavity anteriorly, but they also show an external demarcation into 4 regions, viz., the infundibulum, the tuber, the uterus and the vagina. Such an external differentiation in the oviducts of our specimen is completely lacking.

Histologically, the ovaries in the specimen were made up of numerous large and distended lacunae of varying shapes and sizes (Fig. 2). Most of these lacunae were partially filled with sparce, light-blue staining, non-cellular debris and a few darkly stained particulate in-

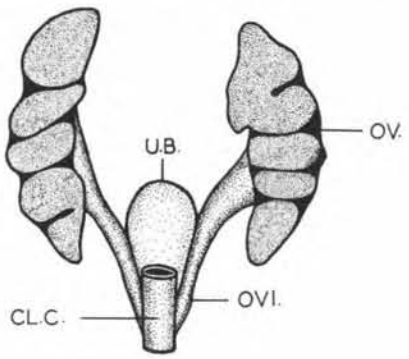

Figure 1. Lissemys punctata punctata, showing the general appearance of the abnormal ovary and the unusual connection between it and its oviduct. OV. ovary; OVI. oviduct; U.B. urinary bladder; and CL.C. cloacal chamber.

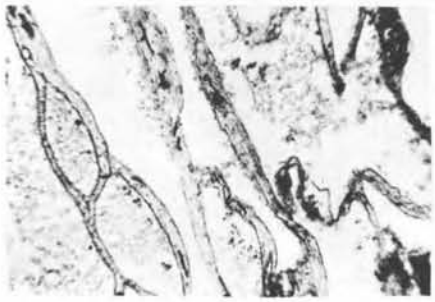

Figure 2. Cross section through the abnormal ovary, showing lacunae filled with a smear and boundary walls having blood cells and capillaries (X 120).

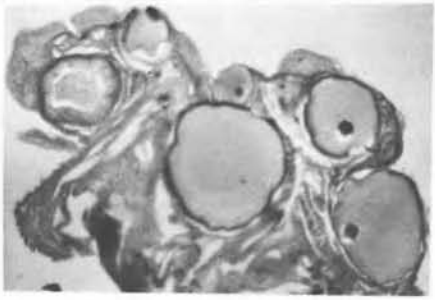

Figure 3. Cross section through normal ovary of L. punctata punctata showing oocytes at different stages of growth (X 50).

clusions. The boundary walls of the lacunae showed the presence of some globular transparent structures, of a non-cellular nature. Similar structures were also found within the lacunae. Large numbers of capillaries and free blood cells were, however, seen in the inter-lacunal filling. The normal histology of ovaries obtained during our study from individuals of comparable size and weight reveals the occurrence of oocytes at different stages of growth, a few corpora lutea and some atretic follicles (Fig. 3). As seen in transverse section, the oviducts resembled normal ones in their histological elements except for a low columnar epithelium on the lumenal side. Perhaps, the low height of the oviducal epithelium, particularly in the tuber portion, is indicative of the failure of production of the ovarian hormones responsible for preparing the oviducts for the reception of the eggs.

We feel these ovaries suffered total atrophy before producing any oocytes or eggs. Although it is presumptuous at present to attribute this type of total ovarian dysgenesis to any specific cause, a disturbed hormonal interplay as the chief factor in this case could not be ruled out.

ACKNOWLEDGMENTS

Authors are grateful to Professor Y.R. Malhotra, Head, Department of Bio-Sciences, University of Jammu, for facilitating our working in the department.

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P.L. DUDA and V.K. GUPTA, Department of Bio-Sciences, University of Jammu, INDIA.

Features Compared	Abnormal Specimen	Mean values of normal specimens (N = 3)
BODY WEIGHT	1900 gms	1083 gms
LENGTH X WIDTH OF CARAPACE	262 X 240	228 X 213
OVARY:		
1. color	whitish	yellowish
2. shape	lobulated	blistered
3. weight		
(i) right ovary	10.50 gms	11.62 gms
(ii) left ovary	9.95 gms	18.21 gms
4. follicular condition	follicles absent	numerous follicles of varying diameters
OVIDUCT:		
1. segmentation	absent	external segmentation
2. length (right/left)	290/295	675/685
3. weight (right/left)	2.38/1.75 gms	12.14/17.62 gms
4. relative epithelial height	low	high

Table 1. Comparison of various features of the abnormal specimen of Lissemys punctata punctata (cat. No. JUBR-57) and normal specimens of the species captured from the same locality and in the same month. (Measurements in mm unless indicated otherwise.)

THE STATUS OF DRYMARCHON CORAIS COUPERI (HOLBROOK), THE EASTERN INDIGO SNAKE, IN THE SOUTHEASTERN UNITED STATES

In recent years, zoologists, naturalists, and others have expressed serious concern about the apparent decline or disappearance of Drymarchon corais couperi over much of its original range. This paper will evaluate the current status of this species in the southeastern Coastal Plain.

Drymarchon corais reaches the northernmost limits of its range in Effingham County, Georgia (Moulis, 1976). It inhabits xeric sandhill habitat over most of its range. Over much of the Coastal Plain, this form might be considered endemic to habitats which support populations of the tortoise, Gopherus polyphemus. Drymarchon utilizes the deep inclined burrows of these tortoises extensively for refuge and wintering. While D. c. couperi is typically associated with xeric habitats, it is sensitive to dessication, and may additionally rely upon these burrows to reduce moisture loss during dry periods (Bogert and Cowles, 1947).

Sandhill habitat typically includes longleaf pine (Pinus australis), turkey oak (Quercus laevis), and the wiregrasses (Aristida stricta and Sporobolus junceus). Each of these species may exist in greater or lesser density, and may be complemented by other pine and oak species. Other plants include saw palmetto (Serenoa repens), prickly pear cactus (Opuntia ompressa), lowbush blueberry (Vaccinium sp.), hawthorn (Crataegus sp.), and slender yucca (Yucca sp.). The soil is sandy or loamy, and is well-drained due to the porosity and elevation of the geological deposits.

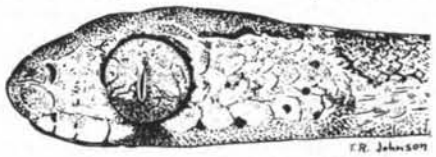
Other vertebrate commensals of Gopherus burrows on a regular or incidental basis include the gopher frog (Rana areolata ssp. capito, sevosa, and aesopus), southern leopard frog (Rana utricularia), southern toad (Bufo terrestris), oak toad (Bufo quercicus), eastern glass lizard (Ophisaurus ventralis), ratsnakes (Elaphe sp.), eastern coachwhip (Masticophis f. flagellum), southern pine snake (Pituophis melanoleucus mugitus), eastern diamondback rattlesnake (Crotalus adamanteus), cottonmouth moccasin (Agkistrodon piscivorus ssp.), red fox (Vulpes fulva), coyote (Canis latrans), river otter (Lutra canadensis), opossum (Didelphis marsupialis), striped skunk (Sylvilagus floridanus), and numerous rodents. Thirty-two species of arthropods, including several endemics, have been found in tortoise burrows (Young and Goff, 1939).

This habitat is described as a fire-subclimax (Laessle, 1942). Periodic burning is essential to maintaining optimum wildlife carrying capacity and species diversity. Such burning occurred naturally in primeval times due to lightning or from accidental or deliberate burning by prehistoric man. Managed burning every 8-10 years removes accumulated leaf litter and keeps pine and oak size short and scrubby. Increased light and reduced leaf litter is conducive to wiregrass growth, which is an essential forage for Gopherus. Tortoise density within a given area is influenced by wiregrass prolificacy. In turn, it has been suggested that burrow-constructing vertebrates may contribute significantly to the carrying capacity of a habitat (Mount, 1963). The absence of periodic burning is increasingly evident in some portions of the Coastal Plain. Such areas have reduced wiregrass growth and a much lower tortoise density per acre.

The elevated, well-drained nature of the sand ridge habitat provides a prime site for construction, agricultural and forestry development, and livestock farming. Primitive and paved roads frequently transect these habitats. Physiographically, this habitat type has always occurred as disjunct segments randomly distributed over the Coastal Plain. There is no question that remaining natural sandhill habitats are rapidly declining, both in quality and in area. It is common to observe small tracts of this habitat directly adjacent to much larger areas of completely cleared farmland or pastureland, all part of the same sand ridge. It is obvious that such small tracts are merely remnants of much larger and extensive natural ridges. Loss of this habitat type in Florida has been estimated at roughly 5% per year (Ashton, pers. comm.). Comparable loss in Georgia is apparent. Encroachment of this type not only destroys the habitat for many species but also increases the likelihood of human encounter with the conspicuous indigo and other snake species.

The use of all terrain vehicles (ATV's) such as trail bikes and dune buggies is prevalent in many otherwise well-preserved sandhill areas. Indiscriminant use of these vehicles destroys wiregrass and other ground vegetation which is essential to soil stability. Basic forage for the tortoises is also reduced. Several such areas are reverting to a dune-like nature. Gopherus is unable to construct burrows in loose, drifting sand, resulting in disruption of the entire ecological community (Franz, pers. comm.).

The association of Crotalus adamanteus, the eastern diamondback rattlesnake, with Gopherus burrows, especially during the winter months, has brought about an additional and serious pressure on the entire tortoise community. Since the rattlesnakes frequently congregate in sand ridges to winter in the burrows, the practice of forcing these reptiles from the burrows by introducing varying amounts of gasoline through a plastic hose has become widespread. The advent and growing popularity of rattlesnake roundups and rodeos, centering around several small communities in southern Georgia, Florida, and Alabama, has significantly increased this pressure.



Many snake hunters are skilled at locating a snake in a burrow by listening through the hose. One half to six ounces of gasoline, ammonia, or some other noxious chemical is then introduced into the burrow if a rattlesnake is detected. Novice hunters may "fumigate" any hole in which a sound is heard. It has been estimated by Speake and Mount (1973) that fewer than 50% of the snakes subjected to "fumigation" in this manner actually leave the burrow. Personal observations and conversations with snake hunters would substantiate this estimate. In fact, a few hunters have discarded the technique due to its relative ineffectiveness.

A high mortality in colubrid snake species for this practice has been demonstrated (Speake and Mount, 1973). Of three specimens of Drymarchon corais couperi confined in tortoise burrows overnight, and exposed to two ounces of gasoline on the following morning, two died in twelve and fourteen days. The third was released after a twenty-four day observation period. All three snakes came to the mouth of the burrow within 3 to 35 minutes after the gasoline was introduced. That Drymarchon and other serpentine commensals of the tortoise community are incidentally or purposely gassed during snake hunts is certain. Fifteen specimens of D.c. couperi were collected by gassing from one large tortoise colony in Jeff Davis County, Georgia in early 1976. All were brought to the Claxton, Georgia rattlesnake roundup, where they were sold to a visiting Florida snake dealer (Moulis, pers. comm.). Personal investigation of six additional specimens from the same county, and at the same event, revealed that they had been excavated from two burrows in a different colony by another hunter. The latter specimens were sold singly to casual visitors to the roundup. All were in poor condition, with numerous skin lesions.

The eastern indigo snake has always been widely sought as a pet or for exhibition purposes due to the large size and docile nature of the species. It is the largest serpent species in North America, and specimens approaching eight feet in length were formerly common. It has been a highly commercialized species for many years. The preference of many specimens for a specific food item, which may be unavailable to the lay keeper, raises serious questions as to its propriety as a pet. In addition, the species is known to regularly harbor linguatulids, a primative arachnid parasite which is transmissible to man (Hunt, pers. comm.).

The effect of residual pesticides on Drymarchon populations has only begun to be evaluated. Three separate samples of body fat provided by the Atlanta Zoological Park to the Georgia Department of Agriculture for analysis yielded the following results:

Metabolites of chlordane

(PPM = parts per million)

#1 female

Heptachlor Epoxide	4.02 PPM
Trans Nonachlor	1.06 PPM
Octachlor Epoxide	0.87 PPM
Dieldrin	1.37 PPM

#2 female

Dieldrin	.08 PPM
Mirex	17.20 PPM

#3 male

Trans Nonachlor	.83 PPM
Octachlor Epoxide	.61 PPM
Dieldrin	5.6 PPM

#4 male

Octachlor epoxide	0.21 PPM
Trans Nonachlor	0.43 PPM
Mirex	0.55 PPM
PCB (arochlor 1260)	4.7 PPM
Heptachlor Epoxide	0.19 PPM
Dieldrin	1.0 PPM

#5 male

Octachlor Epoxide	2.39 PPM
Trans Nonachlor	2.42 PPM
PCB (arochlor 1260)	12.3 PPM
Heptachlor Epoxide	0.65 PPM
Dieldrin	13.3 PPM

Alarmingly high levels of these materials in initial samples indicate the need for extensive analysis.

The last record for D.c. couperi in Alabama was taken in Covington County in 1954 (Neill, 1954). This species was reportedly extirpated in Mississippi in the 1930's and 1940's (Mount and Speake, in press). Only one reference to the species in South Carolina has been located (Ditmars, 1939). No specific records are known. However, remnants of

suitable habitat occur in Jasper County, South Carolina, directly across the Savannah River from identical habitat in Effingham County, Georgia. Although extensive field examination has failed to yield specimens in the South Carolina locality, there remains a possibility of a population existing there.

It is appropriate to suggest that remaining viable and natural populations of this species occur only in Georgia and Florida.

In Georgia, D.c. couperi seems to prefer the Miocene and Plio-Pleistocene marine terrace sand deposits in the middle and lower Coastal Plain of the southeastern quadrant of the state. Only one verified record for this species in southwest Georgia is available (Seminole County, Ashton, pers. comm.). Due to the paucity of suitable habitat in the Dougherty Plain, one suspects this represents a northward extension of Florida panhandle populations, rather than a continuous range across southern Georgia. All records occur in association with xeric sandhill communities. There appears to be a strong preference for tortoise communities constructed on weathered river dunes which are adjacent to or near tupelo (Nyssa aquatica) or bald cypress (Taxodium distichum) swamps, river bottoms, or large tracts of pine flatwoods. Drymarchon appears to range into more mesic habitats during periods of moderate temperature and greater precipitation. Many food species are more abundant in these wetter habitats.

In Florida, Drymarchon remains intimately associated with the sandhill habitat north of Lake Okeechobee, although it is not uncommon to find wandering individuals in decidedly mesic situations. In southern Florida, the species is often common along canal banks, where it may enter the water when pursued, or attempt to escape into the numerous crab holes along the banks. I examined thirteen specimens from these habitats at several localities off Highway 1, near Florida City, Florida, in the late 1960's. Australian pine hammocks, which often comprise the highest terrain in the area, are also frequented by the species. Judging from the escape measures employed, the crab holes are analogous to tortoise burrows in more northerly populations as a place of refuge. A DOR specimen was taken in August, 1969 on Highway 27 in Taylor County, Florida, east of Perry. The habitat was mesic flatwoods. In October, 1970, a specimen was found in a xeric sandhill, 7 miles north of Niceville, Florida, in Okaloosa County.

Florida has protected the eastern indigo snake as a "threatened" species since 1971, due to habitat reduction, wanton killing, highway fatalities, and commercial collecting (Goodson, pers. comm.). In February, 1977, the Georgia Board of Natural Resources designated Drymarchon corais couperi as a "threatened" species under provisions of the Georgia Endangered Species Act of 1973. This step provides protection throughout its remaining range. Protection in Florida and Georgia prohibits the killing, capture, possession, or sale of this animal without permits from the state of origin.

The U.S. Department of Interior, Office of Endangered Species is currently evaluating the comprehensive status of this species. It is likely that it will receive federal protection within the immediate future. Such action would provide conclusive protection throughout the original range, making reintroduction into areas of extirpation possible. Federal matching funds may then become available to the states in question for management, research, and enforcement purposes.

Dr. Dan Speake, Alabama Cooperative Wildlife Research Unit, Auburn University, the Atlanta Zoological Park, and the Savannah Science Museum are assisting the Georgia Department of Natural Resources in specific areas of field and laboratory research, public education, and captive propagation. Dr. Speake is utilizing telemetry to determine home range, habitat preferences, and seasonal movement. A similar study, funded by the Zoological Society of Atlanta, will focus upon thermal preferences.

The potential for captive breeding of D.c. couperi is good. Many areas of prime habitat appear to have extremely low population densities, if indeed any individuals remain at all. Captive breeding from stock appropriate to the proposed release sites would eliminate potential egg predation and allow the monitoring of released hatchlings to obtain data on home range, seasonal range, growth in the wild, and other information. A formal recommendation has been made to the Georgia Department of Natural Resources regarding the development of General Coffee State Park, in Coffee County, Georgia as a natural history park. This park encompasses substantial sand ridge habitat and a dense tortoise population adjacent to the tupelo swamp backwater of Seventeen Mile Creek. Self guiding nature trails could be initiated to interpret the flora, fauna, and physiography of the habitat. Such limited development would increase public awareness and interest, would further justify the state's continued support of this little-used park, and would enable the establishment of an initial state sanctuary for Drymarchon recovery and study, without additional capital expenditures by the state (Lawler, 1976).

Essential to the protection and recovery of Drymarchon corais couperi is adequate protection for Gopherus polyphemus. Pituophis melanoleucus mugitus and Rana areolata sevosa, capito, and aesopus are other commensals of the Gopherus community thought to be declining in at least portions of their ranges. Securing Gopherus habitats and development of a practical recovery program for Drymarchon would directly benefit the entire sand ridge biotic community, and would provide "survival islands" for many species in the future.

There is a consensus among scientific investigators, naturalists, and even some commercial snake hunters, that Drymarchon has seriously declined in the southeast, and is a threatened, if not endangered species. Commercial collection, habitat loss, exposure to gasoline during rattlesnake roundups, wanton killing, and residual pesticides are continuing pressures of great concern. Commercial retail value has soared to from $75 to $250 per specimen. As the species becomes scarcer, the demand and value increases. Federal protection seems to be the only effective way of dealing with this factor. In addition, political considerations within Georgia may delay enforcement of laws prohibiting "fumigation" or other disturbance of tortoise burrows. Federal protection could address this problem on federal lands. It is doubtful that Georgia will have available funds to do more than provide de facto protection within the state. South Carolina has been apprised of the importance of "endangered" status in that state, due to old records there. The very real and vital necessity of acquiring and protecting suitable habitat would be greatly aided by federal protection and associated grants-in-aid to state endangered species programs.

Without positive action toward the full protection and recovery of Drymarchon corais couperi and its prime habitat, the future survival of this and allied species appears to be highly questionable.

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OBSERVATIONS ON BREEDING MIGRATIONS OF AMBYSTOMA TEXANUM

In Kansas, Ambystoma texanum migrates to breeding sites after rains during late February or early March (Collins, 1974). This paper provides new information on various aspects of migration and reproduction in a Kansas population that I observed in 1974 and 1975.

Salamanders were collected from a one-mile stretch of blacktopped road (31st Street between Louisiana and Haskell Streets) in Lawrence, Douglas County, Kansas. Search of the road began soon after dusk on each day in which precipitation had occurred and for several days afterward from February through May. Salamanders were preserved and tagged within three hours of collection. Direction of travel, sex, and snout-vent length was recorded for each animal. In the laboratory, sizes of oviducts, ovarian eggs, opistonephric ducts, and testes were measured with an ocular micrometer or vernier calipers. Number of ovarian eggs were counted and stomach contents were examined. Statistical tests follow Sokal and Rohlf (1969).

Salamanders traveled to the low-lying fields of the Wakarusa River floodplain south of the road and then returned to the north side after breeding. The pattern of direction of travel in both years was an increasing percent of northerly directed salamanders as the season progressed (Table 1). The first appreciable rain of the year occurred on 6 March 1975 when 75 salamanders were collected traveling south. Successive collections showed an increasing percent traveling north. On a comparable date one year earlier, most salamanders were oriented north as was the case with successive collections. Salamanders had migrated south earlier as evidenced by eggs developed to yolk-plug stage found at the breeding site on 2 March. However, the road was searched on four previous occasions beginning on 12 February and no salamanders were seen. Collins (1974) found eggs in the same population as early as 25 January. No sexual differences were noted in timing or direction of travel.

	Date	n	% traveling north
1974	4 Mar	24	63
	28 Apr	17	82
	29 Apr	12	92
1975	6 Mar	75	0
	26 Mar	19	32
	7 Apr	19	74
	13 Apr	13	77

Table 1. Chronological changes in direction of travel.

Table 2 shows various statistics for pre- and post-reproductive animals. All males were mature judging from size of reproductive organs, swollen cloacas, and presence of spermatophores. Two females (SVL - 45, 46 mm) were judged immature based on undeveloped ovaries and small oviducts (0.20, 0.15 mm). Mean snout-vent length of 77 males was 74.0 $\pm$ 0.58 mm (range 60-85) whereas in 74 mature females it was 79.1 $\pm$ 0.53 (range 69-88). The difference in size is significant ($t = 6.48$; $P < 0.001$). Sex ratio was not significantly different from 1 : 1 ($X^2 = 0.06$; $P > 0.50$). Pre-ovulatory females had uniform eggs 1.4-1.7 mm in diameter. Number of ovarian eggs ($\bar{x}$ = 658 $\pm$ 24) ranged from 341-896 and was correlated with snout-vent length $\hat{Y} = -1282 + 24.1x$ ($P < 0.001$). Regression of sizes of ovi-

	n	Number traveling N or S		Percent with food in stomachs	Width of oviduct (mm)	Width of opistonephric duct (mm)	Testis area (mm)
FEMALES							
pre-ovulatory	38	1	37	18.4	2.5±0.62	--	--
post-ovulatory	35	31	4	40.0	0.9±0.03	--	--
MALES							
pre-reproductive	56	0	56	12.5	--	1.2±0.03	33.5±1.30
post-reproductive	19	19	0	36.8	--	0.6±0.04	20.7±1.12

Table 2. Comparison of various statistics between pre-reproductive and post-reproductive A. texanum. Reproductive status of males was determined a priori by direction of travel. Testes approximated a flat, ribbon shape. As an index of testis size, area was computed by multiplying length by greatest width for each testis. Oviducts were measured near the middle of their length.

ducts, opistonephric ducts, testes, and swelling of male cloacas occurred after reproduction. One post-ovulatory female traveling south on 13 April 1975 contained 58 eggs in the left oviduct; the right oviduct, measuring 1.4 mm in diameter, was empty. A significantly higher ($P < 0.05$; Sokal and Rohlf 1969, p. 607) percent of both post-reproductive males and females contained food in the stomach compared to pre-reproductive animals. Apparently, sexually active A. texanum feed little as is true for A. maculatum (Shoop, 1967). Earthworms were the most frequent food item, being found in 34 of 35 stomachs. One stomach contained a centipede and two other stomachs contained, in addition to earthworms, fragments of a beetle, a weevil, and a spider.

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Book Reviews

THIS BROKEN ARCHIPELAGO: CAPE COD AND THE ISLANDS, AMPHIBIANS AND REPTILES. By James D. Lazell, Jr., with photographs by Martin C. Michener, 1976. Demeter Press, Quadrangle/The New York Times Book Company, N.Y., N.Y. xi + 260 pp. $12.50.

The 37 species of amphibians and reptiles known from Cape Cod and its associated islands are presented to the readers of this book with true affection by the author. This is not only a systematic treatment, but a chronology of the author's, and his friends', adventures as herpetologists in the field. The emphasis is on the living animals, where they occur and what they do. The outstanding feature throughout is Lazell's ability to develop a genuine fondness for the small, sometimes slimy, secretive, and mostly misunderstood members of these two vertebrate classes. The book is a first attempt, excepting Roger Conant's field guide, to assess the herpetology of this area. The text is easily read, often humorous, interesting, informative, and sometimes caustic in its attack on individuals, professional and amateur alike. His pointed comments refer primarily to field collecting for museum specimens and taxonomic considerations. One explanation for some rather heavy language may be the author's affiliation with the Massachusetts Audubon Society, but nowhere are his biases totally unfounded.

Chapters 1 and 2 discuss the land and the sea, respectively, describing in understandable detail the glacial origins of the area, the dynamic interactions of land, wind, ice and water. Terms such as knobs, terminal moraines, kettles, pamets and tombalos are so vividly defined that they would be easily remembered, even without the fine habitat photographs. These, and similar terms throughout the text, are also italicized for easy reference. Seral stages of vegetation, subclimaxes and ecotones are described for each island group to contrast the diversity of community types in the area. Of even greater importance, in Chapter 2, the all pervasive role of the sea in shaping the coastal land masses, and cyclicly controlling temperature and salinity, is described.

Chapters 3 through 7 describe the herpetofauna. Each chapter begins with a brief overview of the general origin, distribution and systematics of the order being introduced. In several individual species accounts problems of general biological interest concerning such varied topics as genetics, physiology, and zoogeography are presented. Examples include a discussion of DNA and the genetics of polymorphism in Plethodon cinereus, the peculiar distribution of Notophthalmus viridescens in this area and the hypothesis of a correlation of distribution and the salinity of breeding sites, the taxonomic question of recognizing Notophthalmus instead of Triturus as the real generic name, the nagging question of where Hyla crucifer goes during the "off" season, and why do many herpetologists exhibit what Dr. Lazell terms "ignorance" of the literature concerning systematic revisions? Explaining to a non-biologist the role of DNA in the genetic polymorphisms of Plethodon required considerable insight and writing talent. Lazell does a fair job in about 3 pages. Those who would recognize the simplified, and basically erroneous, statement that "a gene that doesn't work is called recessive" may criticize it. But, in his context we could do much worse in explaining that gene's contract to a dominant one. I do take exception to his view of introgression as "hybrids...so well adapted to new conditions that they out breed either parental stock" (p. 108). His statement, in my opinion, refers to a hybrid swarm. Introgression more properly refers to backcrossing of the F1's by either parental populations. As to "ignorance," Dr. Lazell rightly points out the problems, but does little to indicate solutions (quite unexpected from a Massachusetts Audubon member). If one recognizes how immense was the genus (in this case Natrix), and how variable, then one must admit that a proper definition requires a monographic study of no small effort. With reference to Ed Malnate's study of the genus Natrix, such an effort has split out Natrix from three other genera, and most have accepted the split in principal (including McDowell). Douglas Rossman, an extremely thorough worker, has now separated New World from Old World Natrix, the former designated Nerodia and the latter Natrix. The original Natrix complex, thus pared down, might now be ready for a reexamination of Nerodia-Natrix-Thamnophis affinities. Classifications are slow to change--and in many cases should be. Lumping often obscures problems. Witness the long standing myth of the singular, wide ranging Rana pipiens, or the Natrix sipedon-fasciata complex as a single species group. Surely the lumping of Thamnophis with Nerodia requires more than Lazell's "footnote." The irony of the argument is that while Thamnophis may be Natrix they may not at all be Nerodia!

