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A LIZARD OF THE
SOUTHEASTERN UNITED STATES**

Edwin H. McConkey



UNIVERSITY OF FLORIDA

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THE SUBSPECIES OF *EUMECES EGREGIUS*, A LIZARD OF THE SOUTHEASTERN UNITED STATES

EDWIN H. MCCONKEY¹

The red-tailed skinks of southeastern United States, despite their rarity in collections and inconspicuous place in herpetological literature, have had a history of taxonomic vacillation and uncertainty. *Plestiodon egregius* was described by Baird (1858) on the basis of an unstated number of specimens collected by G. Wurdemann on Indian Key, Florida. Cope (1871) used a single specimen from Brevard County, Florida, to name the species *Plistodon onocrepis*. He pointed out the relationship of *onocrepis* to *egregius* and mentioned several characters by which the two might be "easily distinguished." Later (1900) he listed *onocrepis* as a synonym of *egregius*, giving no reason for the action. Subsequent writers used only the latter name until Taylor (1936) resurrected *onocrepis* as a subspecies of *egregius*. He indicated that the two forms might be specifically related but that it was impossible to come to any definite conclusions on the basis of the few specimens available to him. Carr (1940) reported that he had examined a number of specimens not available to Taylor and that he had found no *egregius-onocrepis* intermediates. Largely because of that, and the fact that the two forms were thought to be sympatric, he restored full specific rank to both. Smith (1946) concluded that, ". . . the problem now is not whether the brown and striped red-tailed skinks are different species, but whether the northern striped specimens are the same as the southern ones" Schmidt (1953) expressed an opposing view by listing *onocrepis* as a race of *egregius* in the sixth edition of *A Check List of North American Amphibians and Reptiles*. The change was made without comment.

Since Taylor's monograph on *Eumeces* (1936), it has been apparent that the red-tailed skinks from southern Georgia and northern Florida were superficially more similar to specimens from the Florida Keys, at the other extreme of the range, than to specimens from the intervening peninsular area. The existence of specimens not available to previous writers makes possible a preliminary consideration of the relationships of the northern lizards. Data will also be presented in support of the current listing of *onocrepis* as a trinomial.

¹The study reported on here was performed while the author was in the Department of Biology, University of Florida. He is currently a doctoral student in the Department of Zoology, University of California, Berkeley. Manuscript submitted 31 July 1956.—Ed.

In the discussion that follows, trivial names used separately refer to subspecies; the binomial form *Eumeces egregius* refers to all of the southeastern red-tailed skinks. In the tables and the associated discussion, reference is made to three populations. The term "northern population" refers to the red-tailed skinks inhabiting southern Georgia and Alabama, northern and western Florida; "central population" pertains to those from the peninsula of Florida, beginning at the symbols "1.2" on the map and extending, as far as is known, to the southern tip of the peninsula; "southern population" includes those lizards occurring on the Florida Keys.

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ANALYSIS OF CHARACTERS

Several writers have stated that the scales of the two middorsal rows in *Eumeces egregius* are "distinctly enlarged," whereas those of *onocephalis* are not noticeably larger than the scales immediately lateral to them. In contrast, my observations indicate that this character does not vary with any geographical consistency. For example, a series of thirteen specimens collected at Silver Springs, Florida, contains six individuals with the scales of the middorsal rows distinctly enlarged, four with the scales not enlarged, and three with an intermediate condition. Similarly, a series of fourteen specimens from Key West consists of six lizards with the scales of the middorsal rows distinctly enlarged, one in which the scales are not enlarged, and seven that cannot be assigned to either extreme. It is unlikely that one could demonstrate

the existence of any difference in the relative size of the scales of the middorsal rows using the samples of red-tailed skinks presently available. Furthermore, the likelihood that such a character might be variously interpreted makes it impractical for taxonomic purposes.