One recurring theme throughout the book concerns the author's almost fanatic aversion to collecting museum specimens, and the seemingly

continuous instruction against displacing individuals from their natural habitats. Unfortunately, in making his point Lazell must admit to paucities of data, or record sized specimens that were not preserved due to this philosophy. I am sure Lazell realizes the importance of museum specimens, as individual records or as series. In several places he does suggest the collection of a voucher specimen. Personally, I believe his aversion to collecting museum specimens is a ploy to down beat the tendency of the young, exuberant, and inexperienced to go hog wild! Similarly, for the several reasons and examples Lazell so clearly presents, no one should attempt displacement of a species from its natural habitat.

Chapter 8 concerns zoogeography of the area based on the herpetofauna. As stated, it is true that we need more in-depth field studies and perhaps less theorizing. However it is unfair, unjustified, and downright wrong to single out MacArthur and Wilson's theory of island biogeography as "worthless." The very fact that Lazell devotes a chapter to the subject and attempts new interpretations, is justification enough for the worth of their efforts.

I enjoyed this book so much that I found little more to criticize that would not be considered trite or just plain philosophical argument. A few typographical, grammatical and illustrational errors are listed here mainly to indicate I read the book thoroughly! "Cape Page" should be Cape Poge in the figure on p. 8; "tell" should be tells (p. 110, line 12); "American toads...breed later" should be breed earlier on p. 111, line 15; "occurs" should be occur (p. 111, line 31); there is an apparent smudge on the right arrow of the figure on p. 112; "impotrant" should be important on p. 140, line 2; the photograph on page 190 is upside down; shading of the figure on p. 199 obliterates locality data; "Opmeodrys" should be Opheodrys in the figure legend on p. 212; "stock" should be stocky on p. 248, line 2.

Most of Martin Michener's photographs are truly outstanding, particularly the frogs and toads, the smaller turtles, and the larger snakes. A compliment to his talents is in reference to his photograph of Natrix s. sirtalis on p. 221, which is every bit as good as the one taken by the late Isabelle Hunt Conant. Michener presents good suggestions for photographing reptiles and amphibians in the last chapter.

This book will be valuable to different groups of people. To the amateur herpetologist and the interested layman, the text will be readable, providing details that took me years to learn in the field. For the high school biology teacher there are many suggestions and examples for the use of laboratory experiments in a natural setting. Professional herpetologists will find interesting hypotheses to test, fine distributional maps, some discussion of geographic variation (however, there are no tables or figures depicting individual variation), and some soul searching arguments which I am sure Lazell will be happy to debate.

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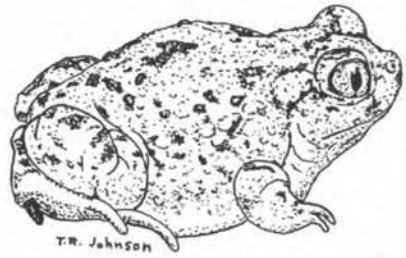


LISTE DER REZENTEN AMPHIBIEN UND REPTILIEN. HYLIDAE, CENTROLENIDAE, PSEUDIDAE. By William E. Duellman, 1977. Das Tierreich, Lief. 95, xix + 225 p. 280 DM (about $117).

Checklists can be among the most useful documents in taxonomic biology. At their lowest level of development--as simple, unadorned lists of species on a taxonomic or geographic basis--their utility is limited and they are likely to age rapidly. But when a checklist is carefully produced to cover one or more large groups, includes extensive synonymies, gives type-localities, cites type-specimens for all species-group taxa, and is thoroughly indexed, then such a checklist is assured a permanent place in the active literature. This is such a work, and the author deserves the plaudits of his colleagues.

This checklist includes as valid taxa (by Duellman's count), 36 genera and 544 species of Hylidae, 2 genera and 55 species of Centrolenidae, and 2 genera and 4 species of Pseudidae. I made no effort to count the number of junior synonyms cited, but the index comprises 21 pages of small print--from acheta to zweifeli. The literature base for the checklist runs through 1974. References are for the most part contained within the synonymies and are given in the customary but lamentable abbreviated mode of citation, omitting titles. The entry for each taxon includes "the most recent publication on the taxon" (presumably the most recent publication of taxonomic significance or utility). If this reference does not appear in the synonymy, there is a separate entry in a terminal bibliography where the much more useful full citation style is employed.

Having expressed my admiration for this publication, I must fulfill the critic's obligation of looking at the other side of the coin. One area where this checklist may create problems for taxonomists is in its listing of "new combinations." Duellman (p. ix) states that "taxonomic changes normally should not be made in a checklist," and I agree completely. However, he finds it necessary to make some changes "for the sake of nomenclatural consistency and stability." Again, I agree that in some instances this may be appropriate; the alternative may mean cluttering the literature with numerous short notes. Some of the new combinations are really not new, however. Duellman specifies ten species of Centrolenella as new combinations (only nine appear in a list on p. ix, but a tenth, C. petropolitana, is in the body of the text), but nine of these species had already been listed under Centrolenella without being indicated as new combinations, by Gorham (1974).

Duellman (p. x) states "New combinations of names listed by Gorham (1974), none of which is supported by evidence, are not included." The difference in evidence seems to lie in Duellman's citing references some of which presumably were available to Gorham but were not cited in his less elaborate format. It would have been better had Gorham indicated new combinations where he created them, but in any event, Duellman's cavalier treatment of Gorham's useful list should not deter taxonomists from determining where particular name combinations were first used.

Tyler's (1971) resurrection of the genus Litoria for frogs of the Australian region formerly placed in Hyla raised questions as to the use of some names that, as secondary homonyms, could not be used in Hyla. One instance is Pelodytes affinis Gray, a name preoccupied by Hyla affinis Spix prior to the revival of Litoria. Nieden (1923) rejected affinis Gray and provided the substitute name Hyla tornieri. Later authors (Loveridge, 1935; Copland, 1957; Moore, 1961; Tyler, 1971) did not recognize tornieri as a valid species, but Cogger (1975), in a work published after Duellman's checklist went to press, revived tornieri (in the new combination of Litoria tornieri) and made diagnostic comparisons. Duellman too listed the species as valid, but under the new combination Litoria affini (Gray), and gave no indication of why specific recognition is warranted. The revival of affinis was improper, and according to Article 59 of the In-

ternational Code (1974 amendment), a junior secondary homonym rejected before 1961 (as Nieden did with affinis) is permanently rejected. Litoria tornieri evidently is the correct name. As an aside, I note that in the synonymy of Litoria affinis, Duellman (p. 114) lists "Hyla latopalmata latopalmata--Copland (partim)," but Copland (1957: 89) placed affinis and tornieri in the synonymy of Hyla lesueurii.

What seems to me an unwarranted revival of a senior synonym is Duellman's use of Litoria punctata Dumeril for the species known for decades as Hyla cyclorhynchus Boulenger and more recently as Litoria cyclorhynchus. The name punctata does not appear to have been used in more than 100 years, was identified with a known species relatively recently (Moore, 1961:319-320), and has an erroneous type-locality. The name would appear to be an excellent candidate for suppression as an "unused senior synonym" (International Code of Zoological Nomenclature Article 79b), and Duellman would have been well advised to "maintain existing usage...and refer the case to the Commission for a decision under the plenary powers" (op. cit., Article 23 a-b).

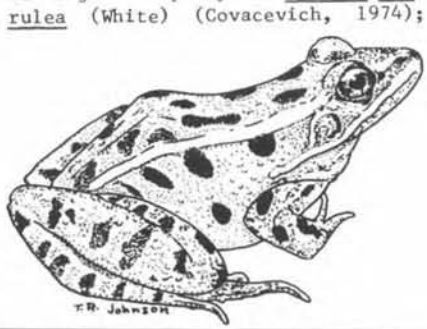
With regard to whether the author of a checklist accepts the most recently published assessment of the taxonomic status of a given form, he is in a difficult position--likely to be damned if he does and damned if he does not. A case in point is Duellman's acceptance of numerous synonymizations or changes from species to subspecies level recommended by Lutz (1973). In reviewing Lutz's book Duellman (1974) was properly critical of changes instituted therein, many of them made with little or no new evidence. I think he would have been justified in rejecting such changes in nomenclature pending more complete study. A stronger case could be made for rejecting Lutz's taxonomy than for sweeping Gorham's new combinations under the rug. In another instance, what seems to be good evidence for restoring species rank to Hyla arborea savignyi was rejected or overlooked (Schneider, 1974), and in the same species group, the decision of Bannikov, Darevsky and Rustamov (1971) to recognize Hyla japonica as a species rather than a subspecies of H. arborea should have been considered.

The area of geographic distribution is one in which some explanatory notes would be helpful. One assumes that in the absence of indication to the contrary, distributional information is summarized from the literature. But what appears to be previously unpublished information is not so identified and, hence, undocumented. An example is the range "Mountains of northeastern Venezuela and Tobago" given for Centrolenella orientalis (p. 192). The inclusion of Tobago in the range of a species known previously only from a single specimen from a montane, mainland locality 370 kilometers away should be documented.

There is a refinement that I stongly urge on future compilers of such extensive checklists as this one. That is to set aside a separate section, thoroughly indexed for species originally described within the major group covered by the checklist but since transferred to a group outside the scope of the list in hand. Presumably the compiler of a checklist will have encountered such names and will have had to decide on their disposition. Thus, little extra work is called for, and the utility of the checklist will be significantly increased.

Consider, for example, the plight of one who might wish to determine the current status of Hyla chica Noble. The logical place to look would be in a checklist of the Hylidae, but since the name was subsequently identified as a junior synonym of an Eleutherodactylus, it has no place in the hylid list. Working back through the Zoological Record, one would eventually find reference to the synonymization in the volume for 1952. Another example is Hyla chimboe Fowler, which is more of a problem because it appears in Gorham's list (1974) in this original form. Unless the reader happened upon a recent paper by Lynch (1976), he would have no way of knowing that chimboe too is an Eleutherodactylus.

Attention needs to be directed to several items so that users of the checklist who so wish may annotate their copies; I include no literature later than the closing date for the checklist, 1974: Hyla kanaima Goin and Woodley (1965) and Hyla microterodisca Werner (1921) were omitted (evidently the latter is a junior synonym of Osteopilus septentrionalis (A. Schwartz and R. Crombie, pers. commun.); Phyllocytes auratus (Boulenger) is not a new combination as indicated on pp. ix and 157, but was first used by Bokermann (1968); Litoria irrorata (de Vis), listed as a valid species, is a junior synonym of Litoria caerulea (White) (Covacevich, 1974); Gastrotheca riobambae is not in the systematic index (p. xii); the specific name of Hyla chrysoscelis is misspelled throughout the text and index ("chrysocelis").



A great accumulation of data such as appears in this checklist can lead one to statistical doodling. I restrained myself to just one such operation: Duellman lists 603 valid species of Hylidae, Centrolenidae and Pseudidae. Of these, 264 (44%) were described by persons who lived at least into the closing year (1974) of the checklist. Aside from saying something about the longevity of herpetologists, this is an indication of the activity in the field of herpetological systematics.

In addition to the general excellence of the text, this is a physically well made publication. The paper appears substantial, the binding is good and the complex job of printing was carried out with few errors apparent to me. But at what a price! Even in a time when $40 technical books are commonplace, this volume stands out at about $0.50 per page. Future compilers of similar checklists should give serious throught to seeking out alternative means and places of publication.

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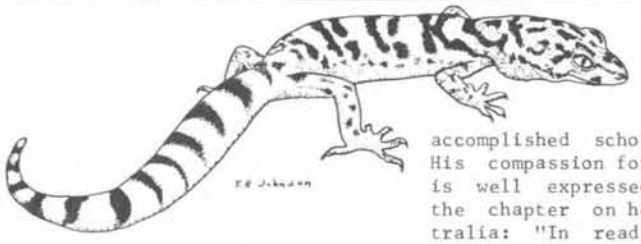
AUSTRALIAN FROGS; HOW THEY STRIVE, THRIVE, AND STAY ALIVE

(Frogs, 1976, Collins Ltd., Sydney, 256 pp.; obtainable in the U.S.A. from Taplinger Publishing Company, 200 Park Avenue South, New York, New York 10003 for $17.50).

In recent years the parturition rate of popular and semi-popular books on amphibians and/or reptiles has been so great that it seems as though the attainment of the carrying capacity of the herpetological community should be imminent. In a packed community a newcomer is likely to survive only if it fills an unoccupied niche. Such is the case of "Frogs," a delightful new book in The Australian Naturalist Library, written by Michael J. Tyler of the University of Adelaide, Australia.

In the preface Tyler tells us: "There are really two major deficiencies in this literary void [publications for naturalists on Australian and New Guinean frogs): firstly a book providing information about the lives of frogs, enabling them to be appreciated as living animals and, secondly, one designed as a field guide for identification. These two objectives are quite different, and my book is concerned only with the first one, which is just how frogs strive, thrive, and stay alive." He has succeeded admirably. "Frogs" is a book about the biology of frogs based primarily upon examples from Australia and New Guinea but with relevant comparative information about species elsewhere in the world.

In a well-organized manner, the reader is presented with 18 chapters beginning with an introduction encompassing basic internal and external structure, distribution, Australian fossils, and a lucid, candid discussion of taxonomy. The latter should be required reading for all biologists. Following are four chapters, each dealing with one of the four families of native Australo-Papuan frogs: Hylidae, Leptodactylidae, Microhylidae, and Ranidae. The sixth chapter deals with the introduced toad, Bufo marinus. Chapters 7 through 16 are concerned with "how frogs strive, thrive, and stay alive," including reproduction, diet and feeding habits, obtaining water and avoiding heat, breathing, communicating by sound, facing enemies, parasites, dispersal, geographic distribution, and frogs and man. Another chapter provides an informative account of the history of herpetology (principally frogs) in Australia. The final chapter on the study of frogs includes commentaries on identification, collecting, maintaining living frogs and tadpoles, techniques of killing and preservation, and herpetological literature. The book concludes with an appendix mostly devoted to lists of the species known from each state in Australia, an extensive list of references organized by chapters, and an index. The illustrations, although not plentiful, are of excellent quality. Thirty-four text figures illustrate principally morphological features. The four black and white and 16 colored plates are excellent; most of these are photographs, and among them are the best illustrations of Australian frogs ever published.



Although the book is directed to Australian naturalists, it far surpasses its intended goal. Tyler writes lucidly and obviously is knowledgeable and enthusiastic about his subject. He whets the reader's appetite with fascinating narratives. He engenders an overwhelming desire to get into the field so as to observe frogs and seek answers to the many intriguing questions posed by the author while he skillfully leads his readers through the maze of information about the biology of Australo-Papuan frogs.

For example, the chapter on reproduction is introduced thusly: "Frogs vary in just about every detail of their reproductive behaviour and the subsequent pattern of development of the young. It isn't just a question of species choosing to be different for the sake of it. Rather the variation is a mirror of the environmental difficulties that have been overcome, and demonstrates a wide variety of success stories."

Tyler represents a fine blend of an astute field naturalist and an accomplished scholarly researcher. His compassion for his predecessors is well expressed in a passage in the chapter on herpetology in Australia: "In reading some of the studies of modern zoologists who have needed to re-examine specimens in some of the collections that were made, it is commonplace to detect a sense of frustration, irritation, and even ridicule at what, by modern standards, are interpreted to be errors of description, resulting from slipshod work. This veiled criticism is unfair, for the only way of assessing early contributions is to appreciate the quality of the techniques of study in vogue in those times, the great difficulty of communication between herpetologists, the absence of specialist journals, the enormous array of new animals demanding attention and concepts of species." How often we forget.

Australia has had many unfortunate intentional introductions of animals. Tyler provides a fascinating account of the history of Bufo marinus in Australia since its introduction in 1935. He takes cognizance of the social and economic reasons for the introduction of the toads, discussing the biological and commercial problems resulting from their population explosion and dispersal, and suggests methods of control. Tyler's approach to conservation measures contained in the chapter on frogs and man embraces a philosophy of the greatest good of all--protection of all species on special reserves, strict regulations on rare species, freedom for amateur and professional alike to utilize and study other species, and limited commercial exploitation of some common species.

Book reviewers are supposed to be highly critical, pointing out errors in the information content, the conceptual framework, the organization, the writing, and the layout of the book. In the case of Tyler's "Frogs" I have nothing but praise, except that I would have chosen a different colored binding.

American writers have been provided with a challenge, for no comparable book has been written on American frogs. With the reading of Tyler's book my enthusiasm for visiting Australia and observing its frog fauna has increased by several factors; probably I shall not be able to await a hoped for companion volume--a field guide.

WILLIAM E. DUELLMAN, Museum of Natural History and Department of Systematics and Ecology, University of Kansas, Lawrence, Kansas 66045.

Conservation

SSAR CONSERVATION COMMITTEE FOR 1977

Members of the SSAR Conservation Committee for 1977 (with the regions they represent in parentheses) are:

Ronald I. Crombie
(West Indies)
Jeffrey H. Black
(South-central U.S.)
Glenn R. Stewart
(Southwestern U.S.)
John H. Larsen, Jr.
(Northwestern U.S.)
Lauren E. Brown
(North-central U.S.)
Robert H. Mount
(Southeastern U.S.)
James D. Lazell, Jr.
(Northeastern U.S.)
Robert A. Thomas
Committee chairperson

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 the range of a species, and thereby permit a more significant interpretation of the biology of same. The standard format for a geographic distribution record is:

Scientific name (common name) as it appears in Conant (1956, 1975) or Stebbins (1966). Locality (use metric for distances). Date and collector(s). Identified or verified by. Place of deposition and catalogue number. Comments. Citation. Submitted by (give name and address).

Please submit new geographic distribution records in the standard format only to Joseph C. Mitchell, Graduate Program in Ecology, University of Tennessee, Knoxville, Tennessee 37916. Short manuscripts are acceptable when data cannot be adequately presented in the standard format.

Recommended citation for new geographic distribution records appearing in Herpetological Review is: Jones, J. 1977. Geographic distribution: Rana pipiens. SSAR Herp. Review 8(1): 1.

SALIENTIA

RANA PALUSTRIS (Pickerel Frog). USA. ARKANSAS: Union Co: 10.3 km S Smackover. 7 June 1974. H.W. Robison. Southern Arkansas University uncataloged. Ouachita Co: Camden city limits at U.S. Hwy. 7, Ouachita River. 25 August 1974. L.D. Blalock. New county records extend known range within the state ca. 190 km S of nearest records in Monroe County and 83 km SE of a record in Polk County. Previous records are from extreme west, north and north central Arkansas (Dowling, 1956, Occ. Paps. Univ. Ark. Mus., 19: 18; Black and Dellinger, 1938, Occ. Paps. Univ. Ark. Mus., 2: 22).

Submitted by HENRY W. ROBISON, Dept. of Biological Sciences, Southern Arkansas University, Magnolia, Arkansas 71753. ●

SAURIA

ANOLIS SAGREI SAGREI (Cuban Brown Anole). USA. FLORIDA: Glades Co: Fisheating Creek Campground along banks of Fisheating Creek, 1 km S Palmdale off US 27. 25 March 1976. C.M. Corwin, et al. Verified by James N. Layne, Archbold Biological Station. Univ. South Alabama Nat. Hist. Mus. 2216-2217. This locality represents an extension of ca. 80 km NW and 160 km SE of Palm Beach County, and Tampa-St. Petersburg populations, respectively (King and Krakauer, 1966, Quart. J. Fla. Acad. Sci., 29: 144-154). Male and female specimens were collected, indicating a breeding colony is probably established in the area.

Submitted by CRAIG M. CORWIN, 417 Cheri Lane, Birmingham, Alabama 35215 and ALICIA V. LINZEY and DONALD W. LINZEY, Department of Biological Sciences, University of South Alabama, Mobile, Alabama 36688. ●

TESTUDINES

CHRYSEMYS NELSONI (Red-bellied Turtle). USA. FLORIDA: Baker Co: Osceola National Forest. Middle Prong, Little St. Mary's River, 7.3 km SW Taylor. 29 April 1977. Seined by C.R. Smith, W. Lippincott, and A. Powers. Verified by W. Auffenberg, Florida State Museum. FSM/UF 39066. First record for the county, and extends the range into the St. Mary's River drainage, approximately 65 km N of previously recorded localities (Carr and Crenshaw. 1957. Bull. Florida St. Mus., Biol. Sci. 2: 25-42).

Submitted by ARNOLD POWERS, c/o Department of Herpetology, Florida State Museum, University of Florida, Gainesville, Florida 32611 and C.R. SMITH, National Fish and Wildlife Lab, Gainesville, Florida 32601. ●

GRAPTEMYS GEOGRAPHICA (Map Turtle). USA. NEW YORK: Dutchess Co: Hyde Park. 1972. Donald C. Buso. Collection of Donald C. Buso. Rhinecliff. 28 July 1972. Nesting female marked and released by Erik Kiviat and Robert L. Bard. Hyde Park. 23 June to 16 July 1973. Six fresh nests. 27 August 1973. Nest with hatchlings emerging. (Seven clutches, 10-18 eggs, $\bar{x} = 15.1$). Donald C. Buso. Cornell University, R9726-9732. Staatsburg. 26 June 1975. Two nests (1 with 14 eggs, not fresh). Erik Kiviat. Bard College Field Station, uncataloged. All data from fresh-tidal Hudson River. Nearest published range margins (Conant, 1975, A Field Guide to Reptiles and Amphibians of Eastern and Central North America, Houghton Mifflin Co., Boston) are ca. 165 km N at Lake Champlain, and ca. 165 km W near Binghamton. The Hudson-Champlain canal (1820) may have been the dispersal route. Unverified reports suggest Hudson River range extends S to Poughkeepsie and N to Athens from localities reported here.

Submitted by ERIK KIVIAT, Bard College, Annandale, New York 12504, and DONALD C. BUSO, Hubbard Brook Experimental Forest, P.O. Box 27, West Thornton, New Hampshire 03285 ●

SERPENTES

HYPSIGLENA TORQUATA DESERTICOLA (Desert Spotted Night Snake). USA. CALIFORNIA: Siskiyou Co: 13.4 km SW Tulelake, North Hill Road. 10 June 1975. Univ. San Francisco Mus. Vert. Zool. 7501. Species apparently known but unreported from northeastern quarter of the Lava Beds National Monument as early as 1976. Considered rare in the area with only occasional specimens encountered on the road. Extends range into northern California approximately 175 km W of closest known range in northwestern Nevada (Tanner, 1944, Great Basin Natur., 4(1-2): 25-92).

Submitted by DAVID A. MULLEN, Department of Biology, University of San Francisco, San Francisco, California 94117. ●

LAMPROPELTIS GETULUS HOLBROOKI (Speckled Kingsnake). USA. COLORADO: Otero Co: 6.2 km SW La Junta. 10 July 1976. Sec. 28, T245, R55W. 30 September 1976. SW 1/4, SW 1/4, Sec. 1, T245, R55W. No date given. Jack K. Kappel. Colorado Univ. Mus., UCM 51486. Eastern extension of known range from western Kansas into southeastern Colorado (Conant, 1975, A Field Guide to Reptiles and Amphibians of Eastern and Central North America, Houghton-Mifflin Co., Boston).

Submitted by JACK K. KAPPEL, Division of Biological Sciences, Otero Junior College, La Junta, Colorado 81050. ●

LAMPROPELTIS MEXICANA MEXICANA (Mexican Kingsnake). MEXICO. ZACATECAS: 2.74 km S Transcoso. 13 July 1964. E.A. Liner and H.A. Dundee. E.A. Liner private collection, EAL 1170. First record for this species from the state of Zacatecas.

Submitted by ERNEST A. LINER, 310 Malibu Blvd., Houma, Louisiana 70360 and HAROLD A. DUNDEE, Department of Biology, Tulane University, New Orleans, Louisiana 70118. ●

TANTILLA NIGRICEPS FUMICEPS (Texas Black-headed Snake). MEXICO. TAMAULIPAS: 16.3 km SW Reynosa on Mexico Hwy. 40. 3 July 1964. E.A. Liner and H.A. Dundee. EAL 992. This is the second record and third specimen from Mexico; all are from Tamaulipas. This record extends the range ca. 88.7 km due east on the first known locality, Mier, reported by Smith (1938, Copeia, 3: 150).

Submitted by ERNEST A. LINER, 310 Malibou B.vd., Houma, Louisiana 70360 and HAROLD A. DUNDEE, Department of Biology, Tulane University, New Orleans, Louisiana 70118. ●

HERPETOLOGICAL RECORDS FROM ILLINOIS

The following range extension and county records are reported for Illinois reptiles and amphibians.

COUNTY RECORDS. Caudata: Ambystoma texanum (Small-mouthed salamander). Effingham Co: jct. U.S. Hwy. 40 and Ill. Hwys. 32-32. 21 March 1975. J.K. Tucker. J.K. Tucker collection, JKT 67. Testudines: Pseudemys scripta elegans (Red eared turtle). Effingham Co: Lake Sara. 27 Sept. 1974. JKT 68. McLean Co. Lake Bloomington at jct. with Money Creek. 15 May 1969. Identified and released by J.K. Tucker. Sternotherus odoratus (Stinkpot). McLean Co: Lake Bloomington. 25 April 1970. T. Belander. Verified by J.K. Tucker. Illinois State Univ. Mus. #1767. Serpentes: Lampropeltis c. calligaster (Prairie kingsnake). Peoria Co: 1.6 km S Kickapoo. June 1963. Identified and released by D. Moll.