Eumeces egregius characteristically possesses two pairs of white stripes visible on at least the anterior third of the body. Their location may be described conveniently by numbering the longitudinal scale rows of the back and sides, beginning at the middorsal line and proceeding laterally in both directions. In some individuals the dorsolateral pair of white stripes occupies the middle of the second scale row of each side anteriorly, and continues in that row as far as the base of the tail; in others the stripes diverge as they proceed posteriorly, coming to occupy the middle of the third scale row of each side in the region of the groin. Several previous writers have claimed that diverging dorsolateral stripes are restricted to *onocrepis* and that the opposite condition is found only in *egregius*. Table 1 presents data on this character. The quantities in each category represent the number of specimens. Unfortunately there is often a rapid decrease in intensity of the light stripes posteriorly, particularly in preserved individuals, so that it becomes impossible to determine whether divergence occurs. Specimens of this type are listed as "questionable" in the table.

In contrast to the variable location of the dorsolateral markings, the lateral light stripes remain on the fifth scale rows throughout their length. Previous authors have indicated that in *egregius* the lateral stripes are always discernible as far back as the groin, whereas in *onocrepis* they fade out anterior to that point. Table 2 presents data on this character. The quantities in each category represent the number of specimens. Certain badly faded specimens are listed as questionable.

Two useful characters that have not been reported on before are the number of ventral scales (counted longitudinally from the first scale behind the chin shields to the anal plate) and the number of scales around the middle of the body. Data on these characters are presented in tables 3 and 4.

The data contained in tables 1 through 4 were analyzed and compared mathematically by the use of conventional chi-square and t -tests. If calculations indicated a probability of 0:05 or less that any given difference could be ascribed to chance, it was assumed that a significant difference had been demonstrated. On this basis the northern

TABLE 1
THE NATURE OF THE DORSOLATERAL LIGHT STRIPES IN *Eumeces egregius*

Population	Diverging	Questionable	Not diverging
Northern	0	1	10
Central	56	1	3
Southern	1	9	20

TABLE 2
THE NATURE OF THE LATERAL LIGHT STRIPES IN *Eumeces egregius*

Population	Reaching groin	Questionable	Not reaching groin
Northern	9	0	2
Central	19	1	40
Southern	28	1	1

TABLE 3
NUMBER OF VENTRAL SCALES FROM CHIN TO ANUS IN *Eumeces egregius*

Population	Mean	Standard error of mean	Observed range	Sample size
Northern	60.36	0.67	56-65	11
Central	57.91	0.28	53-62	57
Southern	61.83	0.40	57-65	29

TABLE 4
NUMBER OF SCALES AROUND MIDBODY IN *Eumeces egregius*

Population	18	19	20	21	22	23	24	Mean	Sample size
Northern	0	0	11	0	0	0	0	20.00	11
Central	3	2	52	1	2	0	0	19.95	60
Southern	0	0	9	3	17	0	1	21.33	30

population differs from the central population in the divergence of the dorsolateral stripes, the length of the lateral stripes, and the number of ventral scales; the central population differs from the southern population with regard to all four characters tabulated; and the northern

population differs from the southern population in the number of scales around the middle of the body.

DISCUSSION

The first question to consider is whether these three mathematically recognizable populations represent one, two, or three species. Since none of the characters considered serves to separate all individuals of any one population from all individuals of any other population, it is reasonable to conclude that the hypothesis of multiple species is not supported by the evidence presented.

It next becomes necessary to determine whether the observed differences are of sufficient magnitude to warrant subspecific recognition. The northern population may easily be distinguished from the central population by the nature of the dorsolateral stripes (93 percent of sample) or the number of ventral scales (76 percent of sample). The central population may be separated readily from the southern population by the number of ventral scales or the number of scales around the midbody (both 87 percent of sample). Were it not for the fact that the dorsolateral stripes of individuals from the southern population are frequently obliterated by preservation, this character could also be used to separate a high percentage of the central and southern animals.

The relationships of the northern and southern populations seem to be close. The only character in which they have been shown to differ by a statistically significant amount is the number of scales around the midbody. On the basis of this character all of the 11 available specimens of the northern population and 70 percent of the 30 specimens of the southern population were correctly identified. Combining the two samples results in a total of 78 percent correct identification. The need for taxonomic recognition of the distinctness of these two populations is evident. Accordingly, three subspecies of red-tailed skinks may be recognized. That referred to above as the southern population should be known as *Eumeces egregius egregius*; the name *E. e. onocrepis* is available for the central population; and the northern population may be called:

EUMECES EGREGIUS SIMILIS, subsp. nov.