RANGE EXTENSION. Serpentes: Lampropeltis c. calligaster (Prairie kingsnake). Fulton Co: 1.6 km S Marietta. 19 April 1974. Identified and released by G.L. Paukstis and J.K. Tucker. Extends range 42 km NW and 59 km N of nearest records (Smith, 1961, Illinois Nat. Hist. Surv. Bull. 28(1): 1-298).

Submitted by DON MOLL, GARY L. PAUKSTIS and JOHN K. TUCKER, Department of Biological Sciences, Illinois State University, Normal, Illinois 61761. ●

Regional Society News

MUHLENBERG GROUP SPONSORS ESHL MEET

The Muhlenberg Group (TMG) of Augusta, New Jersey will be sponsoring the Fall 1977 Eastern Seaboard Herpetological League (ESHL) meeting. The meeting will take place on Oct. 8, from 12:30 to 7:00 p.m., and will be held at the Plains Community House, Plains Road, in Augusta. Subjects ranging from the bog turtle to sea snakes, to the conservation of amphibians and reptiles will be discussed. The following organizations are members of ESHL: N.Y. Herp. Soc., Conn. Herp. Soc., Mass. Herp. Soc., Philadelphia Herp. Soc., Md. Herp. Soc., Ga. Herp. Soc., Fla. Herp. Soc., Assoc. for the Cons. of Turtles and Tortoises, Inc., No. Ohio Herp. Soc., No. N. J. Herp. Soc., and TMG).

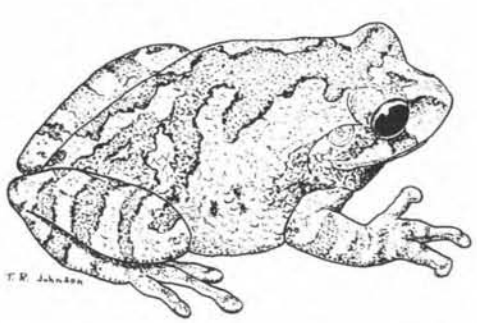
According to Mr. Tom J. Bloomer, Coordinator of TMG, the organization is in the process of printing the first in a series of field studies on members of the turtle genus Clemmys. The Bog Turtle...A Natural History is now available from TMG for 50¢ a copy plus 24¢ postage. The remainder of the natural history studies will be printed in the near future, and the accounts will be combined into a hard cover book in 1978.

Another project of TMG is the preservation of known habitats of Clemmys muhlenbergi. One area is a 100 acre bogland which must first be purchased at a cost of $300,000, and then the land will be turned over to the state of New Jersey as a bog turtle preserve. CONTRIBUTIONS FOR THIS PROJECT WILL BE WARMLY WELCOMED. Please make checks payable to: TMG Bog Turtle Fund.

The Group is also currently doing studies on other members of the genus Clemmys, on the northern pine snake, and on the Blanding's turtle.

To send contributions, or for more information, write to:

Tom J. Bloomer
The Muhlenberg Group
P.O. Box 94
Augusta, N.J. 07822 ●



REGIONAL HERPETOLOGICAL SOCIETIES

The SSAR, through the efforts of the Liaison Committee, is attempting to establish a much closer relationship with regional herpetological societies. In order to accomplish that end, questionnaires were sent to all of the societies for the purpose of compiling a current list and to gain some input as to how SSAR might be of greater assistance to regional societies.

The Committee members, Stanley Dyrkacz, Tom Johnson, Gopher Kuntz, Michael Long and Malvin Skaroff, prepared questionnaires which covered the following topics: status of the society, heirarchy of the organization, membership, publications, frequency of meetings, and other pertinent information. The response was less than over-whelming and the list reflects the amount of information that was returned. The status of many societies could not be determined so any corrections or additions would be welcome. Please send all information to:

James B. Murphy, Chairperson
SSAR Liaison Committee
621 E. Clarendon Drive
Dallas Zoo
Dallas, Texas 75203

A revised list of societies will be published each year by the SSAR.

ARIZONA HERPETOLOGICAL ASSOCIATION

c/o Bruce Bear
2206 W. Vista Avenue
Phoenix, Arizona 85021

Membership: 50
Meetings: Monthly
Publications: Newsletter

ARKANSAS HERPETOLOGICAL SOCIETY

c/o Charles Calhoun
Reptile Department
Little Rock Zoological Gardens
Little Rock, Arkansas 72201

ASSOCIATION FOR THE CONSERVATION OF TURTLES AND TORTOISES (ACTT)

P. O. Box 23 N. Hackensack Station
River Edge, New Jersey 07611

Membership: 13

BAY AREA TURTLE AND TORTOISE CLUB

c/o Sue Hillbun
176 Mission
San Rafael, California 94901
or
P. O. Box 17
2000 Allston Way
Berkeley, California 94701

Editor: Connie Cembura
Publications: Monthly newsletter

BI-STATE TURTLE AND TORTOISE SOCIETY

c/o Frederick G. Wastholz
32 Leonon Parkway
Old Tappan, New Jersey 07675

CALIFORNIA TURTLE AND TORTOISE CLUB

Box 90252
Los Angeles, California 90009

Editor: Ellen Beattie
Meetings: Monthly

CANADIAN AMPHIBIAN AND REPTILE CONSERVATION SOCIETY

c/o Barbara Froom
8 Preston Place
Toronto 12, Ontario
Canada

CHICAGO HERPETOLOGICAL SOCIETY

2001 N. Clark Street
Chicago, Illinois 60614

President: Stanley Dyrkacz
Membership: 250
Meetings: Monthly
Publications: Monthly newsletter
Quarterly bulletin

COLORADO HERPETOLOGICAL SOCIETY

P. O. Box 15381
Denver, Colorado 80215

Secretary: Louise Turner
President: Martin Balt
Meetings: Monthly
Publications: Monthly newsletter
Annual bulletin

CONNECTICUT HERPETOLOGICAL SOCIETY

c/o N. R. Ford
598 Durham Road
Guilford, Connecticut 06437

Membership: 114
Meetings: Monthly
Publications: Monthly newsletter
Annual bulletin

DALLAS HERPETOLOGICAL SOCIETY

c/o Wayne Seifert
Department of Herpetology
Dallas Museum of Natural History
P. O. Box 26193
Dallas, Texas 75226

Meetings: Monthly
Membership: 100
Publications: Monthly newsletter

EASTERN SEABOARD HERPETOLOGICAL LEAGUE

c/o Malvin Skaroff, Coordinator
1025 Lakeside Avenue
Philadelphia, Pennsylvania 19126

FLORIDA HERPETOLOGICAL SOCIETY

c/o Gopher Kuntz, Secretary
8604 Lake Christie Drive
Orlando, Florida 32609

Membership: 40
Publications: Monthly newsletter

FLORIDA WEST COAST HERPETOLOGICAL AND CONSERVATION SOCIETY

c/o John Lewis
1312 S. Evergreen Avenue
Clearwater, Florida 33515

FREE STATE HERPETOLOGICAL SOCIETY

c/o Clyde Prince
Box 285
Carter Lane
Elvaton,
Millersville, Maryland 21108

GEORGIA HERPETOLOGICAL SOCIETY

c/o John C. Zegel, President
3341 Smoke Rise Drive
Stone Mountain, Georgia 33083

GREAT LAKES HERPETOLOGICAL SOCIETY

c/o James Todd, President
15554 Cooper
Taylor, Michigan 48180

Membership: 86
Meetings: Monthly
Publications: Quarterly bulletin

GREATER GAINESVILLE BIOLOGICAL PARKS SOCIETY, INC.

c/o Eddie Leach
2131 N.W. 55th Street
Gainesville, Florida 32605

Membership: 50
Meetings: Monthly

GULF COAST HERPETOLOGICAL SOCIETY

c/o John Zapata
P. O. Box 1562
Houston Zoo
Houston, Texas 77001

INDIANA HERPETOLOGICAL SOCIETY

c/o Garry S. Bryan
453 N. Grant Street
Martinsville, Indiana 46151

NO REPLY

INDIANAPOLIS ZOOLOGICAL SOCIETY REPTILE STUDY GROUP

3120 E. 30th Street
Indianapolis, Indiana 46218

INTERNATIONAL CROCODILIAN SOCIETY

P. O. Box 217
Silver Springs, Florida 32688

NO REPLY

IOWA HERPETOLOGICAL SOCIETY

c/o Henry Wallace
147 Tonawanda Drive
Des Moines, Iowa 50312

NO REPLY

KANSAS HERPETOLOGICAL SOCIETY

c/o Janice Perry
Museum of Natural History
University of Kansas
Lawrence, Kansas 66045

President: Robert F. Clarke
Secretary: Marjorie Perry
Editor: Janice Perry
Membership: 135
Meetings: 6 per year
Publications: Newsletter

KENTUCKY HERPETOLOGICAL SOCIETY

c/o Eddie Ashmore
1300 Ambridge Drive
Louisville, Kentucky 40207

President: William T. Mobley
Membership: 60
Meetings: Monthly
Publications: Newsletter

LONG ISLAND NATURALIST SOCIETY

c/o F. C. Schlauch
415 Clift Street
Central Islip, L.I., NY 11722

MARYLAND HERPETOLOGICAL SOCIETY

Department of Herpetology
Natural History Society of Maryland
2643 North Charles Street
Baltimore, Maryland 21218

Editor: Herbert S. Harris, Jr.
Membership: 250
Meetings: Monthly
Publications: Leaflets, bulletins

MASSACHUSETTS HERPETOLOGICAL SOCIETY

P. O. Box 1082
Boston, Massachusetts 02103

President: John Rollins
Editor: David Taylor
Membership: 250
Meetings: Monthly
Publications: Newsletter, semi-annual review

MEMPHIS HERPETOLOGICAL SOCIETY

P. O. Box 11337
Memphis, Tennessee 38111

NO REPLY

MIDDLE MISSISSIPPI VALLEY HERPETOLOGISTS

c/o M. J. Lodato, President
925 Park Plaza Drive
Evansville, Indiana 47715

Membership: 4
Meetings: Irregular
Publications: None

MISSOURI TURTLE AND TORTOISE SOCIETY

c/o Jim Selke
1340 Layven Avenue
Florissant, Missouri 63031

STATUS UNKNOWN

THE MUHLENBERG GROUP

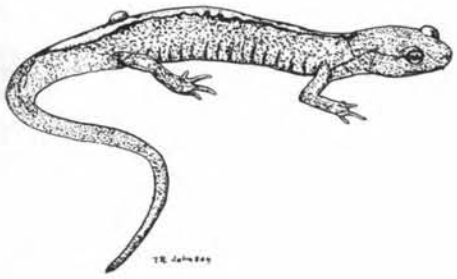
c/o T. J. Bloomer, Coordinator
P. O. Box #94
Augusta, New Jersey 07822

Membership: 42
Meetings: 3 per year

NEVADA HERPETOLOGICAL SOCIETY

c/o Bill Cobb, Jr.
4909 Eugene Avenue
Las Vegas, Nevada 89108

NO REPLY



NEW MEXICO HERPETOLOGICAL SOCIETY

c/o Department of Biology
University of New Mexico
Albuquerque, New Mexico 87131

President: Lititia C. Peirce
Editor: Lynn Mollet
Meetings: Monthly
Publications: Bi-monthly newsletter

NEW YORK HERPETOLOGICAL SOCIETY

P. O. Box 3945
Grand Central Station
New York, New York 10017

Membership: 350
Publications: Bulletin

NEW YORK TURTLE AND TORTOISE SOCIETY

c/o Martha E. Reeves
The Dial Press
750 Third Avenue
New York, New York 10017

NORTHERN NEW JERSEY HERPETOLOGICAL SOCIETY

P. O. Box 94
Augusta, New Jersey 07822

NORTHERN OHIO ASSOCIATION OF HERPETOLOGISTS

c/o Martin Rosenberg
Department of Biology
Case Western Reserve University
Cleveland, Ohio 44106

Membership: 80
Meetings: Monthly
Publications: Newsletter, bulletin

OKLAHOMA HERPETOLOGICAL SOCIETY

c/o Richard Lardie, President
1414 Parker Street
Enid, Oklahoma 73701

OREGON INSTITUTE OF HERPETOLOGY

3675 Madrona Lane
Medford, Oregon 97501

STATUS UNKNOWN

PHILADELPHIA HERPETOLOGICAL SOCIETY

c/o Malvin Skaroff, Secretary
1555 Pratt Street
Philadelphia, Pennsylvania 19124

Membership: 400
Publications: Bulletin

SACRAMENTO VALLEY HERPETOLOGICAL SOCIETY

c/o Bob Pedder
6007 Watt Avenue
North Highlands, Calif. 95660

SAINT LOUIS HERPETOLOGICAL SOCIETY

c/o Patricia Krohmer
9988 Merito Drive
St. Louis, Missouri 63128

Pres.: Randy Krohmer
Membership: 150
Meetings: Monthly
Publications: Monthly newsletter
Special issues

SAN DIEGO TURTLE AND TORTOISE CLUB

c/o Cary Herrera
7620 Eads Avenue
La Jolla, California 92037

NO REPLY

SERPENT SAFARI HERPETOLOGICAL SOCIETY

c/o Peter Emory
RFD 2
Brewster, New York 10509

NO REPLY

SOUTH FLORIDA HERPETOLOGICAL SOCIETY

c/o Saul Friess, President
9972 N. Kendall Dr., #54
Miami, Florida 33176

STATUS UNKNOWN

SOUTHERN ARIZONA HERPETOLOGICAL SOCIETY

c/o Tom Boyden, President
4521 W. Mars Street
Tucson, Arizona 85704

Meetings: Monthly
Membership: 25

SOUTHWEST FLORIDA BOIDAE RESEARCH AND BREEDING CENTER

Route 2, Box 483
North Fort Myers, Florida 33903

SOUTHWEST HERPETOLOGICAL SOCIETY

Two Chapters

San Fernando Valley Chapter
c/o Rick Korne
5730 Newcastle Avenue
Encino, California 91316

c/o Bob Sanders
Curator of Herpetology
San Bernardino County Museum
2024 Orange Tree Lane
Redlands, California 92373

TEXAS HERPETOLOGICAL SOCIETY

c/o Ann Stevens, Secretary
Route 1, Box 120
Wetmore, Texas 78163

Membership: 100
Meetings: Twice a year
Publications: Newsletter twice per year

UTAH HERPETOLOGISTS' LEAGUE

c/o Mike Coffeen, Secretary
Hogle Zoological Gardens
P. O. Box 8475
Salt Lake City, Utah 84108

VIRGINIA HERPETOLOGICAL SOCIETY

c/o F. J. Tobey, Jr., Editor
P. O. Box 1376
Leesburg, Virginia 20075

Membership: 250
Meetings: Irregular
Publications: Bulletin, newsletter

WASHINGTON (formerly Northern Virginia) HERPETOLOGICAL SOCIETY

c/o Scott Rae
317 Adahi Road, S.E.
Vienna, Virginia 21180

Co-Chairpersons: Elizabeth M. Lundell and Thomas More
Membership: 35
Meetings: Monthly
Publications: Irregular newsletter

WEST END REPTILE CLUB

c/o Toni Siquitan
2569 Leebe Avenue
Pomona, California 91766

NO REPLY

WESTERN MASSACHUSETTS HERPETOLOGICAL SOCIETY

P. O. Box 151 Highland Station
Springfield, Massachusetts 01119

WISCONSIN HERPETOLOGICAL SOCIETY

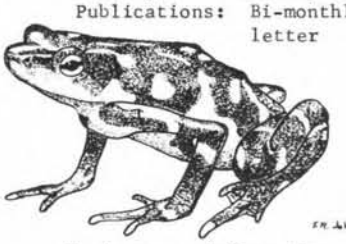
800 West Wells Street
Milwaukee, Wisconsin 53233

Max A. Nickerson, President
Membership: 70-80
Meetings: Bi-monthly
Publications: Bi-monthly newsletter

ZOO FAUNA ASSOCIATION

c/o Dan Watson-Tom Buchanan, Editors
Abilene Zoological Gardens
P. O. Box 60
Abilene, Texas 79604

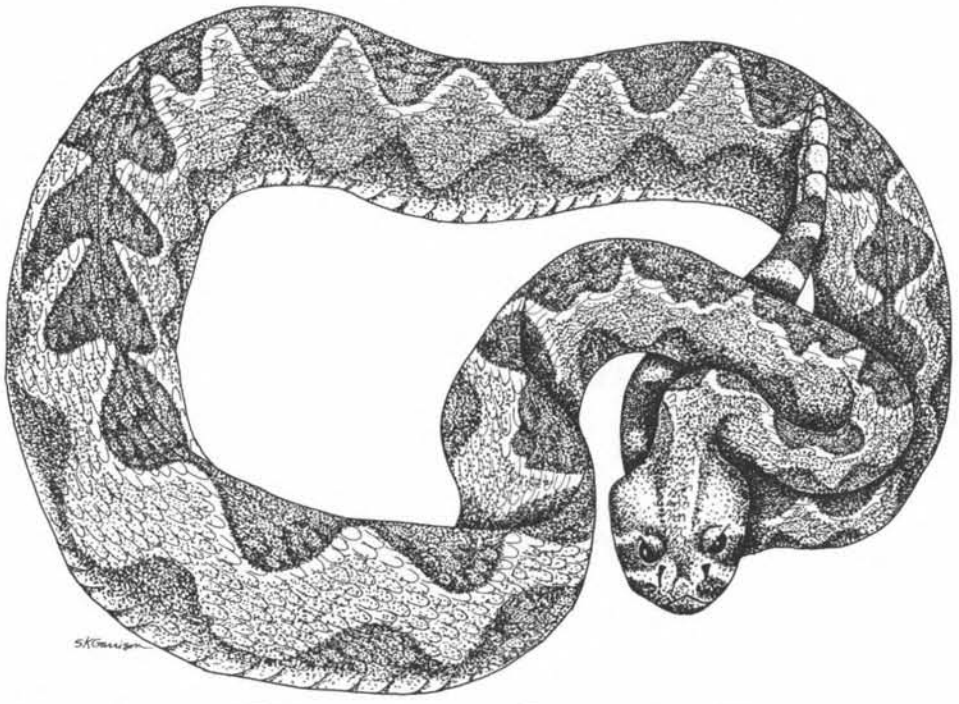
Membership: 80
Meetings: Bi-monthly
Publications: Bi-monthly newsletter



Send news information on YOUR regional herpetological society to the **Regional Society Section Editor** (See inside front cover for address). Black and white photos are welcome.

S.O.S.

(Save Our Snakes)



Help Stop Oklahoma Rattlesnake Roundups

For information on how you can help, write:

Oklahoma Herpetological Society
c/o Dr. Jeffrey H. Black
Department of Biology
Oklahoma Baptist University
Shawnee, OK 74801

News Notes

AN OPEN LETTER ON AGAMID LIZARDS

As most museum curators already know, my doctoral thesis concerns the systematics of the lizard family Agamidae. During the course of my research, I have developed working correspondences with other herpetologists also studying various agamid taxonomic problems. In order to prevent duplication of effort and results by other persons, I shall summarize below which taxa are presently under study and by whom.

For my doctoral thesis, the monotypic genera or genera with only a handfull of species will be adequately treated. These genera include: Acanthosaura, Aphaniotis, Brachysaura, Ceratophora, Chelosania, Cophotis, Dendragama, Hydrosaurus, Lophocalotes, Lyriocephalus, Moloch, Oriocalotes, Otocryptis, Physignathus, Psammophilus, Ptyctolaemus, Salea, Sitana, and Xenagama. Leiolepis and Phoxophrys have already been revised in recent years by Gunther Peters and Robert Inger respectively.

I am also preparing revisions of the species of the larger genera Gonocephalus and Uromastyx, and of the sub-genus Pseudocalotes within the unwieldly genus Calotes. The "amphibolurine" radiation of agamids in Australia, including Amphibolurus, Caimanops, Chlamydosaurus, Diporiphora, Lophognathus, and Tympanocryptis, is being studied by Geoffrey Witten and other students of Harold Cogger in Sydney. The difficult genus Phrynocephalus is being independently studied by Gunther Peters in Berlin and Ronald Whiteman at the University of California at Fullerton.

The polyphyletic assemblage Agama is finally receiving long overdue attention. The sub-genus Stellio, the whorled-tail forms, is being revised by Gunther Peters. The Agama hispida species complex in southern Africa is being revised by G.R. McLachlan at Cape Town. Benedetto Lanza of Florence has completed a review of all Agama species, including several rare endemics, of Somalia. Dirk Kreulen of Holland is reviewing the Agama agama-lionotus-planiceps complex in the rift region of East Africa. Wolfgang Bohme and I are studying the relationships of several Agama species of the Sudanese vegetational belt of northern Africa.

Four diverse agamid genera are thus available for revision: Japalura, Draco, Calotes (excluding the sub-genus Pseudocalotes), and the sub-genus Trapelus, removed from Agama. This latter taxon includes the following species and many synonymous names: agilis, blanfordi, isolepis, sanguinolenta, savignyi, jayakari, flavimaculata, tournevillei, fieldi, kirmanensis, mutabilis, pallids, agnetae, ruderata, megalonyx, rubrigularis. Willi Hennig, famous for his original contributions to cladistics, revised Draco in 1936 for his doctoral thesis. He recognized 16 species and 21 subspecies, not including the nominate forms. However, given the analagous island archipelago radiation of Anolis, I would strongly recommend a reexamination of Draco.

I hope that the above information will be of use to other herpetologists. I will gladly share my voluminous notes concerning the whereabouts of type specimens and my lists of species available for study in all museums in America and Europe. I would also appreciate being informed of other agamid studies, in the present and the future, in order to continue a cooperative effort in the study of agamid lizards.

SCOTT MOODY, Museum of Zoology, University of Michigan, Ann Arbor, Michigan 48109 USA.

TORTOISE DATA DESIRED

Persons having data on care in captivity, field observations and/or photographs of rare species of tortoises may wish to contact Wayne Labenda. Mr. Labenda plans to publish a book about tortoises and can be reached at: 15 North Winifrd Drive, Totowa, New Jersey 07512.

SSAR STUDENT PRIZE COMMITTEE

The SSAR Student Prize Committee for 1977 consists of Robert Bezy, Thomas H. Fritts, Kirkland Jones, Richard Wasserzug and Margaret Stewart (chairperson). The committee awards a cash prize for the best student paper published in the SSAR's Journal of Herpetology.

INFORMATION NEEDED BY FWS ON DRYMARCHON CORAIS COUPERI

The Fish and Wildlife Service now has information on file that the Eastern indigo snake (Drymarchon corais couperi) should be determined to be Threatened. On August 1, 1977, they published in the Federal Register (42 FR 38921-38924) a proposal to make such a determination.

The Office of Endangered Species would appreciate the assistance of you or your colleagues in:
--providing any factual data you may have access to concerning the status of this species;
--advising them of any special considerations that should be taken into account prior to their final determination of the snake's status;
--location of critical habitat;
--providing any other advice or guidance you feel relevant.

The formal comment period for this proposal expires on October 30, 1977. Direct replies to Jack N. Berryman, Acting Associate Director, Office of Endangered Species, U.S. Fish and Wildlife Service, Washington, D.C. 20240.

DUTCHESS COUNTY NY ZOOLOGICAL SURVEY

Data on reptile and amphibian distributions from Dutchess County, New York are wanted for a study of the vertebrate fauna and habitats of the County. Especially desired is information on uncommon, rare or declining species, or species at geographical range margins. The Survey will generate recommendations for the conservation of rare species and rare habitat types on a county basis. A summary of data is available, and a detailed report is in preparation. Rare species localities information will be used discreetly. Write to: E. Kiviat, Bard College, Annandale, New York 12504.

ABSTRACT OMITTED

The abstract of Dale R. Jackson's paper was inadvertently omitted from HR volume 7 (1976), and is as follows:

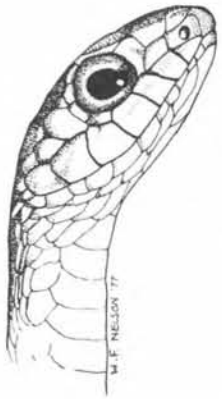
Reproductive Strategies of Sympatric Freshwater Turtles in North Florida. Reproductive strategies of four freshwater emydine turtles (Chrysemys nelsoni, C. floridana, C. scripta, and Deirochelys reticularia), which are sympatric in a narrow zone in north peninsular Florida, were determined by ovarian examination and field observation. All are iteroparous, multiple-clutched species which utilize an r-strategem, largely in response to predation losses at early stages. Developmental quiescence (pre-embryonic diapause) at low temperatures enables two species to nest during late fall and winter. Seasonal ovipositional differences may serve as a means of resource partitioning, predator avoidance, or as a response to seasonal resource availability. Dale R. Jackson, Department of Zoology, University of Florida, Gainesville, Florida 32611.

ERRATA HR 8(2) JUNE 1977

Page 40, col. 3, para. 4, line 3, "R.S. Funk. Verified by J.K. Tucker." should read R.S. Funk and J.K. Tucker."

Page 40, col. 3, para. 4, add at end of paragraph "and is 34 km NNE of isolated colony at Effingham, Effingham Co. (Brown, Funk, Moll, and Tucker, 1975, Herp. Rev. 6(3): 78-79)."

Page 40, col. 3, para. 5, line 2, "Cassady" should read "Cassidy."



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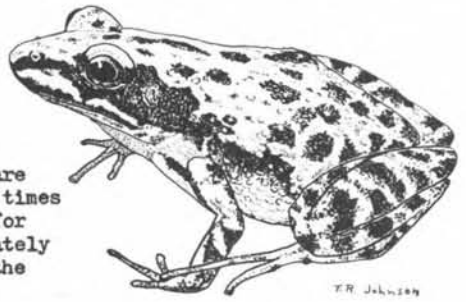

As of January, 1977, approximately 70 searchers are scanning 400 journals. Titles will be published four times per year. Searchers are encouraged to submit titles for inclusion at three month intervals to assure approximately equal listings in HR. Any correspondence concerning the Current Literature Project should be sent to

Richard D. Worthington
Current Literature
Department of Biological Sciences
The University of Texas at El Paso
El Paso, Texas 79968.

A

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ERRATA

In the preparation of Current Literature for Herpetological Review 8(2) the pretyped mats were shortened for photoreduction without careful attention to the continuity of citations. The following corrections are submitted:

Page 45, col. 2, lines 1-59. The following titles were published by W. BISCHOFF:

1974. Echsen des Kaukasus, Teil 4. Die Artwiner Eidechse, Lacerta derjugini Nikolski 1898. AQUAR. TERR. (B) 21(2):63-66.
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1975. A histological study of the tooth of Iguana iguana. [in Jap.] JAP. J. HERP. 6(2):51.

Page 49, col. 2, lines 1-24. The following titles were published by P. FROESCH-FRANZON:

1974. Australische Riesenschlangen II. AQUARIA 21(11):167-172.
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Page 52, col. 1, lines 1-4. The following title was published by J. HEILER:

1976. Gepanzerte Mimosen (Wachstum und Krankheiten der Wasserschildkroten). AQUAR. MAG. 10:464-468.

Page 55, col. 2, lines 1-6. The complete title for the first citation and correct authorship is as follows:

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1976. Notes on breeding behavior in a captive pair of Sonora Mountain kingsnakes, (Lampropeltis pyromelana). BULL. MD. HERP. SOC. 12(1):23-24.
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MORAN, D. J.
1976. A scanning electron microscopic and flame spectrometry study on the role of Ca^{2+} in amphibian neurulation using papaverine inhibition and ionophore induction of morphogenetic movement. J. EXP. ZOOL. 198(3): 409-416.

Page 58, col. 1, lines 1-3. The following title was published by A. MUTH:

1977. Eggs and hatchlings of captive Dipsosaurus dorsalis. COPEIA 1:189-190.

Page 63, col. 1, lines 1-4. The following title was published by M. SCHOBER and H. G. WORRACK:

1976. Kooperation bei der Nachzucht von Elaphe obsoleta quadrivittata. AQUAR. TERR. 23(3): 102-103.

Page 63, col. 2, lines 1-4. The following title was published by H. M. SMITH and M. Á. DEL TORO:

1977. A new troglodytic lizard (Reptilia, Lacertilia, Xantusiidae) from Mexico. J. HERP. 11(1):37-40.

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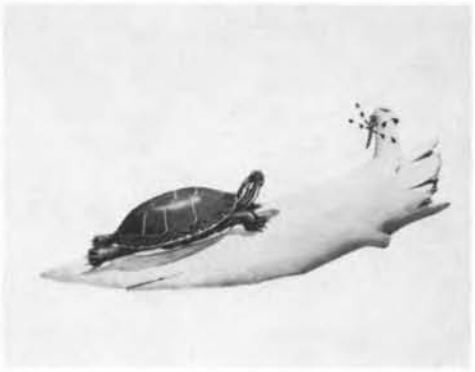

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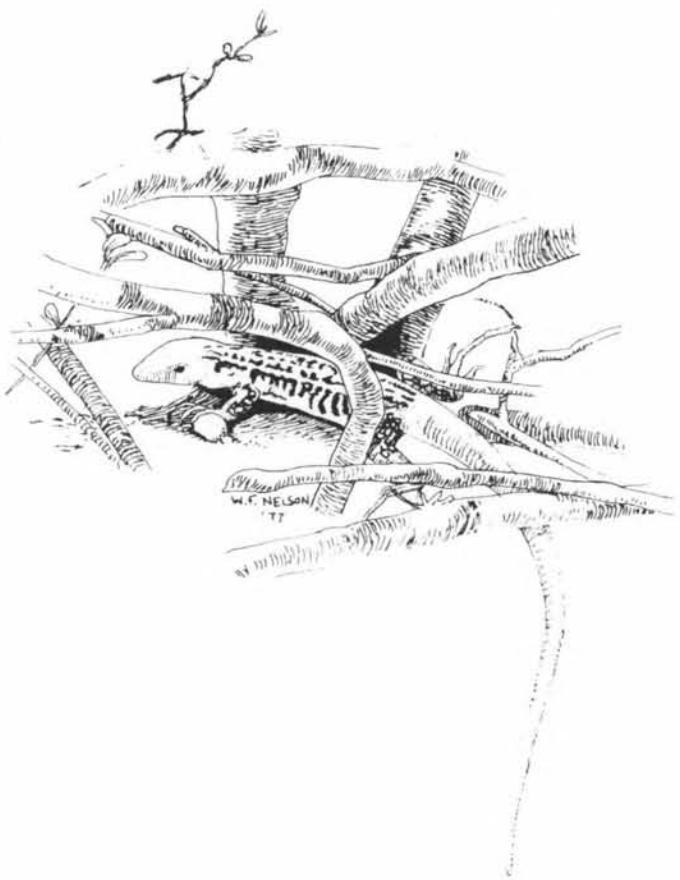

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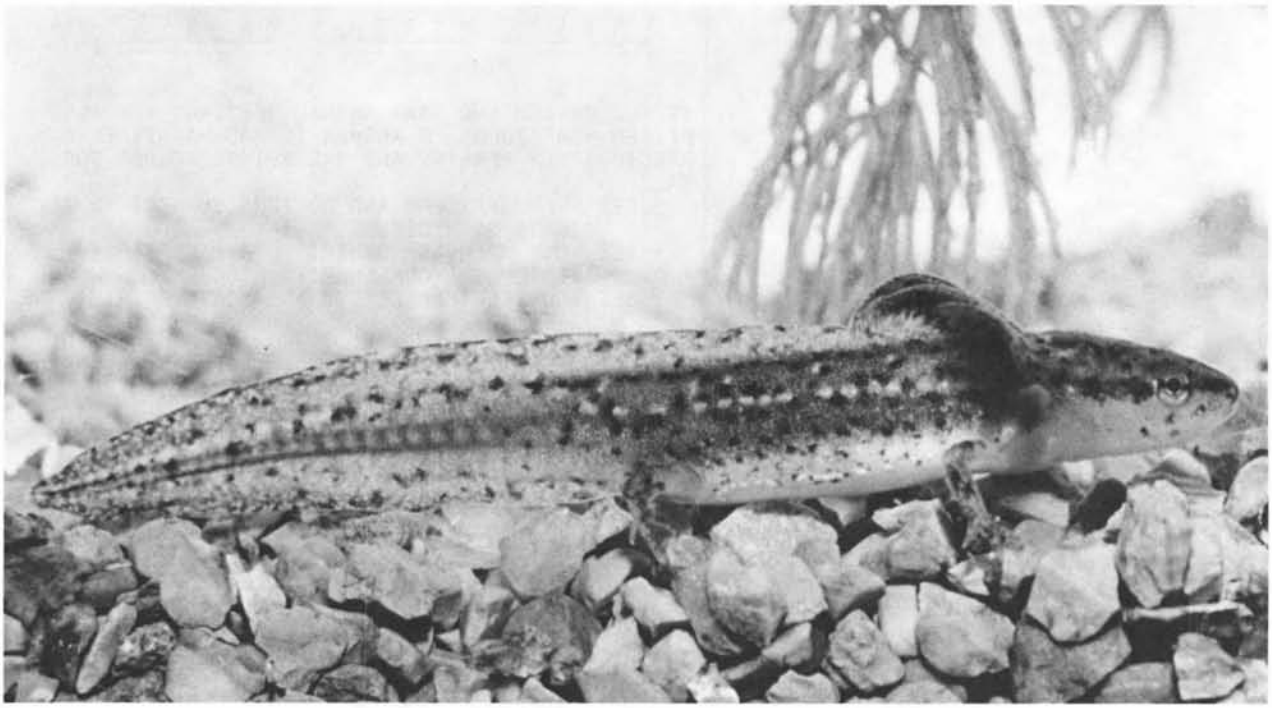
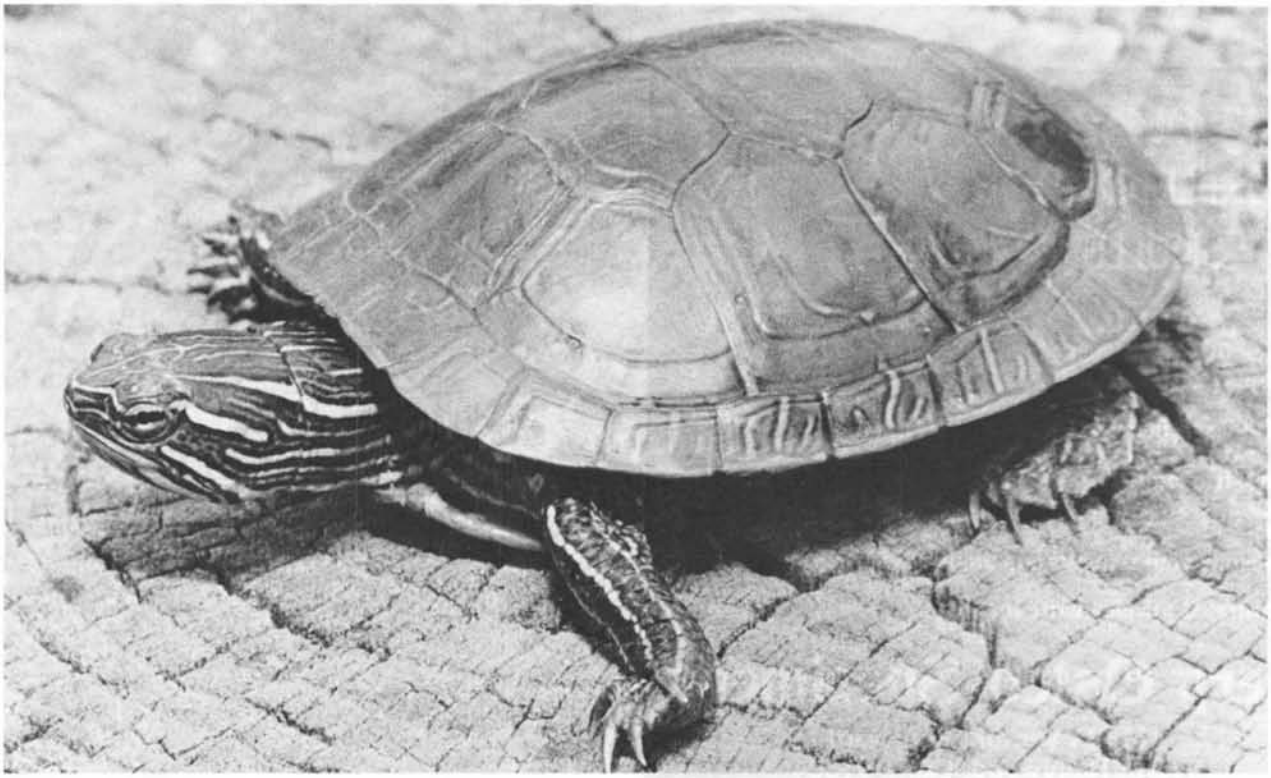


Central newt larvae (Notophthalmus viridescens louisianensis) collected from farm pond in Pulaski County, Missouri, on 5 July 1975. Photograph by Tom R. Johnson.



One of two western painted turtles (Chrysemys picta belli) collected from a farm pond in Grant County, Oklahoma during May 1977. Collected by Michelle Warner, elementary student from Caldwell, Kansas. Photograph by Larry Miller.

CONTRIBUTION TO THE COMPARATIVE CYTOMORPHOLOGY OF HYLID FROGS FROM VENEZUELA. Mercedes L. Acuna. Universidad de Oriente, Cumaa, Venezuela.

The available data from comparative hematology led to the conclusion that there are significant differences among groups of anura from tropical and temperate zones. In order to provide some information about comparative cytomorphology of Hyla from Venezuela, Hyla x-signata, Hyla crepitans, Hyla robertsimoni, Hyla geographica, and Hyla rostrata were selected for the present study.

Blood cell morphology and white cell differential counts were made. On the basis of cytoplasmic staining reactions and corresponding nuclear characteristics as well as size and shape of cells, the morphological features of cell types in smears stained by the Giemsa's method are described. Leucocyte differential counts are also presented by determinations from blood smears. Results and significant differences obtained in this study will be discussed and compared with those from temperate zone frogs.

HEMATOLOGICAL OBSERVATIONS ON SOME ANURANS FROM VENEZUELA. Mercedes L. Acuna and Felicia C. Rodulfo. Universidad de Oriente, Cumana, Venezuela.

The hematology of six species of anurans from the northeastern part of Venezuela (Hyla x-signata, Hyla crepitans, Hyla geographica, Pseudis paradoxa, Bufo granulosus and Leptodactylus fuscus) are compared. Determinations included blood cell counts, hematocrit values, hemoglobin concentrations, and calculations of mean corpuscular volumes, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentrations.

Significant differences among the Hyla were observed in all the hematological indexes. Comparisons of the hematological parameters were made among groups in relation to different habitats. Significant differences were found between arboreal Hyla x-signata and aquatic Pseudis paradoxa. However, no significant differences were observed when the terrestrial Bufo granulosus and Leptodactylus fuscus were compared with the aquatic Pseudis paradoxa. Even though the presently available data are too few to permit more precise statements, the tentative interpretation is that the influence of ecological factors are reflected in the variations of the hematological parameters.

Aldridge, Robert - see Weil

MYOLOGICAL STUDIES ON THE RELATIONSHIP BETWEEN THE ANURAN PREPOLLEX AND PREHALLUX. Marshall L. Andersen. University of Kansas, Lawrence, Kansas.

Hypotheses concerning the relationship between the anuran prepollex and prehallux suggest that the prehallux and prepollex are homologous structures or that the prepollex actually represents the first digit of the anuran manus. Skeletal structure favors the first hypothesis. Recent intensive investigations into the comparative osteology and myology of the manus and pes of 16 families of anurans, however, appears to favor the second hypothesis. The musculature of the prehallux is relatively simple and arises from the plantar aponeurosis. The muscles of the prepollex have a more complex arrangement and arise from the os capitato-hamatum as does similar musculature on the four recognized digits.

REGULATION OF POPULATION SIZE IN A TROPICAL LIZARD, ANOLIS LIMIFRONS. Andrews, Robin M., A. Stanley Rand, and S. Guerrero. Virginia Polytechnic Institute and State University, Blacksburg, VA (senior author) and Smithsonian Tropical Research Institute, Balboa, Canal Zone.

We have been censusing A. limifrons on Barro Colorado Island in Panama since 1971. The population exhibits annual turnover and consistent seasonal changes in age structure primarily as a result of decreased fecundity during the dry season. Population density has fluctuated markedly from year to year. The affect of weather, predation, parasitism, and food availability on survivorship and fecundity has been investigated. Leslie matrix models are used to evaluate the relative importance of the above factors in determination of population density.

INVESTIGATION INTO THE NATURAL HISTORY OF PSEUDACRIS ORNATA IN NORTH CENTRAL FLORIDA-PRELIMINARY REPORT. Ray E. Ashton, Jr., Patricia Ashton, North Carolina State Museum and David Deitz, University of Florida.

Adult Pseudacris ornata were captured in and around cypress head breeding sites at the beginning of the winter breeding season. Frogs were tagged subcutaneously with Cobalt 60 radioactive wire and released. Movements were monitored at 24-48 hour intervals using a Thyac III scintillation probe. Calling sites, microhabitat, movements, burrowing behavior and other activities were noted during and after P. ornata completed breeding activities. This behavioral data is being correlated with weather data, including barometric pressure, using various SAS programming techniques.

During breeding, males utilized grass clumps as major calling sites. During the day and when temperatures and humidity were too low, males burrowed into the grass clump bases, 12-18 cm below the water surface. When water temperatures dropped below 10°C, males left the ponds and burrowed at the base of vegetation clumps. Burrows up to 8 cm in depth were dug by utilizing the hind feet in Scaphiopus fashion.

The only tagged female was originally captured at the edge of the breeding pond. After tagging, this individual moved into an open field 55 m from the site. Eight days later the female returned to the pond and was observed during breeding with a non-tagged male. Immediately following egg deposition the female remained dormant for 5 days just under the leaf litter at the edge of the pond. Temperatures at this site were 6-8°C. At the end of this period the female moved back into the previously used open field where it remained for 2 months. Males remained near the breeding pond edge during this time, never venturing more than 15 m from the pond. Males were subject to high predation during this period. Specific analysis of data is presently being undertaken.

Ashton, Patricia S. - see Ashton, R.

HISTORY OF THE SOUTH AMERICAN HERPETOFAUNA: A PALEONTOLOGICAL APPROACH. Ana M. Baez, Universidad de Buenos Aires, and Zulma B. de Gasparini, Museo de La Plata, Argentina.

The Cenozoic record of amphibians and reptiles in South America is analysed. All the families recorded in the Lower Tertiary are represented in the Recent fauna, except meiolaniids and sebecids, both of which are extinct. It is evident that among them there are elements of different historical backgrounds that could have joined the South American fauna at different times. Some of those groups, such as pipids, iguanids, pelomedusids, meiolaniids, crocodylids, and perhaps leptodactylids and sebecids, also have Mesozoic records in that continent. Unfortunately most of the earliest records come from southern and eastern South America while the knowledge about the groups inhabiting the northern regions is still poor.

Prior to the connection of the Americas in Plio-Pleistocene times other families appear in the fossil

record, e.g. Testudinidae, Trionychidae, Colubridae, Emydidae?, Nettosuchidae. Except the latter, those groups may have reached the continent from the north, possibly by waif transport.

The absence of many families that comprise the Recent herpetofauna in the fossil record could indicate that they are late immigrants. Nevertheless some of them, according to their degree of endemism and phylogenetic relationships, seem to be older members of the South American fauna. Changes in the geographical distribution of the recorded taxa are considered as being related to geological events of different magnitude which provoked physiographic, and conseuently climatic and floristic changes.

LATE CENOZOIC ENVIRONMENTAL CHANGES IN PRESENT TEMPERATE SOUTH AMERICA. Ana M. Baez and Gustavo Scillato. Universidad de Buenos Aires, Argentina.

Present temperate South America extends approximately South of the Tropic of Capricorn. Besides the Andean area, several major physiographic regions can be recognized: Mesopotamia, Chaco-Pampean plains, Pre-Andean area and Patagonian plateau. By Late Tertiary their basic features were attained due to different geological events; nevertheless consideration of the environmental conditions in Pliocene times is relevant as a basis for the discussion of subsequent changes, which in many cases were gradual as the geological and paleontological data suggest.

There is no general agreement concerning the position of the Plio-Pleistocene boundary. The appearance of Nearctic mammals in South America are the paleontological criterion used. During the Pleistocene extensive areas of the Northern Hemisphere were covered with glacial ice; in the region here considered there were no glaciers extending beyond the foot of the Andes. Moreover, only south of 52°S the continental ice cap reached the present Atlantic coast. The glacial cycles of the Andean region should have affected the climatic-ecological conditions, and consequently the distribution of faunas, of the extra-andean regions. Paleozoological data, mainly from the Province of Buenos Aires (a portion of the Chaco-Pampean plains), support fluctuating climatic changes during Pleistocene and Holocene. This is based primarily on the range of variation in taxa whose ecological requirements are known. Other evidences, such as micropaleontological and sedimentological also are considered.

Baker, Wahleah - see Phillips

Baker, Wahleah - see Williams

PHOSPHATE COMPOUNDS IN REPTILIAN RED CELLS. Grant R. Bartlett,. Laboratory for Comparative Biochemistry , San Diego, California.

Interest in phosphate compounds of red blood cells has increased greatly since the discovery that 2,3-diphosphoglycerate (DPG), present in high concentration in red cells of most mammals, acts as an important regulator of oxygen transport by its strong influence on the affinity of hemoglobin for oxygen. Bird red cells contain a large amount of DPG for a brief period during embryonic development, but not after hatch, when inositol pentaphosphate (IP5), which markedly reduces the affinity of hemoglobin for oxygen, becomes a major phosphate constituent. The red cells of man, and of other mammals examined, possess no IP5. We have begun a study of the nature and amounts of phosphate compounds in reptilian red cells. The red cells of man, and of other mammals examined, possess no IP5. We have begun a study of the nature and amounts of phosphate compounds in reptilian red cells. The marine turtles, Chelonia mydas and Lepidochelys olivacea, and the land turtles, Chelydra serpentina and Chrysemys scripta, all had, in their red cells, late in embryonic development, rather large amounts of DPG, which disappeared gradually during the first year after hatch. IP5, absent in the embryo, increased slowly during the first year after hatch to substantial adult levels. The iguanas, Iguana iguana and Ctenosaura pectinata, and the snakes, Elaphe obsoleta and Boa constrictor, had no DPG in their red cells, with perhaps traces of IP5, but unusually high concentrations of ATP. Embryonic, juvenile and adult specimens of Alligator mississippiensis had no DPG or IP5 in their red cells and only low concentrations of ATP and other nucleotides. In contrast to the other reptiles, and mammals, the turtle was remarkably similar to the bird.

EVOLUTIONARY RELATIONSHIPS OF FROGS IN THE NEOTROPICAL FAMILY DENDROBATIDAE. James P. Bogart. University of Guelph.

Chromosomal information obtained from several species of dendrobatid frogs may be used to help formulate a phylogeny which is consistant with some current hypotheses based on other criteria. Colostethus and Phyllobates species possess a diploid chromosome complement of 24 which may be related to some species of the elosiine leptodactylid frogs. Dendrobates species possess diploid chromosome numbers of 20 and 18. Intrageneric variations in chromosomal morphology occur and this information may be useful to help distinguish species groupings.

DEFENSIVE BEHAVIOR IN THE PLETHODONTID SALAMANDERS PSEUDOTRITON MONTANUS AND P. RUBER. Ronald A. Brandon, George M. Labanick, Southern Illinois University at Carbondale, and James E. Huheey, University of Maryland.

Both of these brightly colored salamanders have an elaborate defensive behavior, including lateral and vertical tail displays, tail waving and coiling, head tucking and tail slapping, during which a sticky secretion is released onto the skin surface. Larger specimens tend to do more tail slapping and less posturing. Some specimens of both species, upon continuing harassment, became immobile, P. ruber in a nearly straight posture, P. m. diastictus in a tight coil. The tail displays resemble those of red efts, but in other ways defensive behaviors of these Pseudotriton and red efts differ greatly. These differences and the demonstration of skin toxicity in both forms of Pseudotriton argue against the hypothesis that brightly colored Pseudotriton are palatable, Batesian mimics of the highly toxic red efts. They seem to have some protection of their own.

Brandon, Ronald A. - see Huheey

DEVELOPMENT OF THE UROSTYLE DURING METAMORPHOSIS. Arthur E. Branham and James C. List. Ball State University.

The embryological development of the urostyle during metamorphosis (when the union and ossification of urostyle components is taking place is described in five species of frogs and toads: Leopard Frog (Rana pipiens), Chorus Frog (Pseudacris triseriata), American Toad (Bufo americanus), Gray Tree Frog (Hyla versicolor), and African Clawed Frog (Xenopus laevis). These five genera represent five levels of specialization in frogs and toads, from the primitive Xenopus to the advanced Rana. Tadpoles were reared in the laboratory, preserved at various stages of metamorphosis, and the urostyle region of representative specimens serially cross-sectioned and mounted for observation on microscopic slides. Descriptions and

comparisons of the course of development of the urostyle in these five species is presented.

SNAKE COMMUNITIES: A REVIEW WITH SUGGESTIONS FOR RESEARCH. William S. Brown, Skidmore College, New York. William S. Parker, Mississippi University for Women, Columbus, Mississippi.

Field investigations of snakes have generally focused on autecological studies of single species or, less often, on comparative interspecific ecological studies in a given locality. Few workers have been able to undertake the efforts necessary to sample snakes from habitats supporting a diverse snake community over time sufficient to generate significant input into understanding interactions between various snake species as an assemblage. Our studies at dens have afforded opportunity for seasonal captures of large numbers of individuals and have provided detailed demographic data for comparing at least three species. We here synthesize these findings with previous work with relevance to a community approach. Our review focuses on (1) the trophic niche (food overlap, prey preferences, and thermal-habitat interactions in prey selection); (2) the spatial niche (habitat selection, refuging, dispersal, and habitat conditioning; communal oviposition and overwintering); (3) the temporal niche (activity times, seasonal ingress and emergence); (4) energetics and interspecific growth rates; (5) comparative age-specific survival and reproductive rates in a snake community; and (6) species diversity in selected communities of snakes. Difficulties of capturing these cryptic vertebrates, coupled with their seemingly low population densities, have resulted in certain limitations regarding the contribution of studies of this particular group to the advancement of ecological theory. With these constraints in mind, we offer certain guarded suggestions for future studies of snakes at the community level.

Bull, James A. - see Shine

Burghardt, G. M. - see Denny

SAMPLING HERPETOLOGICAL COMMUNITIES BY A REMOVAL METHOD. R. Bruce Bury. National Fish and Wildlife Laboratory, Fort Collins, Colorado.

Extensive censuses of amphibian and reptile communities are rudimentary. Line transects alone are often poor indicators or inapplicable for measuring herpetofaunas in many habitats.

A removal technique is proposed as a useful tool to determine the species diversity, relative abundance, and estimated biomass of multi-species complexes in varied habitats. This system provides statistically sound comparisons both within and between communities, and serves as a critical indicator of situations altered by man. The removal method is efficient (2-4 days per plot) and inexpensive. It also appears to effectively sample resident populations of amphibians and reptiles.

Representative examples are provided on removal estimates for diurnal desert lizards and for amphibians in a temperate forest.

THE PHYSIOLOGICAL AND BEHAVIORAL MECHANISMS THAT RELATE TO FEEDING STRATEGIES OF REGINA SEPTEMVITTATA DURING ENVIRONMENTAL TEMPERATURE EXTREMES. Joseph A. Butler - Ohio State University. (Presented by title only)

The queen snake, Regina septemvittata, is a semi-aquatic reptile of the mid-eastern United States. It has been stated in several previous studies that this snake feeds almost exclusively on crayfish. If this is the case the snake is exposed to extremely cool water temperatures while feeding during the spring and fall.

The Galapagos marine iguana feeds in water which is below its preferred temperature. This animal meets this stress by physiologically thermoregulating by decreasing conductance below expected levels in the water. My experimentation has shown that the queen snake cannot decrease conductance appreciably while in the water.