DIAGNOSIS.—A *Eumeces egregius* unique in the possession of twenty or fewer scales around the middle of the body in combination with dorsolateral light stripes that do not diverge posteriorly.

HOLOTYPE.—UF 7647, a female from the northwestern outskirts of Augusta, Richmond County, Georgia; collected March 29, 1939, by Wilfred T. Neill.

The holotype has sixty ventral scales from throat to anus, twenty scales around the midbody, nondiverging dorsolateral stripes, and lateral stripes extending to the groin. The tail is complete and is 74 millimeters long. The snout-vent length is 48 millimeters. On each side of the head there are six upper labials, five lower labials, and seven superciliaries. The specimen has no obvious irregularities of scalation, no large blemishes, and no asymmetries that might be used for identification.

The name *similis* is a Latin word meaning "similar" and refers to the resemblance between this form and the subspecies *egregius*.

INTERGRADATION

It is pertinent to consider the pattern characteristics of a sample of six *Eumeces egregius* collected within 300 yards of each other in an area of turkey oak and hawthorn scrub five miles west of Gainesville, Alachua County, Florida.

An obvious possibility for the arrangement of the light stripes in a mixed population of *onocrepis* and *similis* is that some individuals would have nondiverging dorsolateral stripes combined with lateral stripes that faded out before reaching the groin; others would have the opposite condition; and still others would present one of the patterns characteristic of unmixed populations. That is precisely the situation found (see table 5).

Another expression of intermediacy that might be expected is the possession of dorsolateral stripes that diverge one-half scale row on each side as they proceed posteriorly. UF 7654-1 has this condition: The dorsolateral stripes above the groin occupy the lower half of scale rows number two and the upper half of rows number three.

The number of ventral scales in a *similis-onocrepis* mixture might also be expected to average between the mean values for the two subspecies; the value for the mixed sample above is 58.00, those for *onocrepis* and *similis* are 57.91 and 60.36 respectively (see table 3). The presence of the extremely low count of 52 in one specimen may have caused a misleading picture of the true population mean.

Robert E. Hellman and Sam R. Telford recently discovered at Cedar Key, Levy County, Florida, a population of *Eumeces egregius* living in and about the piled-up tidal wrack that lines most of the

TABLE 5

CHARACTERISTICS OF A SAMPLE OF *Eumeces egregius* FROM ALACHUA COUNTY, FLORIDA

Specimen	Number of ventrals	Dorsolateral stripes diverge	Lateral stripes reach groin
UF 7653	61	yes	no
7654-1	59	no	yes
7654-2	61	no	yes
7652	59	no	yes
2873	52	no	no
2708	56	yes	yes

TABLE 6

CHARACTERISTICS OF A SAMPLE OF *Eumeces egregius* FROM LEVY COUNTY, FLORIDA

Specimen	Number of ventrals	Dorsolateral stripes diverge	Lateral stripes reach groin
UF 3125-1	58	yes	no
-2	58	?	no
-3	58	yes	yes
-4	59	?	no
-5	60	yes	no
-6	60	yes	yes
-7	59	?	no
-8	57	yes	yes
-9	61	?	yes

For the present, I think it best to regard the Cedar Key population of *Eumeces egregius* as *similis-onocrepis* intermediates. Their location on an island, presumably isolated from other red-tailed skinks by several miles of salt marsh and swamp, adds to their attractiveness for further investigation.

The probable intergradation area of *onocrepis* and *egregius* is extreme southern Florida, an area from which no specimens are known. Anyone interested in obtaining red-tailed skinks from that region may find it worth while to examine the tidal wrack along the shore of Cape Sable.

RELATIONSHIPS

The evolutionary relationships of the three subspecies of *Eumeces egregius* present an intriguing and almost baffling problem. How is

it that *similis* and *egregius* resemble each other more closely than either resembles the geographically intermediate *onocrepis*? Several possibilities come to mind. Convergent evolution may account for the similarities, but in the absence of any well-established precedent, it seems prudent to look elsewhere for an explanation.

It may be that *similis* and *egregius* represent the remnants of a once continuous population that has been split by the development of *onocrepis* within its borders, but this explanation only raises more questions. The hypothesis that follows, although highly speculative, is offered for consideration.