Some fish have evolved enzyme systems which allow them to be active over wide thermal ranges. It is generally accepted that at least terrestrial reptiles have not been pressured to evolve such enzymes due to the wide variety of microhabitats available in terrestrial environments and because reptiles may behaviorally thermoregulate. My studies have shown that the enzyme myosin ATPase of R. septemvittata is most active near 28C (i.e. near eccritic and preferred temperatures of this animal). If this enzyme cannot be acclimated to function at lower temperatures (which I have not shown) the animal must be functioning in a different manner.

One possibility is that the snake feeds on more terrestrial prey during these cold periods and switches to crayfish when water temperatures are more favorable. Stomach contents are being collected and classified according to season. Results are scanty at present as more samples are needed but if there is a seasonal difference in prey taken this could explain how this snake copes with temperature extremes. If no difference is found the possibility of low temperature acclimation of the enzyme myosin ATPase must be considered.

NEW RECORDS OF COLUBRID SNAKES FROM PERU, WITH NOTES ON THEIR ECOLOGY AND DISTRIBUTION. Nelly C. de Espinoza, Museo de Historia Natural "Javier Prado", Apartado 1109, Lima, Peru.

The following 18 species of colubrid snakes are reported from Peru: Atractus occipitoalbus, Chironius cinnamomeus, C. flavolineatus, C. monticola, C. laevicolis, Dipsas indica ecuadorensis, Dryadophis danieli, Drymobius chloroticus, Drymarchon corais melanurus, Leimadophis fraseri, L. melanostigma, L. oligolepis, L. typhlus forsteri, L. triscalis, Pseudoeryx plicitalis mimeticus, Sibon nebulata leucomelas, Thamnophis proximus, and Xenodon merremii.

ANALYSIS OF THE HERPETOFAUNA OF FLORIDA LONGLEAF PINE-TURKEY OAK (SANDHILL) HABITAT. Howard W. Campbell. National Fish and Wildlife Laboratory, Gainesville, Fla.

The Sandhill habitat in Florida supports a community of 55 plus species of amphibians and reptiles, with at least 19 species of amphibians and 36 species of reptiles. Of these none are considered to be endemic to the habitat, 11 are restricted to habitats with similar physical characteristics, and the rest range throughout a variety of habitats.

Within-habitat resource partitioning is achieved through a complex of spatial and temporal utilization strategies. The composition of the community is regulated by numerous physical factors including nature of the substrate, fire frequency, ground cover and surface water distribution, as well as geologic history.

TECHNIQUES FOR HERPETOFAUNAL COMMUNITY ANALYSIS. Howard W. Campbell and Steven P. Christman. National Fish and Wildlife Laboratory, Gainesville, Fla.

Herptofaunal community analysis has been hampered by the lack of adequate sampling procedures and techniques. The great diversity of habitus, habitat and habits represented in the various groups studied by herpetologists has raised serious obstacles to the development of standard, cross and even within-group, sampling procedures. We view the development of such procedures as one of, if not the most, imperative needs

in the establishment of any effective approach to the analysis of herp communities.

We have developed a sampling approach that utilizes can traps and funnel traps placed in a "plus" shaped pattern with 18" high fences which has proven effective in a variety of habitats in Florida and could be of use in many other areas and habitats. The design was selected to maximize home range intercepts while minimizing cost of materials. A comparison with data obtained from other sampling programs in the same habitats indicates that the system is capable of providing a broad picture of the reptile and amphibian community in a relatively short period but that specialized sampling techniques are still required for certain species in any habitat.

Campbell, Howard W. - see Scott

TEMPERATE HERPETOFAUNAS: PATAGONIA. Jose M. Cei. Instituto Biologia Animal, Universidad Nacional de Cuyo, Mendoza, Argentina.

A general survey of the evolutionary development of the Tertiary Patagonian Biota is given. Paleontological and paleoclimatic evidence points out the remarkable similarity between preglacial ecological conditions of central and western Patagonian lands and both the xeric Chacoan and the humid Chilean ecosystems. The relationships between the Oligocene batrachofauna of Chubut and the present Antartandic batrachofauna are briefly analyzed. The available information on the Cenozoic reptilian fauna is reviewed, and the present composition and regional trends of the Patagonian herpetofauna are discussed.

Northern or ancient Patagonian and a southern or Deseadan major animal habitats are defined and morphologically and/or phytogeographically characterized. Fundamental herpetofaunal associations of the ancient Patagonian major animal habitat, between 38^{o} and 44^{o} South Latitude, are related to the steppe climax, to the western volcanic highlands of Neuquen, Rio Negro provinces and to the isolated basaltic Somuncura Plateau. Endemism and geographic variation of significant members of these communities are analyzed. Herpetofaunal districts of the southern Patagonian, or Deseadan major animal habitat also are recognized. They are the extensive Central highlands of Santa Cruz, the isolated volcanic Meseta near Buenos Aires Lake, the southernmost or Magellanian region of the continent and the San Jorge Gulf coastal association.

The origin and evolution of the present Patagonian herpetofauna are analyzed, and ecotonal forms and endemic forms are compared. The biogeographical patterns of northern Patagonia are pointed out, and the evolutionary importance of the extra-Andean group of primitive telmatobiine frogs is emphasized. These isolated anurans live in the western basaltic lagoons and on the Somuncura Plateau, where they are sympatric with another endemic, monotypic telmatobiine genus, which inhabits warm spring waters.

Evolutionary trends and speciation of the Patagonian genus Liolaemus are discussed. The saxicolous elongatus-kriegi group and the fossorial, psammophilous fitzingeriboulengeri group, are proposed and discussed. A kingi-archeforus group and a magellanicus group are also recognized on the basis of morphological and physiological characteristics. General conclusions on the post-Pleistocene evolutionary radiation of Patagonian lizards are presented.

ENERGETICS IN DIFFERENT LIFE HISTORIES OF AMBYSTOMA TIGRINUM. R. Christopher Chambers. Texas Tech University.

In West Texas Ambystoma tigrinum exhibits life history strategies ranging from a quickly developing aquatic larval stage culminating in metamorphosis to reproductively mature "larvae" which never metamorphose, or neotenes. Lipid deposition and depletion, reflecting energy allocation, has both an ontogenetic and seasonal component. These were isolated by sampling monthly for one year from a permanent neotenic population and from various temporary ponds which held larvae at different stages of development. Carcass and caudal lipid levels and fat body and gonadal weights were analysed separately by covariance analyses with total lean dry weight as the covariate.

Larvae initially have larger carcass lipid deposits than caudal and fat body lipid reserves. Caudal levels surpass carcass deposits before metamorphosis with fat body weight negatively correlated with ovarian weight. All components show significant positive correlation with body size. Immatures from the neotenic population show a similar ontogentic pattern.

Mature neotenes exhibit greater variation in caudal than carcass deposits with an increased lipid level in April and May. Both lipid compartments show a positive relationship with body size; females possessing more body lipid than males. Ovarian weight, the most labile component, shows negative correlation with fat body weight and positive correlation with body size prior to oviposition in November.

Significantly higher lipid levels in the neotenic population reflect higher prey densities in the permanent pond. In all populations selection favors rapid growth and gonadal development. Egg laying before metamorphosis increases fecundity. High lipid deposition rates and paedogenesis increase fitness by allowing flexibility in life history patterns.

Christman, Stephen P. - see Campbell

THE HERPETOFAUNA OF FLORIDA SAND-PINE SCRUB. Steven P. Christman. National Fish and Wildlife Laboratory, Gainesville.

The unique Sand-pine scrub habitat is endemic to Florida and is rapidly disappearing. Although the habitat includes no permanent fresh water, species diversity of terrestrial reptiles may be higher in scrub than any other habitat in Florida. Over 40 species of amphibians and reptiles have been recorded from scrub and at least two are essentially restricted to it. Species diversity and species assemblages appear to change with scrub maturity. Sand-pine scrub is maintained by periodic fire, without which succession to hammock would occur resulting in extirpation of much of the highly-adapted scrub fauna.

Colbert, Sylvia - see Ralin

CINEMATOGRAPHIC TECHNIQUES IN HERPETOLOGICAL EDUCATION. Alan D. Collier. Miami University, Hamilton, Ohio.

Struck by the lack of good herptile films useful for general zoology classrooms (excluding National Geographic televised specials), an attempt was made to formulate a filmed introduction to herptile behavior suitable for wide-range use.

The feeding behavior of selected reptiles and amphibians was chosen because it is the most active and easily photographed behavior. The herptiles filmed were selected on the basis of availability and subsequent film results, also for their general audience recognition.

Attempts were made to document anecdotal reports and explore heretofore unresearched herptiles. Also, behavior that might have been disturbing to viewers was eliminated as not to detract from its educational value.

The finished product is now being used in zoology classes at Miami University's Hamilton Campus. A

second, more detailed film suitable for more advanced classes is now underway.

VARIATION OF DIEL ACTIVITY OF A CHIHUAHUAN DESERT LIZARD COMMUNITY. F. Michael Creusere and Walter G. Whitford. New Mexico State University, Las Cruces, New Mexico.

The diel activity of the ten species that make up a Chihuahuan Desert lizard community can be divided into four main patterns: (a) unimodal throughout most of the day; (b) unimodal for a brief period only, usually morning; (c) bimodal, but with emphasis on early morning activity and (d) true bimodal activity. Species packing in this community was examined on the basis of temporal patterns of activity and microhabitat use.

Lincoln Index population estimates for Cnemidophorus tigris and Holbrookia (Cophosaurus) texana usually indicated densities 3X to 4X that observed at any point in time. Both species were continuously active throughout the day. However, individuals were not necessarily active throughout the day. Most had well defined activity periods occurring in five patterns: (a) early morning activity only; (b) mid-day activity only; (c) late afternoon activity only; (d) both early morning and late afternoon activity and (e) activity throughout the day. Those individuals active at mid-day were usually large males restricted to narrow, arroyo sub-habitats. Females of both species ceased activity from two to six weeks, moving from the population to lay eggs in other habitats.

Small males and some females of most species had their activity restricted to subhabitats not used by the population as a whole and had more restricted activity periods. In all species variability in activity pattern of both sexes was related to the breadth of activity for the species i.e. in species with restricted activity patterns individual variation was small.

THE SIGNIFICANCE OF REPRODUCTIVE ECOLOGY IN FROGS AND ITS RELEVANCE TO THE STUDY OF ANURAN COMMUNITIES. Martha L. Crump. University of Florida, Gainesville, Florida.

The following aspects are important components of anuran community ecology: (1) species diversity (both richness and equitability components), (2) resource utilization (niche breadth calculations of at least the three basic niche dimensions--food, space, and time), (3) community stability (extent of fluctuation of the component population sizes and an analysis of the factors controlling population levels), and (4) interactions of the members of the community (extent to which species limit each others' activities).

Species that depend upon standing bodies of water for reproduction frequently migrate to breeding sites. This results in mixed-species assemblages different from the communities during the non-reproductive periods. In addition, larval communities are entirely independent of the adult communities. Therefore, it is necessary to analyze the four aspects mentioned above for all three types of communities. This "poly-community" phenomenon has an effect on population fluctuations of frog species and on their resultant intra-community interactions. The other components of the community (prey and predators of frogs) are likewise affected by this extremely dynamic system.

It is during the breeding period when most potential species interactions would be expected to occur and when competition for limited resources would be at a maximum. The obvious question is "How can such a high number of species coexist in a restricted area?" Analysis of behavioral isolating mechanisms and resource utilization provide answers in terms of species-specific requirements.

Reproductive strategies have a profound effect on community stability and species diversity. In aseasonal environments where reproduction is continuous, clutch sizes are smaller, but more clutches are produced per year. The result is a buffering against adult population fluctuations, yielding greater community stability and a potential for increased species diversity. Aquatic larval communities are generally characterized by highly fluctuating population sizes due to catastrophic and unpredictable phenomena (such as the evaporation of the site) and high predation pressures. Age-specific mortality (especially high at gastrulation, hatching, and metamorphosis) has obvious significance to community stability.

Another important aspect of reproductive strategy is mode of reproduction (combination of ovoposition site and type of development). An increase in the diversity of reproductive modes results in greater resource partitioning. A world-wide survey of reproductive modes reveals a greater diversity in aseasonal environments than in seasonal environments. Areas high in species richness exhibit a concomitant high diversity of reproductive modes. Mode of reproduction has obvious implications to genetic variability of a population. The most generalized species (those depositing eggs directly in water) breed in the most unpredictable environment and produce the largest clutch-sizes--and therefore exhibit the greatest potential for high genetic variability.

Crump, Martha L. - see Kaplan

AGGRESSIVE BEHAVIOR IN THE GREEN SALAMANDER, ANEIDES AENEUS. Paul V. Cupp, Jr. Eastern Kentucky University.

During June-July, 1976, aggressive interactions were observed between male green salamanders, Aneides aeneus, when single males were introduced into a test chamber already inhabited by a resident male. Of 49 such introductions, 45 resulted in aggressive encounters after which one of the males would retreat. Resident males were usually the aggressors and were victors in 43 of the 45 aggressive encounters. Introduced males returned the aggression in only 11 instances and were victors in only two of the encounters. An aggressive encounter usually consisted of the aggressor rapidly biting and/or vigorously pressing his snout along the back of the other male. In six encounters, prolonged bite-holds were observed in which the jaws of one male would grip the mid-body region or a limb of the other male. These data indicate that A. aeneus is territorial, which may result from competition for favorable rock crevices. Also, this behavior may enhance the chances of a resident male having a successful reproductive effort.

EFFECT OF TONGUE REMOVAL ON THE FEEDING BEHAVIOR OF AN ADULT GARTER SNAKE THAMNOPHIS SIRTALIS. W. D. Denny, G. M. Burghardt, and R. P. Saunders. University of Tennessee.

In two experiments, we attempted to assess the relative importance of the vomeronasal and olfactory systems in garter snakes. Snakes used were an adult T. sirtalis sirtalis which had its tongue surgically removed as an adult several years previously, and three normal T. sirtalis controls. In Experiment 1, the tongueless animal and a control were placed separately for a number of trials in a chamber in which the odor of the nightcrawler Lumbricus terrestris was then introduced. Snakes were then allowed access to Lumbricus pieces. The unusual feeding behavior of the tongueless snake, which consisted of lunging around the cage with mouth wide open, a pattern not seen in any of the control animals, seemed to disrupt the normal

feeding sequence of stalk and attack. We attributed this animal's bizarre feeding behaviors, which seemed to be triggered by the odor of the prey items, to its tonguelessness. In Experiment 2, the tongueless animal and 3 controls were presented with prey items, first with no extra prey odor present and second with odor introduced. All three controls showed decreased latencies when the prey odor was introduced while the tongueless snake showed an increase in latency. Results suggest that the loss of the tongue decreased the ability of this snake to locate prey in an ambiguous olfactory situation.

REPRODUCTIVE CYCLE AND FEEDING BEHAVIOUR OF CUPRIGUANUS ACHALENSIS (SAURIA IGUANIDAE). di Tada, Ismael; R. Martori; B. Kufner y A. Ocana; Centro de Zoologia Aplicada, Universidad de Cordoba, Argentina. (Presented by title only)

Cupriguanus achalensis is the only lizard that lives in Pampa de Achala (elev. 2,200 mts.), an extra cordilleran relict in Sierras Grandes System, Province of Cordoba, Argentine.

Based on field observation a population of Cupriguanus achalensis was studied during the active period of the specie from September to April.

The reproductive cycle presents the following seasonal variations: espermiogenesis begins in September and spermatozoa are present in October and November, in this period copulation occurs. The size and weight of testes decease in December and January, and increase at the end of the summer or beginning of autumn.

Egg development begins in October and laying occurs in January. Hatchings were found from December to January, a year after deposition.

The daily feeding activity is resumed in a simple model. Cupriguanus achalensis is a generalist and he behaves as predator and a primary consumer. Activity begins when the sustratum temperature reaches 22C.

This specie uses a passive strategy (sit and wait) to capture arthropods and active (search) to eat vegetals. The ingestion sequence of an arthropod and other, and an arthropod and a vegetal indicate a predation preference.

These data are correlated with climatic phenomena and food disponibility.

ORIGIN AND DISTRIBUTION OF REPTILES OF LOWLAND TROPICAL RAINFORESTS OF SOUTH AMERICA. James R. Dixon.

Of the 203 reptile genera occurring in South America, approximately 175 (86%) appear to have their origin on that continent, and of the 175, 72 (41%) appear to have evolved within lowland rainforest situations.

Of approximately 1,100 species of South American reptiles, 550 (50%) occur within the boundaries of lowland (- 1000m) tropical rainforests that comprise about 42% of the standing vegetation of South America. Of the 550 reptile species, about 300 (54%) are endemic to the forests and 74% of all South American reptile genera are involved in the forests to some degree.

The South American rainforests have contracted and expanded through the Pleistocene glacial and interglacial periods, often being connected by a series of rainforest corridors of various dimensions, allowing for repeated dispersal of Amazonian reptiles into the Atlantic and Choco forests. There appears to be little migration from the latter into the Amazon forest. The Atlantic and Amazon forests have been most frequently in contact with each other, while the orogeny of the Andes in the Pliocene effectively restricted movements of Amazonian reptiles into the Choco forest.

Prior to the orogeny of the Andes, there appear to have been widespread tropical conditions that allowed aquatic reptiles (crocodiles, turtles,Dracaena) to become well established over much of the area. However, later climatic and geologic events caused extinction of several aquatic species, as evidenced by fossil lowland rainforest species at relatively high (2000m) elevations.

The life style of the modern reptiles of the lowland tropical rainforests is primarily terrestrial (43%), followed by arboreal (26%) fossorial (21%) and aquatic (10%). Many of the terrestrial forms occupy open, semiopen and/or modified forest zones. Some of the latter are surviving relics from Savannah formations of glacial periods, some are perianthropic and the remainder generalists. Only a few species of Andean genera have successfully invaded the lowland tropical rainforests.

As one would expect, the Choco Forest reptile fauna is closely allied to the fauna of Central America while the Atlantic reptile fauna shows less endemism, fewer species and a close affinity to the Amazon Forest fauna.

Though the theory of lowland tropical rainforest refugia during glacial maxima may explain the occurrence of endemism through isolation, the high number of endemic fossorial forms of reptiles may have evolved through changes in edaphic and climatic factors, independent of forest refugia. This may also explain the low number of endemic aquatic reptiles.

Dole, Jim W.--see Durant.

INTEGUMENTARY STRUCTURES CORRELATED WITH URICOTELY IN AN AFRICAN TREEFROG. Drewes, R. C., (California Academy of Sciences), S. S. Hillman, (University of California, Riverside), R. W. Putnam, (UCLA), and O. M. Sokol, (Stanford University).

Uricotely, low evaporative water loss, and high rates of water uptake through the ventral surface have been demonstrated in Chiromantis petersi Boul., an African rhacophorid treefrog (Drewes, et al., in press), placing the species on a par with its congener, C. xerampelina, and with the South American hylid, Phyllomedusa sauvagei Boul. Detailed examination of the anatomy of the integument of C. petersi and comparison with skin samples taken from some 60 other frog species reveal a unique arrangement of chromatophore units in the dermis which appears to be correlated with low EWL and high rates of water uptake.

THE ACOUSTICAL NICHE: AUDITORY RESOURCE PARTITIONING IN ANURAN COMMUNITIES. William E. Duellman. University of Kansas.

Frogs have a limited vocal repertoire; yet within any given multispecies breeding congregation each species has a distinctive call. Moreover, in different habitats or in geographically distant areas similar kinds of calls are produced by different species of frogs. Calls of 39 species of hylid frogs from three widely separated areas (Puerto Viejo, Costa Rica; Belem, Brasil; and Santa Cecilia, Ecuador) were analyzed for seven parameters: 1) number of notes per call group, 2) note repetition rate, 3) number of secondary notes, 4) duration of note, 5) pulse rate, 6) fundamental frequency, and 7) dominant frequency. Cluster analysis revealed that those species having the most similar calls are members of either widely separated geographic communities or different ecological communities within a given area. Discriminant function analyses of individual breeding congregations revealed that 100 percent discrimination is accomplished by utilizing only two or three parameters of the calls. These results suggest that the acoustical parameters of anuran breeding congregations can be viewed as ecological resources in which there is no overlap in utilization within a breeding congregation. Thus, distinctive acoustical niches are evident within anuran communities, and allopatric species fill equivalent niches in different communities.

ORIGIN, EVOLUTION AND DISPERSAL OF THE ANDEAN HERPETOFAUNA. William E. Duellman. University of Kansas.

The herpetofauna of the high Andes consists of two major assemblages. The southern assemblage occurs principally to the south of the Huancabamba Depression in northern Peru. Within this assemblage two groups can be recognized: 1) A Patagonian element of recent invaders of the Andes (Pleurodema, Bufo, Ctenoblepharis, Liolaemus, Phymaturus, Pristidactylus, and Tachymenis), none of which extends north of the Huancabamba Depression; and 2) A mid-Andean element composed of Telmatobius and Stenocercus (both extending north of the Huancabamba Depression) and Batrachophrynus (central Peru). The northern assemblage is composed of three groups: 1) A major northern Andean element made up of Bolitoglossa, Eleutherodactylus, Atelopus, Osornophryne, Colostethus, Cryptobatrachus, Hyla, Centrolenella, Phenacosaurus, Anadia, and Pholidobolus, none of which occurs to the south of the Huancabamba Depression, plus Phrynopus, Gastrotheca, and Proctoporus, all of which occur to the north and south of the Huancabamba Depression. 2) A derived element in the Merida Andes sharing Bolitoglossa, Eleutherodactylus, Atelopus, Colostethus, Hyla, Centrolenella, and Anadia with the northern Andes in Colombia. 3) A partly shared and partly independently derived fauna in the Sierra Nevada de Santa Marta with the endemic Geobatrachus, species of Eleutherodactylus mostly related to species in the Cordillera de la Costa in Venezuela, and three genera (Bolitoglossa, Atelopus, and Cryptobatrachus) shared with the main northern Andes. The members of the northern assemblage are either congeneric with species in the adjacent humid tropical lowlands or are derived from lowland groups.

The herpetofaunas on the humid slopes of the Andes are composed of many endemic species and some endemic genera (Amblyphrynus, Rhamphophryne, Amphignathodon, Centrolene) that are related to taxa in the humid tropical lowlands and related or not to taxa in the high Andes.

The diversity of the Andean herpetofauna is due to: 1) Independent invasions of the Andes by numerous ancestral stocks, and 2) Geographic isolation through expansion and contraction of habitats correlated with altitudinal climatic shifts during the Quaternary. The major physical barriers to distribution are the low depressions--Huancabamba Depression in northern Peru and the Cucuta Depression at the Colombian-Venezuelan frontier. A second factor contributing to broad distributional patterns is the change from an aseasonal humid climate in the north to a seasonal semi-arid climate in the south.

Duellman, William E.--see Pefaur.

ECOLOGICAL DISTRIBUTION OF THE SALIENTIAN FAUNA OF THE MERIDA ANDES, VENEZUELA. Pedro Durant. Universidad de Los Andes, Venezuela.

From August 1970 to October 1971, the main natural areas of the State of Merida were covered in a collecting program along five transects through the western side of the Andes. The areas were selected according to the life zone systems of Tamayo and Holdridge. Each one of the samples collected was identified to species and most of the morphological analysis was done on living material. The distribution of the representative groups of Salientia from these censuses was related to changes in the biophysical conditions from the Parmo or Sub-Alpine life zone to the Tropical wet forest life zone.

About 50% of the 30 genera, and 28% of the 110 species of Salientia in Venezuela are represented in the Merida Andes. The most representative genera are : Hyla (28.4%), Colostethus (18.0%), and Leptodactylus (14.3%). The tropical wet forest harbored about 39.2% of the species collected, and the Paramo only 10.7%. Some species such as C. meridensis and Eleutherodactylus williamsi, seem to be restricted to very specific habitats (Pre-Montane Pluvial Forest and Low Montane Wet Forest, respectively). Others such as Bufo marinus, H. crepitans, and L. podicipinus have wide distribution in most of the life zones of the State of Merida.

AMPHIBIAN ECOLOGY OF THE VENEZUELAN ANDES. Pedro Durant (Universidad de Los Andes, Merida - Venezuela) and Jim W. Dole. (California State University, Northridge).

Some of the biophysical conditions as they change from the Paramo, or Subalpine life zone (3850 m. high, 3-6C biotemperature and 780 mm. rain fall) to the tropical wet forest life zone (62-150 m. high, 28-30^{o}C biotemperature and 3900 mm. rain fall) are discussed. In these environments 50% of the amphibian genera, and 28% of the frog species of Venezuela belong to the Merida Andes alone. Some species (Colostethus meridensis, Eleutherodactylus williamsi, etc.) seem to be restricted to very specific habitats, while others (Bufo marinus, Hyla crepitans, Leptodactylus podicipinus, etc.) are widespread in most of the Andes life zones.

The reproductive cycles and growth of B. marinus and H. crepitans at the xerophytic life zone of the Merida Andes were studied. The supposed nutritional value of some microorganisms found in the gut, the apparent physiological differences in the intestine regions, and the space that the tadpoles of these species occupy in the same pond, all suggest the development of an ecological mechanism in these frogs which allows them to grow in the same body of water while avoiding inter-specific competition effects.

Growth, home range, movements, reproductive activity, seasonal changes in the population structure, significance of food source and differences in the stomach contents before and during breeding season are discussed for Atelopus oxyrhynchus in a Venezuelan cloud forest.

A COMPARISON OF THERMAL TIME CONSTANT OF AQUATIC AND TERRESTRIAL TURTLES. Vickie Earnhart and E. Norbert Smith. Northeastern Oklahoma State University, Tahlequah, Oklahoma.

This study is a review of the literature dealing with turtle thermoregulation. Published heating and cooling rates were compared using thermal time constants and corrected to zero air speed. Data were collected on 9 species of turtles, 5 aquatic and 4 terrestrial.

Regression formulas were then used to calculate weight specific thermal time constants during heating and cooling in each group. For a theoretical aquatic turtle, in air, the warming time constant ranged from16.9 to 203 min. for 0.1 - 10 kg turtles respectively. The cooling time constant went from 24.31 to 174 min. for 0.1 - 10 kg turtles, respectively. For theoretical aquatic turtles in water the warming constant went from 3.2 to 38.4 min. for 0.1 - 10 kg, respectively.

For theoretical terrestrial turtles, (in air) the warming time constant ranged from 23.0 - 375.9 min. for 0.1 - 10 kg turtle, respectively. The cooling time constant ranged from 20.1 - 373.0 min. for a 0.1 - 10 kg turtle.

The ratio of the warming time constant to the cooling time constant (T_W/T_C) was also calculated for each group. For the aquatic turtles in air the ratio went from 0.70 - 1.17 min. for 0.1 - 10 kg, respectively.

The ratio in the terrestrial turtles in air went from 1.15 - 1.01 min. for 0.1 - 10 kg, respectively.

The above observations indicate a profound difference in the heating and cooling response of aquatic and terrestrial turtles. Larger aquatic animals heat much faster than they cool. Large terrestrial turtles cool faster than they heat.

A ZOOGEOGRAPHIC ANALYSIS OF THE HERPETOFAUNA OF THE WEST INDIES. Arthur C. Echternacht. The University of Tennessee - Knoxville.

A quantitative analysis of the herpetofauna of the West Indies is presented. The emphasis is on the relationship between species diversity and area. Sixty-eight islands and their banks are considered. Banks and islands are analyzed separately, as are amphibians and reptiles, and lizards and snakes. Diversity is, in some cases, more closely correlated with bank area than with island area. Amphibian (anuran) and lizard diversity are related to island (or bank) area, whereas snake diversity is related to both area and to diversity of the other groups. This is not unexpected inasmuch as many West Indian snakes prey primarily on other poikilothermic vertebrates.

TERRESTRIAL LOCOMOTION IN SALAMANDERS: GAIT ANALYSIS. James L. Edwards, Michigan State University.

Single-frame motion picture analysis of representatives of the families Ambystomatidae, Dicamptodontidae, Salamandridae and Plethodontidae revealed that all salamanders progress through a typical sequence of gaits. At the slowest speeds, salamanders use a gait previously unreported in vertebrates, in which each limb is in contact with the ground for at least 90% of the stride duration. At faster speeds, the animals switch to lateral sequence, diagonal couplet walks, and then to trots. At the fastest speeds, salamanders abandon their limbs entirely, and "swim" across the substrate in a type of locomotion I call fast lateral undulation. Although any individual will follow the above sequence of gaits, the exact speed at which an individual will switch from one gait to another varies considerably from one locomotor sequence to the next; however, elongate salamanders usually switch to the next fastest gait at lower speeds than more robust forms. Salamanders use only about one-fourth of all terrestrial gaits found by Hildebrand in other vertebrates.

Use of the "walk pattern analysis" of Dagg and de Vos allowed the clustering of salamander gaits into seven similarity groups, which represent "comfortable" locomotor patterns used by large numbers of salamanders. The groups were linked by means of a Prim network to predict how any individual would move from one similarity group to another.

PARTITIONING OF FOOD RESOURCES IN SNAKES OF THE UNIVERSITY OF KANSAS NATURAL HISTORY RESERVATION. Henry S. Fitch. University of Kansas.

Fifteen species of snakes are present on the 239 ha reservation in population densities ranging from 1800 per ha in Diadophis punctatus to less than one per 100 ha in Elaphe guttata. These species differ greatly in size, seasonal schedule, habitat, and their terrestrial. fossorial, arboreal or aquatic adaptations. More than 2500 separate food items have been recorded from snakes on the area. A wide range of prey species are taken, and each species of snake overlaps others in some degree, but in no two does the diet have exactly the same composition. Major food resources are earthworms (mainly Allolobophora caliginosa), voles (mainly Microtus ochrogaster) and frogs (mainly Rana blairi). In all instances of two snake species preferring the same kind of prey, resource partitioning can be shown in: 1) partial habitat separation, or 2) sizes of individual prey items taken, or both.

STRUCTURE AND FUNCTION OF ANOLE DEWLAPS. Henry S. Fitch and Virginia R. Fitch. University of Kansas, Lawrence.

In male lizards of the genus Anolis the dewlap is a highly developed display organ. The species-specific bobbing displays serve varied functions including species recognition, sex recognition, courtship, and maintenance of territory. Females of most species lack dewlaps although their chins may show traces of dewlap color; some have small dewlaps, and a few have them well developed. In the males, size, shape, color, markings and patterns of allometric growth are distinctive of species; squamation is especially complex and varied. Dewlaps having diverse scale patterns are illustrated. Like the display for which it serves, the dewlap itself provides characters that may be indicative of degree of relationship between species. However, except for general color, dewlap characters have not yet been utilized in classification.

Fitch, Virginia - see Fitch, H.

THE HERPETOFAUNA OF THE NOTHOFAGUS FORESTS OF SOUTHERN CHILE. Ramon Formas C., Instituto de Zoologia, Universidad Austral de Chile, Casilla 567, Valdivia, Chile.

The herpetofauna of the austral Nothofagus forests is very poor in species but contains many endemic amphibians (Caudiverbera, Telmatobufo, Hylorina, Batrachyla, Rhinoderma, Eupsophus, Insuetophrynus) There are no endemic genera of reptiles. The fauna is composed of some Tertiary anuran elements and of others that migrated into the region (among them some other amphibians and all of the reptiles). The migrant fauna is Patagonian and Andean in origin. Pleistocene glaciation resulted in modifications of distributions. In post-Pleistocene times the Nothofagus forest and its herpetofauna reached more northerly latitudes than at present. There are still some small relictual patches of forest (Valparaiso) where disjunct populations of southern anurans (Batrachyla, Rhinoderma) dwell. The geographic isolation of the Nothofagus forest possibly has permitted intense speciation, especially among the migrant elements.

COMPOSITION, DISTRIBUTION AND ORIGIN OF THE CHACOAN HERPETOFAUNA. Jose M. Gallardo.

The Chacoan herpetofauna occupies the northern part of the Chaco-Bonariensean Plateau having an elevation of 100-500 m. Below 100 m there is a transition to the Litoral-Mesopotamian fauna; above 500 m there is a transition to the Subandean fauna. In this area there is a rainfall gradient generally coinciding with the topography. The vegetation principally is a Chacoan park type with monte and isolated trees interspersed in grassland; thorn bushes or halophytic vegetation sometimes are present. The existence of rivers influence the faunistic distributions.

The herpetofauna is composed of five families of amphibians, six of lizards, five of snakes, one of turtles, and one of crocodilians. There is a total of 46 genera and 63 species. The amphibians and to a lesser degree the lizards have a parallel origin with the Litoral-Mesopotamian fauna. Both apparently originated from the same Guayana-Brasilian stock, which differentiated later through isolation and reinvasion of some areas. The view fits the refugia theory for survival during unfavorable climatic periods with subsequent reinvasion of areas when favorable climates returned. River systems have been fundamental to the

distribution of amphibians. Snakes have a broader distribution and in general do not follow the patterns of amphibians and lizards. Turtles and crocodilians reach farthest west through the rivers; their distributions tend to coincide with those of the fish fauna. The Chacoan herpetofauna seems to have originated from the Parana River fauna, which in the past extended to the west, where it subsequently adapted to the more rigorous climatic conditions. Among the species of the Chacoan herpetofauna are several that show reproductive, dietary and/or ethological adaptations denoting their adjustment to the conditions present on the Chaco-Bonariensean Plateau.

Gasparini, Zulma - see Baez

SAMPLE SIZE IN TAXONOMIC ELECTROPHORETIC STUDIES - AN EMPIRICAL ANALYSIS. George C. Gorman, U.C.L.A.

Electrophoretic studies have been used primarily in the analyses of questions related to population genetics. Large sample sizes for such studies are clearly requisite. A carry-over from this approach is that workers assume that sample sizes of 20-30 or more individuals are desirable if not necessary when one is using electrophoresis primarily for taxonomic analyses. Theory suggests otherwise. Dr. M. Nei and co-workers have pointed out that increasing the number of loci sampled is far more important than increasing the number of individuals sampled for a taxonomic comparison.

Empirical analysis of previous studies on the relationships of insular Anolis lizards supports theory rather convincingly. Genetic distance estimates are remarkably insensitive to sample size for number of individuals. A randomly chosen individual from the population will often be sufficient. The error in genetic distance estimates is far greater by decreasing the number of loci sampled, than by decreasing the number of individuals sampled.

Even heterozygosity estimates are relatively insensitive to sample size. Ten individuals appears to be sufficient for most purposes. Even two individuals ususally gives the correct "ballpark" estimate.

THE ECOLOGY OF THE SPECTACLED CAIMAN IN THE VENEZUELAN GUAYANA. *S. J. Gorzula. I.V.I.C. - Caracas 101, Venezuela.

For three years a population of spectacled caimans, Caimancrocodilus crocodilus, has been studied using mark and recapture techniques. The caimans occur in a savanna lagoon system that consists of 4 permanent and 9 temporary lagoons. During the dry season the lagoons cover 2.28 hectares, and during the rainy season 23.32 hectares.

Migration to temporary lagoons occurs in the rainy season. Such migrations occur on nights when it is raining, and the caimans frequently return to the permanent lagoons on the same night. Caimans, displaced from their lagoons, will home up to 2 km.

A growth curve was made from the data of 36 recaptured caimans. It was estimated that in this area caimans take 6 years to reach a total length of 97 cms. Thereafter the growth rate varies from year to year. During a dry year there may be no growth at all, and during a wet year a large caiman may increase in length by up to 10 cms.

During the first two years of life, the young caimans stay near the site of the nest, and eat terrestrial insects. Older caimans eat insects during the dry season, but during the rainy season migrate to temporary lagoons and eat frogs. Although there are 26 species of frogs that breed in the area, only three species--Bufo granulosus, Elachistocleis ovalis, and Pleuroderma brachyops--were found in the stomach contents of the caimans.

*This work was financed by CONICIT S1-0168. VENEZUELA

BEHAVIOR, ECOLOGY, AND THE ADAPTIVE ZONE OF AFRICAN MOLE VIPERS (ATRACTASPIS). Harry W. Greene. University of Tennessee, Knoxville.

Morphological and biochemical studies by others suggest that mole vipers are related to aparallactine colubrids and not viperids. I will summarize literature records, stomach analyses, and observations on captive A. bibronii and A. microlepidota. Defensive behavior is similar to that of many other small, secretive snakes and includes head hiding, neck arching, body flattening, tail display, body snapping, cloacal discharge, biting, and immobility. Prey killing behavior is unusual and differs from viperids in at least two respects: (i) one fang is used, and the strike is a posterior and/or lateral head movement (rather than a forward movement with two fangs); (ii) single and multiple rodent prey are struck repeatedly before ingestion of any one item begins (rather than a single strike at one item prior to ingesting it). Data are available on 75 prey items in 45 specimens of four species. One snake had eaten an anuran and one contained 12 reptile eggs. Thirty-one specimens contained 1-2 reptiles per stomach ($\bar{x}$=1.13); 11 specimens contained 1-4 mammals per stomach ($\bar{x}$=2.45) Eighteen of 27 mammals (67%) appeared to be nestlings; 9 of 11 stomachs with mammals (82%) had multiple prey. The peculiar prey killing behavior and unusual cranial modifications of Atractaspis are perhaps adaptations for (i) delivery of a venomous bite to a potentially dangerous prey in a confined space and (ii) rapidly immobilizing several prey items (some of which might otherwise escape) prior to ingesting them. (Supported by the Theodore Roosevelt Memorial Fund, the Karl P. Schmidt Fund, and NSF BNS 76-19903).

Guerrero, S. - see Andrews

QUATERNARY BIOGEOGRAPHY OF TROPICAL LOWLAND SOUTH AMERICA. Jurgen Haffer.

Climatic-vegetational fluctuations in the neotropical lowlands during the Quaternary caused vast changes in the distribution of forest and nonforest biota. Comparatively restricted populations of plants and animals probably were isolated and deviated in remnant habitat areas ('refugia') during adverse climatic periods, often reaching the level of new subspecies or species before they established secondary contact with other refuge populations during expansive phases under a favorable climate. Numerous species probably became extinct during the Pleistocene vegetational fluctuations, probably leading to the elimination of entire evolutionary lines.

Results of recent biogeographical studies on neotropical birds, lizards, butterflies, and plants of forest habitats support the refuge theory. A total of about 40 forest refugia have been proposed in Middle and South America, a larger number for plants and insects than for vertebrates. This difference may reflect different survival ability of these groups of organisms in refugia of varying size. Quaternary vegetational fluctuations probably also determined the evolution of nonforest faunas at the level of subspecies and species. Additional direct evidence for the location of Quaternary forest and nonforest refugia based on eomorphological, pedological, and palynological data is needed to substantiate the above conclusions which are largely derived from biogeographical interpretations.

A REVIEW OF STRUCTURING IN HERPETOLOGICAL COMMUNITIES. Harold Heatwole. University of New England, New South Wales, Australia.

A literature review of the structuring of herpetological communites is presented. Structuring is examined from several viewpoints:

1. Numbers of species and individuals in different communities as related to environmental and vegetational features;
2. biomass;
3. spatial relations - relation to environmental geometry and to habitat selection; and
4. community interactions.

Hillman, S. S. - see Drewes

CALL DIFFERENCES AND CALLING SITE SEGREGATION IN ANURAN SPECIES FROM CENTRAL AMAZONIAN FLOATING MEADOWS. Walter Hodl. Zool. Inst. d. Univ. Wien, Austria.

The acoustic behavior of 15 sympatric and synchronically breeding species of frogs in an area of floating meadows near Manaus, Brazil was studied for a period of 8 months. The calling positions of each species can be identified with certain physiognomic types of vegetation.

Sound analyses were used to compare the mating calls. The main variables are dominant frequency, call duration and pulse repetition rate. Each of the 15 species has a distinct mating call and differs from the acoustic behavior of each other one. Eleven species are separated in their dominant frequency ranges within their specific calling sites. Species sharing emphasized frequency ranges within identical calling sites differ greatly in at least two temporal variables.

The roles of calling position, spectral, and temporal features of mating calls in species recognition and premating reproductive isolation are discussed.

DISTRESS CALLS IN CENTRAL AMAZONIAN FROGS. Walter Hodl. Zool. Inst. d. Univ. Wien, Austria.

Distress calls of Hyla lanciformis and H. Boans (juvenile and adult), Leptodactylus ocellatus, L. pentadactylus and Hydrolaetare sp. (adult) are presented in oscillograms and sonagrams. The calls are species-specific, yet showing striking similarities in spectral patterns. A possible protective and communicative function of this call type is discussed.

THE HERPETOFAUNA OF GUIANA, AN APPRAISAL OF OUR CURRENT KNOWLEDGE. Marinus S. Hoogmoed. Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands.

The Guiana region (bordered by the Orinoco, Cassiquiare Canal, Rio Negro, Amazon and Atlantic Ocean) geologically is one of the oldest regions of South America. The greater part is formed by the pre-Cambrian Guiana-shield, Roraima sandstone covers parts of southern Venezuela and western Guyana, with isolated remnants in central Guyana and central Surinam. The overall elevation of the area does not exceed 1000 m, but the sandstone remnants may reach heights of about 3000 m. Because of their isolated position and their releatively high elevation, these mountains (tepui's) represent subtropical islands in a tropical lowland sea. The total number of reptiles and amphibians known to occur in Guiana at present is 394, of which 162 are amphibians, 232 reptiles. These numbers comprise five sea turtles, one cosmopolitan gecko and five species imported from the Caribbean. The remainder can be assigned to five major groups: endemics; amazonian; widespread; reaching eastern limit of distribution in this area; species reaching Guiana from S. and C. Brazil. Of amphibians 81, of reptiles 64 species are restricted to the Guiana region, or occur only slightly over the borders of the area delimited. The species in the other groups may form endemic subspecies in the area (34 subspecies belonging to 27 species). Most endemics are concentrated in the western part of Guiana, and can be divided into "lowland" and "altitudinal" endemics, the latter exclusively occurring over 1000 m. About 28% of amphibian and 16% of reptile endemics are altitudinal. Endemic altitudinal genera like Otophryne and Oreophrynella seem to represent relics from the early Tertiary, Stefania seems to represent a recent radiation, the position of Riolama is not very clear. The remaining endemic genera (Allophryne, Rhinatrema, Peltocephalus, Amapasaurus) are lowland endemics and their history is not very clear. Endemic species of Elosia and Euparkerella point to relations with SE Brazilian highlands. Most altitudinal endemic species are subtropical derivatives of lower living relatives. The origin of most of the lowland endemics probably is related to the history of the postulated Guiana forest refuge during Quaternary climatic changes. Major geographic barriers are absent for lowland species and differential distribution in most cases probably is due to ecological competition or special habitat requirements. Altitudinal endemics have restricted distributions on one or a few neighbouring tepui's.

NOVEL TOXINS AND THE QUESTION OF WARNING COLORATION AND MIMICRY IN SALAMANDERS. James E. Huheey, University of Maryland, College Park, MD, and Ronald A. Brandon, Southern Illinois University at Carbondale, Carbondale, IL.

It has long been known tht red efts and other American salamandrids are protected by the potent low-molecular weight neurotoxin, tetrodotoxin (TTX). We here report the presence of a second, high-molecular toxin in the skin of Notopthalmus and Taricha which can be distinguished from TTX by its pharmacological and chemical properties. Furthermore, a high-molecular weight, non-TTX poison has been isolated from the skin of salamanders of the genus Pseudotriton. In LD_{50} mouse bioassays (intraperitoneal injection), pseudotritontoxin has comparable toxicity to TTX on a per salamander basis. The finding of these novel toxins requires that the mimetic relationship of these forms, usually considered to be Batesian, be re-examined.

Huheey, James E. - see Brandon

DIFFERENTIATION IN THE GENERA ENYALIUS AND STROBILURUS (IGUANIDAE): IMPLICATIONS FOR PLEISTOCENE CLIMATIC CHANGES IN EASTERN BRAZIL. James F. Jackson University of Southwestern Louisiana.

Geographic variation in meristic and morphometric characters are examined to delimit the taxa of the forest-restricted genus Enyalius in eastern Brazil. Eight taxa are recognized. Phenetic affinities among these are described by multiple discriminant analysis and Wagner networks based on separate morphological data sets. A phylogeny is proposed, and a sequence of allopatric differentiations is hypothesized. The locations of refugia of the Brazilian Atlantic forest during drier climatic periods are hypothesized from present variation in vegetation and precipitation: Santa Catarina refuge, around Baias de Paranagua and Sao Francisco and adjacent slopes of Serra do Mar; Sao Paulo refuge, Serra do Mar between Paranapiacaba and Sao Sebastiao; Bocaina refuge, around Baia da Ilha Grande; Mantiqueira refuge, on Serra da Mantiqueira; Orgaos refuge, on Serra dos Orgaos; Southern Espirito Santo refuge, in the mountains south of Rio Doce; Northern Espirito Santo refuge, on the Coastal plain north of Rio Doce; Salvador refuge, around Baia de Todos os Santos; Pernambuco refuge, along coast of northern Alagoas and southern Pernambuco; Upper Rio Doce refuge, near the headwaters in Minas Gerais. Locations of the hypothesized refugia are compared with the geographical separations in Enyalius proposed to have preceded

differentiation. Differentiation in Enyalius is most interpretable with reference to past forest refugia separated by corridors of open vegetation. Geographic variation in Strobilurus torquatus in northeastern Brazil requires similar conclusions.

THE TAXONOMIC STATUS OF DESMOGNATHUS WELTERI BARBOUR AND A COMPARISON WITH TWO SYMPATRIC CONGENERS. J. Eric Juterbock. Ohio State University.

Abundant morphological and life history evidence exists that Desmognathus welteri Barbour is a full and distinct species and not a giant subspecies of D. fuscus. D. welteri is sympatric throughout its range with both D. fuscus and D. monticola and is more aquatic than either congener. Larvae of D. welteri are larger at hatching than those of either D. fuscus or D. monitcola and maintain this difference throughout larval life. They transform 21-24 months after hatching unlike those of either congener, both of which have larvae which transform no later than nine months after hatching. Adults of D. fuscus are significantly smaller than those of D. welteri and D. monticola. D. welteri and D. monticola have very different types of jaw teeth and patterns of replacement; D. fuscus resembles D. welteri in both regards. All three species have different tail shapes. Color patterns, though variable, show definite patterns of interspecific variation which are characterized. A brief review is made of interspecific differences reported elsewhere for related characters. The known range of D. welteri is described.

THE NON-COST OF BROODING IN AMBYSTOMA OPACUM. Robert H. Kaplan, Brooklyn College of the City University of New York and Martha L. Crump, University of Florida.

Brooding behavior in salamanders ranges from a weak bond between the parent and offspring (mere presence of parent at the egg deposition site) to active defense of the clutch and transporting of the eggs to a more favorable site. From theoretical literature we reason that brooding behavior would not evolve if the cost to the overall fitness of the parent exceeds the benefit. This cost is measured as a decrease in the future reproductive success of the parent. The cost could be generated by energy drains on the brooding parent due to the physical nature of the behavior itself and/or the relatively lower feeding rate which may be associated with the behavior.

Ambystoma opacum is the only member of a primarily aquatic-breeding genus of salamanders that remains with its eggs after terrestrial deposition. In order to determine the energetic cost of this "parental investment," we compared dry weight, total calories, weight-specific caloric content, and ash content in females that had just begun to brood with those near completion of brooding. Differences in these four variables between the two groups are not significant at $P \leq 0.05$. The argument that brooding females are at an energetic disadvantage because they are unable to forage is discarded because the males collected from the area during the same time period also had empty stomachs and intestines. We therefore suggest that there is no increase in energetic cost due to brooding in A. opacum.

DIFFERENTIATION AND HYBRIDIZATION IN THE NATRIX FASCIATA COMPLEX (REPTILIA: SERPENTES): A NONMORPHOLOGICAL APPROACH. Howard I. Kochman. National Fish and Wildlife Laboratory.

Reproductive interactions among freshwater and coastal populations of Natrix fasciata were evaluated on the basis of osmoregulatory criteria. Putative hybrids between water snakes of the fasciata and clarki groups were collected from a brackish creek along the Atlantic coast of central Florida. Captive-born juveniles, as well as snakes collected wild at this site, were experimentally subjected to full-strength seawater for a maximum duration of 20 days. Variational patterns of survival time and dehydration rate suggest secondary intergradation among highly differentiated, though reproductively compatible taxa.

Within populations, body weight correlates negatively with dehydration rate and positively with salinity tolerance. The fact that neonatal N. f. clarki averaged over 38% heavier than N. f. pictiventris may therefore represent a strategy to reduce the osmotic stress of juveniles in saline habitats. The characteristic salinity tolerance of salt marsh snakes. however, is primarily a function of weight-independent strategies, involving low rates of dehydration and an inherent reluctance to ingest seawater.

Kufner, B. - see DiTada

Labanick, George M. - see Brandon

HERPETOFAUNAL RELATIONSHIPS OF SOUTH AMERICA WITH AFRICA. Raymond F. Laurent.

At first sight, the contrast between the Neotropical and Ethiopian herpetofaunas is so striking that it seems to fit the Matthewsian or Darlingtonian zoogeographic theories (vicariance of the Ranidae with the Leptodactylidae, Agamidae with the Iguanidae, etc). However, the plate tectonics proved such theories to be incorrect. Some recent paleontological discoveries indeed confirm that Africa and South America were united until almost the end of the Mesozoic. Of those preatlantic groups, only a few are now surviving as such: the Gymnophiona as a whole, the Pipidae, the Pelomedusidae, the Gekkonidae as a whole, the Amphisbaenidae, the Leptotyphlopidae, and probably the Typhlopidae. Many are extinct, for example the Mesosuchians, and many other Mesozoic reptiles. The Leiopelmatidae were present in Jurassic times in South America and presumably in Africa as well. A less old wave probably is represented by the Myobatrachidae which also became extinct there except for Heleophryne in Africa and those that evolved into Leptodactylids and Ranoids. The Geotrypetes - Apodops group survived in Africa while the Ichthyophiidae did so only in the Neotropical Realm. Some groups apparently managed to migrate from one continent to the other before the final split. The Bufonidae and the Iguanidae did it from west to east while the Microhylids travelled in the opposite direction. The Iguanidae reached Madagascar where they survived but they did not in Africa.

Some other groups had a similar opportunity but failed to establish themselves on the other continent probably because they prohibit mutual ecological occurrence. The sister groups leptodactylids and ranids are a typical case.

For many millions of years after its birth the Atlantic Ocean was a narrow sea and therefore not a major barrier against rafting dispersal. Kluge demonstrated such crossings as recent as Pliocene or Pleistocene for the Hemidactylus mabouia brooki complex. Quite reasonably, many groups might have been successful in a similar feat during earlier periods. Especially for the Gekkoninae several waves might be considered. In general, the rafting from South America to Africa seems to be a dubious and unusual event (Typhlopidae, Natricidae), whereas the African invaders of South America seem to have been considerably more frequent--not only the Gekkoninae, but also the skinks (Mabuya) and the Gavialidae which died out there afterwards, perhaps also some amphisbaenians and Typhlopidae, the Lycodontinae and the Colubridae (sensu Underwood).

Some groups apparently came from elsewhere in both continents according a Matthewsian or Darlingtonian scheme; these include the Testudinidae, Crocodylidae, Elapidae, and possibly the Lycodontinae, Boiginae, Natricidae and Colubridae.

A round-about Odyssey through northern continents in fundamented for the Ranidae with Rana palmipes as a rather agressive pioneer. An inverse course is quite unlikely but seems a remote possibility for the Boiginae, which are numerous in South America (Leptodeira, etc.) and so far made a modest inroad in Africa (Telescopus).