Geologists are not in agreement as to the details of Florida's geography during the various interglacial periods, but it is reasonably well established that the peninsula was several times reduced to one or more islands. If one assumes that *similis* and *egregius* are less differentiated from the ancestral stock than is *onocrepis*, it is reasonable to postulate that the latter developed on an island during the last (Sangamon) interglacial stage. The recession of the seas during Wisconsin time would have permitted *onocrepis* to occupy the entire peninsula of Florida by following the expanding shore line. It then would have been fragmented into its present distribution gradually, as the former shores and beaches were modified by vegetational succession.

Egregius, I should like to suggest, developed its identity *in situ* on the Florida Keys, having reached there from the northern part of the state via the lowland region now formed primarily by the St. Johns and Kissimmee river valleys. Although this trough was probably 100 feet or more above sea level during the Wisconsin glaciation than it is at present, it seems likely that even then it was a drainage basin, vegetationally different from the ridges that flanked it on the east and west. The little that I know of the ecology of *similis* indicates that it is a much more vagile organism than is *onocrepis*, which appears to be restricted to the high pine-turkey oak and scrub associations. I have seen *similis* collected in a very damp locality between a flatwoods and a hammock in west Florida, as well as in the dry situations mentioned above. If, at the time of the last glaciers, the eastern Florida lowlands were sufficiently different ecologically from the neighboring ridges, they might have formed a highway down which *similis* could have traveled to the end of the peninsula and to the Keys.

SUMMARY

The red-tailed skinks of the southeastern United States, *Eumeces*

egregius, are shown to belong to three subspecifically differentiated populations. The new name *similis* is proposed for the population inhabiting northern Florida, southern Georgia, and Alabama; *onocrepis* pertains to the peninsular race; and *egregius* is restricted to the population on the Florida Keys. A population in Alachua County is demonstrated to be intermediate between *similis* and *onocrepis*, and it is suggested that the red-tailed lizards at Cedar Key in Levy County, Florida, may also be intergrades. The evolutionary relationships of the several forms are considered, and a hypothesis is presented to account for the present distribution.

SPECIMENS EXAMINED

EUMECES EGREGIUS EGREGIUS.—*Florida*. Monroe County. Key West: MCZ 44754, 31904, 6152 (2); USNM 85259-260; CM 6247-248; UF 1839; UMMZ 95576-(14). Big Pine Key: USNM 125130, 95805, 61692. Upper Matcumbe Key: USNM 95752-753; UMMZ 102216. Key Largo: UMMZ 102538. Dry Tortugas: MCZ 978.

EUMECES EGREGIUS ONOCREPIS.—*Florida*. No specific locality: MCZ 28386; AMNH 1521. Brevard County: MCZ 10441; CM 1678; USNM 12002 (3), 13700. Broward County: USNM 85261. Citrus County: UF 1866. Dade County: MCZ 43110; USNM 26309, 32097-98, 85258. Hernando County: MCZ 29361. Lake County: MCZ 10064-65, 10771; USNM 75294-296, 19980-981, 69657, 56982; UMMZ 79589, 50150. Marion County: MCZ 43146-149, 44755-756; CM 27455; USNM 103512; ERA-WTN unnumbered (13). Orange County: UF 306. Palm Beach County: UMMZ 86423. Pinellas County: MCZ 12851-853. Polk County: USNM 48744, 49738, 60515-516. Sarasota County: CM 27452-454. Volusia County: MCZ 14464.

EUMECES EGREGIUS ONOCREPIS X SIMILIS.—*Florida*. Alachua County: CM 17111; AMNH 68877-878; UMMZ 57725; UF 64 (2), 2873, 2708, 7652-654. Clay County: CM 23444. Levy County: UF 3125 (9).

EUMECES EGREGIUS SIMILIS.—*Alabama*. Baldwin County: UA 49-408 (1). *Florida*. Columbia County: UF 7651. Duval County: AMNH 22423. Leon County: UF 1741 (2). Jackson County: UF 2652. *Georgia*. Baker County: JWC 613. Richmond County: UF 7647-649, 7650 (2).

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