However, the most numerous groups evolved on only one side of the Atlantic and failed to colonize the other continent. Examples are the Dermophiinae, Caecilidae (sensu stricto) Typhlonectidae, the already-mentioned Leptodactylidae, the Hylidae, Centrolenidae, Pseudidae, Dendrobatidae, Teiidae, Anguidae, Boini, Dipsadinae, Xenodontinae, Crotalinae for South America; the Scolecomorphidae, Herpelinae, Ranidae (except for Rana palmipes), Hyperoliidae, Agamidae, Chamaeleonidae, Lacertidae, Cordylidae, Varanidae, Pythoninae, Dasypeltinae and Viperinae for Africa. A temporary inroad before the Turonian severance or a short-lived beach head on either side are distinct possibilities which paleontological discoveries in Cretaceous and Paleocene beds on the critical coast zones of both continents might substantiate.

THE HERPETOFAUNA OF THE LLANOS AND ASSOCIATED NON-FOREST REGIONS OF NORTHERN SOUTH AMERICA. Juan R. Leon. Escuela de Ciencias Universidad de Oriente, Cumana, Venezuela, S.A.

Considering the great number of species and diversity of South American neotropical amphibians and reptiles, a discussion restricted to llanos species deals with only a tiny fraction of the entire herpetofauna. Since different authors in this symposium will be dealing with other major areas, a good amount of knowledge on the origin, evolution, dispersal and complexity of the neotropical amphibians and reptiles can be gained.

The northern South American flat lands (llanos) mostly occur in Colombia and Venezuela east of Andes, where they range from 0 to 500 meters above sea level. Geologically, the origin and existence of these llanos can be traced back to Plio-Pleistocene. The actual composition and distribution of the herpetofauna of this area is explained as a function of the recent origin, and the climatic, topographic and ecological changes that have taken place subsequently. These changes are thought to have altered the amount of precipitation inducing a relative aridity to this landscape.

The amphibians and reptiles of the llanos of Colombia and Venezuela are presented together with a brief review of adjacent areas like the Caribbean scrub. In general, the herpetofauna of the South American llanos is impoverished considering its relative land extension. Actually, there is not a typical herpetofauna inhabiting the llanos, probably as a result of recent dispersion of faunal elements into this area coming in from adjacent regions, mostly from Amazonian forests, perhaps as a consequence of a high level of adaptation of animals to the arid climatic conditions. On the basis of these two points of view different aspects of the llanos herpetofauna are discussed.

BIOGEOGRAPHY OF THE AMPHIBIANS IN THE ORIENTAL REGION OF THE GUIANAS. Lescure, Jean. Museum National d'Histoire Naturelle, Paris, France.

NO ABSTRACT RECEIVED.

TRACKING AS AN AID IN THE STUDY OF SNAKE COMMUNITIES. Harvey B. Lillywhite. The University of Kansas, Lawrence, Kansas.

Snakes weighing as little as two grams leave identifiable impressions when crawling over finely textured soil surfaces. Dirt roads, dune habitats, and surfaces prepared by scraping or brushing of topsoil have been used as trackways in ecological studies of snake communities in southern California chaparral and desert. Preliminary data point to the usefulness of snake tracks in determining behavioral density, spatial relationships, social behavior, and species composition within communities. In a montane chaparral community it was possible to discriminate reliably among tracks made by the three common species, Crotalus viridis, Pituophis melanoleucus, and Masticophis lateralis. In desert sand environment, individual sidewinder rattlesnakes, Crotalus cerastes, have been followed for distances exceeding 1.8 Km. Data for snake activity in chaparral point to the difficulties of estimating accurately the absolute densities of snake populations by any presently accepted method.

List, James C. - see Branham

REFUGIA, REFUGES AND MINIMUM CRITICAL SIZE:PROBLEMS IN THE CONSERVATION OF THE NEOTROPICAL HERPETOFAUNA. Thomas E. Lovejoy. World Wildlife Fund-U.S., Washington, D. C.

As the face of South America changes steps must be taken to set aside refuges in which the continent's herpetofauna can survive. Contours of endemism as in Pleistocene refugia constitute one means of identifying areas for conservation priority. Contours of species diversity represent another approach. The merits of the two will be discussed. Also, refuges must be above a minimum critical size to retain species over long periods of time. Aspects of this problem will be discussed, as will emerging results on reptiles as contrasted to data available on birds.

THE AMPHIBIANS OF THE LOWLAND TROPICAL FORESTS OF SOUTH AMERICA. John D. Lynch. The University of Nebraska-Lincoln, Lincoln, Nebraska.

The lowland tropical forests (rainforests Auct., below 1000 m) of South America exist as four units: the Trans-andean forests (Choco, Nechi, and Magdalena), the Northern forests (Santa Marta, Maracaibo Basin, and coastal Venezuela), the Central cis-andean forests (Amazonia or Hylaea Auct.), and the Atlantic forests (eastern and southeastern Brasil). These four forests harbor 530 species of amphibians belonging to 13 families (one salamander, three caecilians, and nine anurans).

Endemicity is pronounced; only 26 species (4.9 %) are shared by two or more forests. The Northern forests are most depauperate (39 species) and least distinct (56 % endemicity). The Atlantic forests harbor 183 species (92 % endemic), the Central forests 225 (90 % endemic) and the Trans-andean forests 126 (88 % endemic).

Hylid frogs are dominant in all four forests (Atlantic 38 %, Central cis-andean 37 %, Northern 28 %, and Trans-andean 22 %) as are leptodactylid frogs (Atlantic 37 %, Central cis-andean 24 %, Northern 26 %, and Trans-andean 25 %). The leptodactylids of the Central, Northern, and Trans-andean forests are essentially eleutherodactylines and leptodactylines whereas those of the Atlantic forests are primarily elosiines, grypiscines, leptodactylines, and odontophrynines. Dendrobatid frogs are prominent components of Central, Northern, and Trans-andean forests but essentially absent in Atlantic forests.

Four areas of marked endemism are apparent:(1)the South American Choco, (2) the upper Amazon Basin (Napo-Ucayali drainages), (3) the Guyanas, and (4) coastal Brazil (Rio de Janeiro - Sao Paulo area). Forty-four per cent (233) of all forest dwelling species of South American Amphibia are restricted to these four forest areas.

Many amphibian groups and genera exhibit distributional patterns congruent with Haffer's forest refugia model. Such a model, consisting of waves of advances and retreats of forests, could be used to account for some of the high species densities observed in some groups.

However, amphibians are poorly represented in some of the proposed refugia or core areas. The poor representation may reflect profound differences between forests mediated by seasonality of rainfall. Unlike amniotes or aquatic vertebrates, most amphibians attempt to be terrestrial without the amniote water-conserving mechanisms. The lack of such mechanisms is most apparent in the reproductive strategies of the amphibians.

The high species densities (and endemicities) of Amphibia correlate well with areas of high aseasonal rainfall. In forested regions, such rainfall provides high humidity microhabitats of long duration necessary for the most fragile reproductive modes employed by amphibians (direct development, terrestrial eggs and larvae). Such environments do not of necessity reduce the success of more pedestrian reproductive modes (eggs and larvae in water).

The importance of reproductive mode in providing constraints to or enhancement of dispersal of forest amphibians is demonstrated by observing that a greater proportion of mode 1 and mode 5 species are non-endemic than might be predicted and that fewer mode 6 and mode 8 species are non-endemic than might be predicted if non-endemicity and reproductive mode are not related. If the sensitivity to seasonality of rainfall is an appropriate index to forest fidelity, then groups exhibiting the more sensitive reproductive modes become of importance in drawing inferences about past climates and biogeographic events. The groups exhibiting sensitive reproductive modes include bolitoglossine salamanders and dendrobatid and eleutherodactyline frogs. The two groups of frogs are autochthonous South American forest elements most dominant in the northern forests of South America. In each case, their ancestry may be traced to the forests of southeastern Brasil. The Brasilian groups are in turn derived from leptodactyloid groups in the Austral forest of Patagonia.

Martori, R. - see DiTada

UTILIZATION OF CAVE RESOURCES BY A LIZARD COMMUNITY. William J. Mautz. Cornell University, Ithaca, New York.

A community of three lizard species exploits the resources of a system of caves at Puerto Marquez, Guerrero, Mexico. The caves provide a stable, low temperature, high humidity environment with variable and sparse food resources. Anolis taylori (Iguanidae), Phyllodactylus lanei (Gekkonidae), and Lepidophyma smithi (Xantusiidae) differ in the degree to which they utilize the cave resources. These differences are apparent in activity pattern, body temperature, evaporative water loss, and diet. Specializations for cavernicolous life involve absence of a diel activity cycle, absence of thermo-regulatory activity, low resistence to water loss, and a generalized diet that includes decaying fruit and probably carrion.

Maxson, Linda R. - see Wake

Mecham, John S. - see Sattler

THE ENERGETIC BASIS OF SOCIAL BEHAVIOR: LIZARD SOCIAL STRUCTURES. George Middendorf III and Wilfred M. Post III. Graduate Program in Ecology, University of Tennessee.

The mechanisms controlling the specific social structures exhibited by various vertebrate populations are as yet unknown. Although some suggestions have been made of environmental or genetic causality, most investigators have been content to label the social structure as to general type. Investigations of lizards have often contained reports of their social structure; several different types have been reported. These reports are examined for iguanid lizards and other vertebrates where appropriate. Specific attention is paid to environmental conditions of the population under study. From this examination an energetic-based model is proposed in which both population density and resource abundance are seen as crucial factors. Social structures, particularly territoriality and social hierarchy, once thought dichotomous, are seen as points on a spectrum of social hierarchy to social aggregation. These structures replace one another depending upon the environmental conditions. While the concept of a social structure reflecting the environmental conditions is not new, the concept of an energetic-based spectrum of structures reflecting these conditions is. Such a formulation suggests that studies of social behavior should, in addition to examining type and variation of structure, consider the energetic cost to the animals, the associated gain, and, most importantly, consider the structure in relation to the ecological conditions. Until an approach of this sort is used, studies of social structure will remain only descriptive. The social behavior of the iguanid lizard Sceloporus jarrovi is currently being examined utilizing this approach. (Funded by NSF-DEB 76-16841).

ACTIVITY METABOLISM IN THE MUDPUPPY, NECTURUS MACULOSUS. Kirk Miller. Department of Zoology, University of Oklahoma.

Routine and sustained activity metabolism were investigated in Necturus maculosus acclimated at 5°C or 15°C and an LD 12:12 photoperiod. Mudpuppies exhibited significant daily cycles in oxygen consumption and spontaneous locomotor activity at both acclimation temperatures. The majority of the increment of oxygen consumption during periods of high spontaneous activity was due to air breathing. Routine whole body lactate levels did not vary with acclimation temperature or time of day.

Animals from both acclimation temperatures were electrically stimulated to maximum activity for 30 min (complete exhaustion) at two times of day. Animals stimulated to maximum activity during periods of high spontaneous levels and depended entirely on anaerobiosis for extra energy production. Animals stimulated to maximum activity during periods of low spontaneous activity increased oxygen consumption by air breathing but derived the majority of the increase in energy production anaerobically.

Whole body lactate production during maximum activity was independent of acclimation temperature and independent of the level of spontaneous activity at the time of stimulation. Whole body lactate levels remained high for more than 10 h following stimulation but returned to resting levels within 24 h. Salamanders may excrete lactate into the medium but no lactate was found in bladder urine.

Mudpuppies routinely produce 50 - 75% of their energy aerobically, during stimulated maximum activity, however, 67 - 75% of total energy produced is derived anaerobically.

McNulty, John A. - see Schwalm

COMPARISON OF "NATURALISTIC" AND QUADRAT APPROACHES IN THE ANALYSIS OF A BRAZILIAN FROG COMMUNITY. Craig Nelson. Indiana University, Bloomington, Indiana.

Approximately 60 species of anurans occur at the Boraceia Biological Station of the Sao Paulo Museum of Zoology in southeastern Brazil. Three techniques were used for analyzing the habitat differences among the more ubiquitous members of this community. In the first, or "naturalistic", numerous records of site of capture of each species are compared with gross habitat divisions of the station (forest, scrub, meadow, pondside, streamside, etc.). In the second random quadrats were searched. In the third, quadrats were non-randomly placed. In the latter two cases a number of physical and biotic parameters were measured, and weighted and unweighted "niche" breadth and overlap were calculated.

AMPHIBIAN COMMUNITIES IN SOUTHERN INDIANA: FACTORS INFLUENCING SPECIES COMPOSITION IN PONDS. Craig Nelson. Indiana University, Bloomington, Indiana.

Laboratory and field data combined with speculation suggest that three major processes are important in determining the species composition of amphibian communites at individual ponds in southern Indiana. A primary factor is the relative permanence of the pond which largely determines the types, if any, of aquatic vertebrate predators which overwinter in the pond. The nature of the predators in turn is a strong influence on egg and larval survival of spring breeding forms. In several cases it appears that some species are maintained by a stochastic process including escape from predators in good years and nearly complete mortality in other years. Finally, habitat selection and competition among cogeners influence the pool of species available in particular habitats.

Ocand, A. - see DiTada

TEMPERATURE INDUCED ANOMALIES IN NATRIX FASCIATA. David Wm. Osgood. Butler University. (Presented by title only)

Thirty-four litters of the banded water snake, Natrix fasciata, were incubated under controlled, constant-temperature conditions. The 754 young snakes from these litters were compared with a control group of 20 broods (384 snakes) taken from females caught shortly prior to littering. Of 1,138 young snakes examined, 33 were grossly abnormal in external morphology. The various anomalies can be classified into general groups (shortening of the axial skeleton, bending of the vertebral column, cleft palate, microphthalmia, and reversal of subcaudal scales). Some types of abnormalities were positively correlated with high (30C) and others with low (21C) developmental temperature. The frequency of anomalies was lowest in the 26C treatment group. The incidence of abnormalities in both the 21C and 30C treatment groups was more than twice that of the controls or 26C sample.

Packard, Gary C. - see Packard, M.

Packard, Gary C. and Mary C. - see Tracy

Parker, William S. - see Brown

SCANNING ELECTRON MICROSCOPY OF EGGS OF SQUAMATA. Mary J. Packard, C. Richard Tracy, and Gary C. Packard. Colorado State University, Fort Collins.

Light microscopy in conjunction with scanning electron microscopy has been used to study the morphology and ultrastructure of "parchment-shelled" eggs from a number of species of Squamata. Shells from eggs fixed in formalin at the time of oviposition and shells from eggs incubated to hatching were examined. In general, "parchment-shelled" eggs are composed of several layers of fibers with a calcareous (=crystalline) layer forming the outermost surface. Both the fibrous layers and the calcareous layer vary in structure and thickness from species to species. The continuity of the crystalline layer is often broken by cracks or fissures which presumably provide for the exchange of respiratory gases with the environment, as well as for the uptake of liquid water from the substate.

COMMUNITY STRUCTURE IN HIGH ANDEAN HERPETOFAUNAS. Jaime E. Pefaur and William E. Duellman. University of Kansas.

Density, diversity, niche breadth and niche overlap were analyzed for amphibians and reptiles in 10 study sites above tree line in the Andes. Two to eight species were found at each site; a total of 1373 specimens of 33 specimens was studied.

Values for speices diverity of the entire herpetofauna show no clear latitudinal trends; there is a significant trend for increasing species diversity in reptiles from equatorial to temperate sites, but there is a comparatively higher diversity in amphibians in the equatorial sites. Two niche dimensions were analyzed fully -- structural habitat and food. Niche breadth values for structural habitat are slightly higher in reptiles than in amphibians. Niche breadth values for food are inverse. Overall niche breadth is higher in amphibians than in reptiles, the former being more generalists than the latter. Niche overlap for structural habitat is higher than for food. Overlap values between any species of pairs in the same community are generally low, with the exception of some pairs of amphibians in which values are relatively high. However, there is no consistent difference in values within and between communities. Unexpectably, niche overlap increases with decreasing species richness and species diversity.

Penna V. Mario - see Veloso

A PRELIMINARY STUDY OF SKIN SURFACE SCULPTURING IN TOADS. David Pettus and Tyler A. Woolley. Colorado State University, Ft. Collins, Colorado.

Specimens from three species of toads (Bufo boreas, B. terrestris and B. woodhousei) were studied by scanning electron microscopy. Skins from four regions of the body were examined at relatively low magnifications (65X and 300X). Surface sculpturing showed considerable variation between regions as well as between species. Well developed channels were present on all species and most regions. The pattern of channels is more reticulate on the ventral and lateral surfaces and more parallel on the dorsum. The skin of B. terrestris is more rugose and spinose than that of the other two species. Too few specimens were used to permit definitive conclusions, but the technique appears promising in working out the adaptive significance of the differences between species.

EFFECTS OF DNA BIOSYNTHETIC INHIBITORS ON BULLFROG TADPOLES DURING THYROID HORMONE INDUCED METAMORPHOSIS. Robert Phillips, James Williams, Wahleah Baker, and Gary VanDenbos. Northeastern Oklahoma State University, Tahlequah, Oklahoma.

The nature of the control mechanisms regulating cell growth and replication in eukaryotic organisms is an active area of research. The anuran system, Rana catesbeiana, provides an interesting animal model for a

number of reasons, especially: a). their existence for extended periods of time in the larval (tadpole) state, and b). the ability to induce metamorphosis precociously with thyroid hormone (TH).

The morphological and biochemical transition which takes place during the metamorphosis climax are interesting from the standpoint of their rapidity and efficiency, and pose the question: to what extent are the developing tissues (ie. limbs, lungs) dependent on pre-formed moelcular components from regressing tissue (ie. tail, gills)?

We are investigating this question by comparing the morphological and biochemical effects of drugs, which inhibit DNA synthesis by blocking specific metabolic steps in the precursor-to-DNA pathway, on TH treated and control tadpoles. One of these drugs, 5-fluorodeoxyuridine is used as a human chemotheraputic agent. The extent to which the dose sensitivity of tadpoles reflects that used to regulate cell proliferation will also be discussed.

This study was supported by NIH grant 1-SO6-RR-08123.

Phillips, Robert - see Williams

ACTIVITY, HABITAT, AND POPULATION STRUCTURE IN THE TURTLE, TRIONYX MUTICUS. Michael V. Plummer. Harding College.

A riverine population of Trionyx muticus was studied for 3 years by capture-mark-recapture. These turtles were most active from May through September. Trapping success was affected by changes in water level, and a midsummer period of inactivity was associated with low, stable water levels and high water temperatures. Males preferred areas with emergent sandbars but females preferred deeper, more open water except during the nesting season when they moved into shallow water adjacent to sandbars. Deviations from parity in sex ratios were attributed to biases in sampling. About 82% of the male population and 25% of the female population was mature. There was a high degree of mobility within and between local subsets of the population; discrete populational boundaries were not observed. Approximately 1900 turtles were estimated to be within a 1.5 km section of river. However, direct counts of all individuals present were not feasible even for small areas, and indices based on capture-mark-recapture were biased by temporary emigration and immigration.

Post, Wilfred M. III - see Middendorf

Putnam, R. W. - see Drewes

MORPHOLOGICAL VARIATION IN A DIPLOID-TETRAPLOID SPECIES COMPLEX OF TREEFROGS. Ralin, Dennis B., James S. Rogers, and Sylvia Colbert. Kentucky State University, University of New Orleans, Kentucky State University.

A multiple discriminant analysis of 13 external morphological measurements was made on diploid (Hyla chrysoscelis) and tetraploid (H. versicolor) populations. Eastern populations of H. chrysoscelis (South Carolina, Georgia, Ohio, Mississippi) clearly separate from western (south-central Texas) populations when plotted on the first two DF axes. Populations of H. vericolor occupy intermediate positions, but are not very distinct from the eastern diploid populations.

A bivariate plot of the same populations, utilizing indices based on two qualitative characteristics used to define the three formerly described subspecies, shows a similar pattern. Eastern diploid populations plot in the upper right-hand portion of the graph, because most or all individuals have a reticulate pattern on the posterior border of the thighs (1.0) and noticeable webbing between the fingers (1.0). Western diploid populations plot in the lower left-hand portion of the graph, because most or all individuals lack the above characters (0.0, 0.0).

The morphological analyses are consistent with non-morphological data indicating an intermediate origin of H. versicolor, involving two groups of diploid populations. The range of the former subspecies H. v. sandersi corresponds well with that of the western diploid populations. The range of H. v. chrysoscelis (type locality Dallas, Texas) probably included diploid intergrades in north-central Texas and extreme eastern Texas-Louisiana, as well as southern tetraploid populations. The former subspecies H. v. versicolor probably included most eastern diploid populations and northeastern tetraploid populations.

Rand, A. Stanley - see Andrews

USE OF A MAMMALIAN RESOURCE BY A CHIHUAHUAN SNAKE COMMUNITY. Robert Reynolds. University of New Mexico, Albuquerque, New Mexico.

During the summers of 1975-1976 I studied the snake and rodent communities northeast of Chihuahua city. This region is desert scrub with Larrea, Flourensia, Parthenium and Prosopis the characteristic genera.

Snakes were collected along an 80.5 km stretch of route 16. Examination of capture sites for the plant species present, structural characteristics of the vegetation and topographic features showed that snake species exhibited distinct habitat preferences. Rodent species present and their relative densities were assessed by 4500 trap nights at 15 trap stations. Twelve species of rodents were recorded.

Digestive tracts of 274 snakes of 16 species were examined and yielded 121 food items. Rodents comprised 60.68% of the diet by frequency of occurrence, with birds, reptiles, amphibians and arthropods accounting for the remainder. The frequency of occurrence of the rodent species in the snake diets is closely related to their relative densities found by trapping.

The size of the prey was roughly proportional to the size of the predator. Arena experiments in which prey were introduced to a predator show that snakes are selecting prey items on the basis of size and probably not on species. Small snakes selected smaller rodents, whereas large snakes took larger rodents and ignored the smallest species.

The coexistence of the snakes is probably due to differences in the habitat preferences of the snakes and rodents, and is also the result of size differences within and between predator species. Each predator species of a given size class takes a different size class of prey.

Rodulfo, Felicia C. - see Acuna

Rogers, James S. - see Ralin

DISTRIBUTION PATTERNS, CLADISTIC PATTERNS, PALEOGEOGRAPHY, AND BIOTIC HISTORY. Rosen, Donn E. American Museum of Natural History, New York, N.Y.

No ABSTRACT RECEIVED.

Ross, John - see Stewart

COMPARATIVE CRANIAL OSTEOLOGY OF FARANCIA AND PSEUDOERYX: SYSTEMATIC IMPLICATIONS. Douglas A. Rossman, Louisiana State Univ., and David L. Cundall, Lehigh Univ.

Neill (1964) united the montypic North American xenodontine snake genera Abastor and Farancia, and he postulated that Farancia erytrogramma and F. abacura shared a common ancestor with Pseudoeryx plicatilis of

South America. Our examination of approximately 90 skull characters supports the congeneric relationship between the rainbow snake (F. erytrogramma) and the mud snake (F. abacura), but it fails to confirm a close affinity between Farancia and Pseudoeryx. The two genera exhibit their greatest differences in the nasal and orbital regions of the skull. The similarities between Farancia and Pseudoeryx in external features probably can be attributed to convergence. Many skull characters exhibit considerable intraspecific variation, which underscores the need to examine series when conducting osteological studies.

HYBRIDIZATION IN SPADEFOOT TOADS. Paul W. Sattler and John S. Mecham. Texas Tech University.

Hybridization and introgression between Scaphiopus bombifrons and S. hammondi are being investigated with the use of seven electrophoretic species-specific markers. Field studies have demonstrated that significant numbers of hybrids and backcross progeny occur throughout the wide area of sympatry. Experimental laboratory crosses have been made in order to more precisely measure levels of fertility of various hybrid products. Analysis of laboratory hybrids has shown that all but one of the protein markers are inherited codomonately, and so may be used to differentiate between hybrids and offspring from backcrosses. Further, the large number of markers permits identification of the parental species involved in the backcross. Preliminary data does not suggest the occurrence of differential introgression between the two species.

Saunders, R. P. - see Denny

THE ELABORATION OF VENOM DELIVERY SYSTEMS IN SNAKES. Alan H. Savitzky. National Museum of Natural History.

Systems for the injection of venom under pressure through tubular fangs have been developed in at least five lineages of colubroid snakes. Three of these culminated in proteroglyphous taxa, two in solenoglyphous ones. Despite numerous differences between these groups, sufficient similarities exist to recognize common responses to adaptive and mechanical problems. Four components of the venom delivery system may be recognized: venom, fangs, storage lumina, and gland-deforming muscles. Although each of the five proteroglyphous and solenoglyphous groups has developed all four components, other taxa exhibit different combinations of them. Examination of these forms suggests the sequence of modifications leading to fully elaborated systems. Functional coordination among the components of well-developed venom delivery systems enhances the likelihood of convergence in independent lineages of many structural details, including features not immediately related to feeding activities. Although selection favors gradual improvement in the venom delivery apparatus, full attainment of the front-fanged condition consititutes a major adaptive step.

COMPARISON OF CHROMATOPHORE ULTRASTRUCTURE IN NEOTROPICAL HYLID AND CENTROLENID FROGS. Patricia A. Schwalm (University of Chicago) and John A. McNulty (Stritch School of Medicine, Loyola University).

Chromatophore ultrastructure in the infrared-reflecting glass-frog Centrolenella fleischmanni (family Centrolenidae) was found to differ markedly from that of other arboreal green frogs (family Hylidae). Four types of pigment cells are found in the dermis of C. fleischmanni: two correspond in structure to typical hylid xanthophores and iridiophores, one is similar to the unusual melanophores of phyllomedusine hylids (which also reflect infrared light) and one chromatophore type is unlike any cell previously described. A major difference in organization of pigment cells is apparent. The dermis is not primarily composed of discrete groups of chromatophores in associations resembling the hylid dermal chromatophore unit. Instead, flat xanthophores form a continuous sheet just under the basement lamina. This layer is occasionally interrupted by groups of iridiophores that break up the green ground color as a series of light spots. The stellate processes of the new pigment cell also form a continous layer, generally subjacent to other chromatophore types. Pigment granules in the new cell are moderately electron-dense and have an irregular shape that suggests a fluid composition. Melanophores are too few and widely spaced to contribute significantly to the overall appearance of C. fleischmanni. Melanosomes have a fibrous appearance but are smaller and lack the electron-dense inner core of the phyllomedusine melanosomes they resemble.

Implications of chromatophore ultrastructure are discussed in terms of systematics and development.

Scitallo Y., Gustavo - see Baez

SEASONAL SHIFT IN THE TEMPERATURE PREFERENDUM OF THE WANDERING GARTER SNAKE. John R. Scott. Colorado State University, Fort Collins, Colorado.

A constant temperature thermal gradient was used to evaluate preferred body temperatures of spring and fall specimens of Thamnophis elegans vagrans (Baird and Girard) from a montane habitat. Spring animals, which were overwintered at 4°C in the laboratory, maintained significantly higher cloacal temperatures over a 2 day period than animals collected and tested in the fall. Voluntary hypothermia in the fall should be adaptive in that cool retreats (hibernacula) are sought which protect against early winter storms. Hyperthermia in the spring may enhance reproduction and digestion.

THE HERPETOFAUNA OF FOREST LITTER PLOTS FROM CAMEROON. Norman J. Scott, Jr. National Fish and Wildlife Laboratory, Albuquerque, New Mexico.

Systematic samples of African forest litter herpetofaunas were made in Cameroon, Africa. The African faunas are compared with faunas from similar tropical forests of Asia and Central America. Data compared include total species, distribution of individuals among species, and the taxonomic make-up of the samples.

Of special interest are the African samples that were taken from a forest established on a white sand soil. This type of system is generally supposed to be much less productive than tropical forests growing on other types of soils.

THE STATUS OF STUDIES OF HERPETOLOGICAL COMMUNITIES AND SUGGESTIONS FOR FUTURE RESEARCH. Norman J. Scott, Jr., (address above) and Howard W. Campbell, National Fish and Wildlife Laboratory, Gainesville, Fla.

Historical trends in the study of herpetological communities are summarized. Contributions from this session are considered to represent the present "state of the art."

General goals are defined as perceived in these studies and recommendations are made for ways in which these goals can be furthered. Additional ways of looking at herpetological communities are suggested.

LOW FREQUENCIES OF REPRODUCTION IN ITEROPAROUS ORGANISMS. Richard Shine and James J. Bull. University of Utah.

Most vertebrates reproduce every year after maturing, but some, mainly poikilotherms, reproduce at

lower frequencies. Reproducing every second year, or less often, is known in a variety of salamanders, frogs, snakes, lizards, turtles and fish. A simple mathematical model suggests that low reproductive frequencies are at a selective advantage over high frequencies if reproducing entails a large fecundity-independent cost. A large fecundity-independent cost means that even a small clutch entails a high cost (in energy and survivorship) to the reproducing animal. Breeding migrations, territory defense, nest-building and brooding are examples of activities where the costs are largely independent of the number of offspring produced. We make three predictions from this model: (1) species with low reproductive frequencies should show obvious high fecundity-independent costs; (2) within a species, the sex with the highest fecundity-independent cost should show the lowest reproductive frequency; and (3) within a species, the lowest reproductive frequency should be found in the poorest-quality habitat. The data support these predictions.

QUATERNARY BIOGEOGRAPHY OF THE SOUTH AMERICAN HIGHLANDS. Beryl B. Simpson. Smithsonian Institution, Washington, D. C.

The major highland areas of South America include the complex Andean Cordillera, the Pantepui Highlands and the mountains of southeastern Brazil. Quaternary climatic events affected these highlands differently because of their varying ages, elevations and latitudinal positions. The Andean Cordillera which spans about 66 degrees of latitude and reaches elevations over 6000 m, is Cenozoic in age with the highest elevations uplifted only at the end of the Pliocene. The biota of the high Andes thus developed primarily during the Quaternary via immigration from Central America and radiations within the high elevation zones fostered by cyclical climatic changes. Glacial periods, correlated with those elsewhere, were times of ice expansion throughout the length of the Cordillera. In the most northern and southern parts of the Andes, glacial periods were times of range expansion and increased dispersal for supraforest elements: interglacials were periods of population restrictions. Across the Altiplano, the reverse situation applied. In addition to cold/warm cycles, arid/humid cycles variously affected the Andean biota. In contrast to the Andes, the Venezuelan and Brazilian highlands are ancient, in some cases over 1700 million years old. As a consequence of long term erosion, these highlands are lower than those in the western part of the continent and were less drastically affected by Quaternary climatic changes. Biogeographical evidence indicates that the primary Quaternary changes were lowered vegetation zones that allowed increased immigration from other montane regions. The floras and faunas of these highlands are consequently now composed of ancient elements mixed with Pleistocene immigrants.

FOOD RESOURCE PARTITIONING OF BURROWING SAND-PINE SCRUB REPTILES. Charles R. Smith. National Fish and Wildlife Laboratory, Gainesville, Florida.

Tantilla relicta, Eumeces egregius and Neoseps reynoldsi share essentially the same fossorial microhabitat within the sand-pine scrub of Florida. Except for Eumeces egregius (Mount, 1963), little has been reported in the literature on their food habits. Stomach analysis of specimens from several localities in Florida shows considerable differences in their preferred prey. Tantilla relicta is a completely fossorial snake which specializes on tenebrionid larvae. Neoseps reynoldsi also burrows exclusively and feeds on a variety of prey, including termites, lycosids, tenebrionid larvae and ant lions (Neurtoptera). Eumeces egregius, the most surficial of the three species, generalizes on blattids, lycosids and gryllids.

GROWTH AND MOVEMENT OF ALLIGATORS IN SOUTH TEXAS. E. Norbert Smith. Northeastern Oklahoma State University. Tahlequah, Oklahoma.

The growth and movement of the American alligator, Alligator mississippiensis, has been studied at the Welder Wildlife Refuge, Sinton, Texas for six years. Nearly 150 animals have been measured, weighed, sexed, marked and released. Eleven alligators have been recaptured and showed a mean annual weight gain of 8.9 ± 1.7 pounds (4.0 ± 0.8 kg) and 9.4 ± 0.8 inches (23.9 ± 2.0 cm). Rate of weight gain was positively correlated with initial body weight. Rate of length gain was not correlated with initial body length.

Alligators of all sizes were found to move freely between the Aransas River and impoundments on the refuge. Intense collecting activity on the lakes resulted in movement to the river.

Night counts and nest counts were found to be the most reliable method for estimating the population. Mark-recapture estimates are grossly inflated because alligators once caught become wary and are seldom recaptured. The population of alligators at the Welder Refuge appears to have doubled the past 5 years. This is probably the result of federal and state protection for the reptile.

This research was supported by generous grants from: The National Geographic Society, Welder Wildlife Foundation, and the Caesar Kleiberg Foundation.

Smith, E. Norbert - see Earnhart, V.

Sokol, O. M. - see Drewes

THE ALBANY PINE BUSH - A NORTHERN HERPETOLOGICAL OUTPOST FOR SOUTHERN SPECIES IN NEW YORK. Margaret M. Stewart and John Rossi. State University of New York at Albany.

The Albany Pine Bush, a pitch pine - scrub oak fire subclimax, has developed on sand dunes deposited as post-glacial Lake Albany drained out the Hudson River Valley. Several species of amphibians and reptiles, absent or rare from surrounding areas, live in the Pine Bush and comprise a community far more like that of Long Island than mid-state New York. Since the fire-controlled dune area is inhospitable to most species, about half as many species live there compared to surrounding areas. At present the Pine Bush supports 26 species while 43 are present in surrounding Albany County.

The "greater" sand plains area of Albany, Schenectady, Saratoga and Warren counties contain the northern-most populations in New York for 9 of the 26 species known from the sand plains. This pattern probably results from migrations of southern species up the Hudson Valley corridor, warmer than surrounding highlands. Distributional patterns of these amphibians and reptiles correspond to those of several plant species and appear to follow patterns of underlying bedrock.

As development encroaches on the Pine Bush, one of the few remaining open areas of the Capital District, populations of several species are being greatly reduced and may be entirely cut off from the main range of the species if not lost. One or more species have disappeared during the last century. Only rigid protection of the area can save these peripheral populations.

THE EFFECT OF CHLORINE ON THE DEVELOPMENT OF RANA PIPIENS EGGS. Betty I. Tarnowski. Butler University. (Presented by title only)

Developing eggs of Rana pipiens were exposed to various chlorine concentrations in a flow through system. A high mortality to developing embryos occurred after departure from the egg jelly at chlorine concentrations of 0.6 ppm and 0.9 ppm. Exposure of embryos to chlorine concentrations of 0.3 ppm and 0.04 ppm did not result in high mortalities following hatching, but increased the time necessary for completion of development. It is suggested that the egg jelly provided protection to the developing embryos since eggs exposed to chlorine concentratons of 0.6 ppm, only while in the egg jelly, showed no high mortality upon hatching or subsequent abnormal development. Survivors of the 0.6 ppm exposure through test duration resulted in chlorine-related abnormalities seen as a reduced body length and twisted tail. An analysis of chlorine-exposed egg jelly is in progress to determine if the egg jelly prevents contact of chlorine with the egg by chemically reacting with the chlorine.

GENUS, OR SUBGENUS: THAT IS THE QUESTION. Robert A. Thomas. Texas A&M University.

Current studies of certain Neotropical xenodontine colubrid snake genera indicate that confusion exists concerning parameters used to define species assemblages. The Philodryas-Alsophis generic complex is used as a model for discussion and comment is made on taxonomic categorical alternatives.

PARTITIONING OF FOOD IN A COMMUNITY OF TROPICAL FROGS. Catherine Ann Toft. University of California, Davis, California.

In the neotropical rain forest, a number of species of frogs are found in the leaf litter by day. These species partition food on the basis of food type and food size. The structure of this community has at least these components: number and equitability of species; the proportion of species that specialize on different types of prey; and the similarity in prey utilization of species that specialize on the type of prey.

The factors which determine the structure of this community will vary from place to place in the neotropics and include the predictability, abundance, and seasonality of food resources. Where the relative influences of these factors vary, communities of different structure result.

THE DYNAMICS OF WATER EXCHANGE BY EGGS OF PAINTED TURTLES (CHRYSEMYS PICTA). C. Richard Tracy, Gary C. Packard, and Mary J. Packard. Colorado State University, Fort Collins.

Water exchanges of painted turtle eggs depend upon such factors as substrate water potential, relative surface of the eggshell exposed to the nest atmosphere, hydraulic conductance of the eggshell, and conductance of the eggshell to water vapor. Eggs absorb liquid water across that portion of the eggshell in contact with the substrate, and simultaneously lose water vapor from that part of the eggshell exposed to air inside the nest chamber. Depending upon the rates of influx and efflux of water, eggs may experience increases or decreases in weight during incubation, or they may maintain a constant weight between oviposition and hatching. Water absorption by turtle eggs may have considerable adaptive significance, for hatchlings emerging from eggs absorbing and storing large quantities of water are heavier than hatchlings emerging from eggs taking up smaller quantities of water from the substrate. Additionally, water absorption equal to, or in excess of, water loss by transpiration assures that the shape of the egg will be such that sufficient space is available to accommodate the developing embryo.

Tracy, C. Richard - see Packard, M.

COLLECTION OF HIBERNATING CNEMIDOPHORUS SEXLINEATUS (LACERTILIA: TEIIDE) FROM VARIOUS PARTS OF ITS RANGE. Stanely E. Trauth. Auburn University.

A total of 776 six-lined racerunners was collected during hibernation periods extending from October, 1973, to April, 1977. Lizards were unearthed from 299 separate localities in nine states. Excavations generally were made on south- and west-facing, red clay banks along secondary highways. Animals were found to hibernate communally or singly. Communal hibernacula consisting of well-developed burrow systems were occassionally found. The "typical" microhabitat site for hibernation, which varied little throughout the portion of the range studied, is discussed.

HERPETOFAUNAL RELATIONSHIPS OF SOUTH AMERICA WITH AUSTRALIA. Michael J. Tyler. University of Adelaide.

With the sole exception of the Pygopodidae, the families comprising the modern Australian herpetofauna evolved beyond its continental borders. South America constituted the first source but, in contrast with South American/African herpetofaunal exchange, there was no direct land communication with Australia, and Antarctica constituted a substantial intermediary landmass.

From South America, Australia received the Leptodactylidae and Hylidae as totally separate entities, but conceivably simultaneously. The Leptodactylidae differentiated substantially: primarily to occupy terrestrial, fossorial and aquatic niches; secondarily to form a few scansorial animals. It is not represented by the Limnodynastinae, Myobatrachinae and Rheobatrachinae. The Hylidae exploited the arboreal and scansorial regimes, differentiating from a Neotropical hyline stock to constitute an endemic subfamily: the Nyctimystinae.

Within Australia the ancestral hylid stock may have resembled the Litoria aurea group, and at an early stage this diverged to give rise to a separate lineage lacking intercalary structures and now represented solely by the fossorial Cyclorana. The second lineage produced the scansorial, and ultimately more highly modified arboreal frogs. Within this second lineage intercalary structures have become more labile, and now include all other forms recorded in the Anura. For the systematist Cyclorana remains a problematical genus which cannot be accommodated in the Hylidae.

At the time of the onset of rapid drift of Australia from Antarctica (55-53 m.y. B.P.), Australia probably lacked snakes. (A possible exception is the large boid Wonambi known from the Pleistocene of South Australia, and with apparent affinites to Madstoia.) At that time the only lizards in Australia were the diplodactyline geckos from which the Pygopodidae evolved.

Pleurodine chelonians are restricted to the Neotropical and Australian Regions, but the Chelidae is the only modern family common to both. The current distribution of chelids in Australia is unquestionably relictual; the family occurred as far south as Tasmania in the Eocene, and in the now arid Central Australia in the Miocene. Chelid source ancestry is uncertain; the Lower Cretaceous Chelycarapookidae of Victoria is a candidate.

The depauperate nature of the Australian fauna was remedied in the Miocene. In the mid-Miocene New Guinea (the leading edge of the Australian continental plate) collided with a chain of oriental islands and accreted some of them. These islands were occupied by various ranid genera including Platymantis and by the microhylids Oreophryne and Sphenophryne. The Carettochelyidae, Scincidae, Boidae (Pythoninae), Elapidae, Agamidae, Varanidae and Typhlopidae all entered as a result of this collision - some at the time

of impact and others subsequently. The Ranidae and Scincidae had at least two invasions, and in general the sequence of arrival greatly influenced the relative success of the colonisers. Nevertheless ranids and microhylids have scarcely penetrated northern Australia. Hence the anuran fauna of Australia is almost wholly from a South American source, whereas the reptile fauna is predominantly Oriental.

VanDenbos, Gary - see Phillips.

VanDenbos, Gary - see Williams.

STRUCTURAL PATTERNS OF SPONTANEOUS AND EVOKED CALLS IN THE BUFO SPINULOSUS SPECIES GROUP (AMPHIBIA-BUFONIDAE). Alberto Veloso M. and Mario Penna V. Universidad de Chile.

There are two allopatric species of the genus Bufo in Central Chile (Lat. 33S). Bufo spinulosus lives in the highlands (Andes mountains) and B. chilensis in Acacia caven steppes and coastal lowlands. A third species, B. atacamensis (Lat. 28S) has a narrow distributional range and is restricted to small valleys surrounded by an extreme xeric environment. Absence of spontaneous vocal activity has been indicated as an important character in this group. This statement is not according with present observations. Bufo spinulosus during the reproductive season shows a spontaneous call in the field. The call consist in a complex signal initiated with a single pulse structure followed by a trill. The same signal is present during homosexual and heterosexual amplexus or can be artifically evoked. Bufo chilensis, a closely related species, shows a typical release call, elicited by homosexual amplexus. A second call is produced during the amplexus and differs from the release call in duration, pulse frequency and energetic parameters. There is geographic variation in the release call of B. chilensis. The northern populations exhibit different pulse frequency and modulation than southern populations. Furthermore, marginal northern populations show similar call characteristic than the geographically isolated Bufo atacamensis. Intrageneric relationships are pointed out by present call analysis. Supported by Proj. 3098. Univ. de Chile and Prog. Multinacional de Genetica, O.A.S.

THE HISTORY AND DISTRIBUTION OF AN INTRODUCED POPULATION OF LACERTA MURALIS (REPTILIA, SAURIA, LACERTIDAE), IN CINCINNATI, OHIO. Gregory O. Vigle. Cincinnati Museum of Natural History.

A sizable population of Lacerta muralis has been established in an urban area within the city limits of Cincinnati as the result of the release of two individuals in 1948. The original pair of lizards was captured in the Lake Como region of northern Italy by a young boy who brought them to Cincinnati and released them outside his home, hoping that they would reproduce. They did.

The lizards are present in large numbers on stone and concrete walls on the north valley wall and flood plain of the Ohio River. It appears that the lizards inhabit an area of approximately one by three kilometers, with the original release site being near the center of distribution. Well-traveled roads have not limited the spread of the population.

AMPHIBIAN EGGS: A NEGLECTED MICROHABITAT. Jaime Villa. Section of Neurobiology and Behavior, Cornell University.

In the past hundred years herpetologists have collected the eggs of hundreds of amphibian species and have described them (or the resulting larvae), usually viewing the eggs as a brief, transitory stage of the amphibian life cycle.

Organisms found in association with the eggs, however, have been traditionally neglected (or given only very limited attention) although they may be a very important (often adverse) factor in the amphibian's population. For many organisms--ranging from fungi and single-celled algae--amphibian egg masses are an important (and sometimes even obligatory microhabitat where developing and/or feeding takes place. Cases are presented of associations ranging from occasional commensals to parasites and predators of the embryos before or after hatching. Usually these associations are not restricted by taxonomic or geographic boundaries. On the contrary, they are likely to be found anywhere in the world where amphibians breed; work in this direction is only beginning.

GENETIC DIFFERENTIATION, ALBUMIN EVOLUTION, AND THEIR BIOGEOGRAPHIC IMPLICATIONS IN PLETHODONTID SALAMANDERS (GENUS HYDROMANTES) OF CALIFORNIA AND SOUTHERN EUROPE. David B. Wake, Linda R. Maxson, and Gloria Z. Wurst. University of California, Berkeley; University of Illinois, Urbana; University of California, Berkeley.

Genetic variation and albumin evolution were studied in the plethodontid salamander genus Hydromantes using starch-gel electrophoresis and the immunological technique microcomplement fixation. There is generally high concordance in the data from these two approaches. The three California species are relatively little differentiated, with H. shastae showing as much differentiation among various populations as occurs between the three species. The Sardinian H. genei and H. italicus (from the mainland, primarily Italy) are strongly differentiated, and form a separate but not well defined group, while the three California species form a much tighter, less differentiated group. The curious distribution of the highly derived genus and the fact that the two European species are the only members of the large family Plethodontidae in the Old World are considered in the light of the new data. Plethodontids are thought to have dispersed to present-day Europe from North America, with phylogenetic separation of the groups dating to Oligocene times. Separation of the two European species was just a little more recent. Hydromantes, like many other amphibians, has changed little at the organismal level despite great change at the level of structural genes (research supported by NSF grant BMS 74-20922).

THE EFFECTS OF TEMPERATURE ON THE REPRODUCTIVE CYCLE OF THE MALE WATER SNAKE, (NATRIX SIPEDON). Michael R. Weil and Robert D. Aldridge - St. Louis University.

The effect of various temperatures upon the male reproductive cycle of the common water snake (Natrix sipedon) was studied. Snakes were divided into five groups and kept in five different temperature regimes for ten weeks. Those kept in chambers 1-4 were maintained at 21.3, 23.3, 27.4, and 29.3°C for 8 hours per day respectively. All were kept at 20°C for the remaining 16 hours per day. Controls were kept at 20° C for the entire day.

Testicular growth appears to be positively correlated with increasing temperatures, as measured by estimated testis volumes. Additionally, increases in seminiferous tubule diameters appear to be nearly linearly related to increases in temperature. This was determined by measuring 20 seminiferous tubule diameters for each individual and averaging the results for all individuals within an environment. Interstitial cell nuclear diameters were measured in the same manner as seminiferous tubule diameters and were found to be unrelated to temperature. Spermatogenesis was measured

by approximating the number of rows of each type of meiotic cell and then assigning one type as being most prevalent. Rate of germ cell proliferation appeared to increase with increasing temperatures except in the two warmest environments where spermatogenic activity was similar.

HERPETOFAUNAL SURVEY OF THE SINAI PENINSULA (1967-1977). Yehuda L. Werner. University of Chicago, Illinois

Collections from Sinai in the Hebrew University of Jerusalem and in Tel-Aviv University, made in 1956 and since 1967, exceed 1000 specimens and 50 taxa. The author created manual locality-record maps as part of a distributional checklist of the reptiles of Israel and Sinai being prepared with J. H. Hoofien; and is examining morphological variation as part of a computerized study of geographical variation of squamates in the area Turkey-Sinai with C. Kosswig (DFG-funded).

The only amphibian found is Bufo viridis.

Of the 50-plus reptiles, 9 taxa have not previously been confirmed from Sinai; only 5 taxa do not occur in the Negev as well. Ten additional taxa occur in both Israel and Egypt: 5 probably do occur in Sinai; 5 others apparently lack suitable habitats there (including Acanthodactylus pardalis whose record had been based on an A. boskianus - courtesy H. Marx). A dozen literature records await verification and some (e.g., Agama mutabilis seem erroneous.

The interesting reptile community of N Sinai dunes includes Testudo kleinmanni (in dunes elsewhere in the region replaced by T. graeca), Stenodactylus petrii (elsewhere S. doriae), S. stenodactylus, Agama savignii (elsewhere A. pallida), Chamaeleo c. musae (C. c. recticrista), Acanthodactylus scutellatus (elsewhere A. boskianus or A. schreiberi), Eremias olivieri, Sphenopssepsoides (elsewhere Chalcides ocellatus), Scincus scincus, Lytorhynchus diadema, Spalerosophis vipera (elsewhere C. cerastes).

Ptyodactylus hasselquistii guttatus inhabits northern and central Sinai and southern mountaintops, whereas in the southern canyons P. h. cf. hasselquistii occurs.

Thus, herpetologically, Sinai turned from a poorly-known into a well-known corner of the Near-East.

PLATYSTERNON AND THE EVOLUTION OF CHELYDRID TURTLES. K. N. Whetstone. University of Kansas, Lawrence.

Gaffney (1975) placed the Asiatic genus Platysternon in the Chelydridae on the basis of a presumed sister group relationship to Macroclemys. Additional specimens of the Miocene Macroclemys schmidti indicate that some of the characters hypothesized by Gaffney to be synapomorphies actually represent convergences. Also, Platysternon lacks the cruciform plastron, narrow epiplastra, "T" shaped entoplastron, serrated carapacial margin, and long costiform process on the nuchal bone which are found in Chelydra and Macroclemys. If Platysternon is a chelydrid, loss of these characters must be interpreted as evolutionary reversals. No hypothesis of reversal for these characters is necessary if Platysternon represents the sister group of the Emydinae (sensu McDowell). Platysternon shares at least one presumed synapomorphy with emydines and testudinids, the presence of two biconvex vertebrae in the neck. Platysternon also has a double articulation between the 5th and 6th cervicals, a character otherwise unique to the Emydinae.

The oldest known chelydrid turtle is a new genus from the Upper Cretaceous Hell Creek Formation of Montana. This turtle is distinguished from other known chelydrids by a suite of plesiomorphic characters which support Gaffney's theory of independent shell reduction for chelydrids and toxochelyids.

Whitford, Walter G. - see Creusure.

ANURAN SUCCESSION AT TEMPORARY PONDS IN A POST OAK SAVANNA REGION. John A. Wiest, Jr. Texas A&M University.

Reproductive strategies of anurans utilizing temporary ponds in a Texas post oak savanna region were studied during an abnormally wet year, September 1972 through September 1973. Anuran succession was documented and correlated with varying environmental conditions. The overriding causes of variation in anuran reproductive patterns were due to fluctuations in air and water temperatures, rainfall, and possibly humidity. The anuran species in the study area were separated spatially and temporally. Calling, breeding, and larval periods for nine species were documented. The vocalization strategy, based on the first evening when calling was heard for each species, was as follows: Rana sphenocephala, vocalized first, followed by Pseudacris streckeri, Pseudacris triseriata, Pseudacris clarki, Scaphiopus holbrooki, Acris crepitans, Hyla versicolor, Bufo valliceps, and Gastrophryne olivacea. Males of each species initiated the calling period, and the presence of adult females determined the breeding period. Calling activity was not always a good predictor of the presence of larvae for a particular species, and each species was present as larvae over a different time span. For most anurans there was a larval bloom in April and May, and these months corresponded to the time of the year associated with the most rainfall. Because of the drying tendencies of temporary ponds, there is an adaptive advantage for most larvae to be in the ponds in spring months.

EFFECT OF THYROID HORMONE ON HEPATIC CELL PROLIFERATION AND TURNOVER IN THE BULLFROG TADPOLE. James Williams, Wahleah Baker, Robert Phillips and Gary VanDenbos. Northeastern Oklahoma State University, Tahlequah, Oklahoma.

The precocious initiation of a number of biochemical changes associated with metamorphosis have been documented using thyroid hormones(TH). Reports describing the biochemical transformation and ultrastructural reorganization of the liver in Rana catesbeiana tadpoles during metamorphosis fall into two conflicting categories. One group assumes the metamorphic transition occurs in a population of cells existing before the onset of metamorphosis. Another assumes the hepatic transition occurs in a new population of cells, cells produced in response to early metamorphic signals. The audioradiographic analysis of the incorporation of ^{3}H thymidine into liver cells as a function of TH was used as an indicator of mitotic activity. These studies suggest a TH mediated increase in the fixation of ^{3}H thymidine in particular hepatic cells while the labeling kinetics of ^{125}Id-Urd suggest the thyroid hormone induced metamorphic transitions of the liver can be thought of as occurring in an essentially fixed population of cells. (Supported by NIH Grant 1-S06-RR-08123)

Williams, James - see Phillips

Wooley, Tyler A.- see Pettus.

BIOGEOGRAPHY OF THE HERPETOFAUNA OF THE DESERTS OF WESTERN SOUTH AMERICA. John W. Wright. Los Angeles County Museum of Natural History, Los Angeles, California.

NO ABSTRACT RECEIVED.

Wurst, Gloria - see Wake.

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