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Wilmer W. Tanner
Brigham Young University

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A TAXONOMIC AND ECOLOGICAL STUDY OF THE WESTERN SKINK (Eumeces skiltonianus)

Wilmer W. Tanner[1]

Introduction

The most widespread and perhaps the most abundant skink in western North America is *Eumeces skiltonianus* Baird and Girard. This species occupies a wide area extending from southern British Columbia southward to the mountains of northern Baja California and westward through the Great Basin to the southern high plateaus of Utah and northern Arizona. The distribution is essentially that given by Stebbins (1954:322) except for the inclusion of extreme southern Utah and northern Arizona. Smith (1946:601) added Arizona and also an isolated area in southeastern Utah. The latter was presumably based on a specimen (BYU 534) taken near the Bears Ears, Elk Ridge, San Juan County. A re-examination places this specimen with the *multivirgatus* complex, more likely *Eumeces gaigei*, and adds a new species to the Utah list. To my knowledge *skiltonianus* does not exist east or south of the Colorado River, although it does reach the rim of the Grand Canyon in northern Arizona.

Other recent studies concerning the species *Emeces skiltonianus*, by Talyor (1935), Rodgers and Fitch (1947), and Stebbins (1954), have included specimens from the above area as a single form. Most of the material available for the above studies came from California, Oregon, and Washington, with comparatively small series from widely separated localities east of the Sierra Nevada's. Each of the above studies contribute to a more complete understanding of the *skiltonianus* group (*E. skiltonianus* and *E. gilberti*); however, the availability of a large series from the coastal states, principally California, aided in clarifying the taxonomic status of the skinks of this state, primarily that of *Emueces gilberti* and its subspecies. Up to now, taxonomic studies concerning the skinks of the eastern axis of the Great Basin, including primarily the Bonneville basin, and the Snake River valley of southern Idaho have done little more than to list the representatives available as *Eumeces skiltonianus* and to indicate a need for further study of the variations known to exist in the species.

Although previous studies, Taylor (1935), Tanner (1943), Smith (1946), and Rodgers and Fitch (1947), have given valuable informa-

1. Department of Zoology and Entomology, No. 155, Brigham Young University, Provo, Utah

tion concerning the ecology, life history and taxonomy of *skiltonianus*, these studies included relatively few specimens outside of California. For example, Taylor (loc. cit.) in his extensive study lists 52 specimens from all of the states north and east of California, more than 70 from Baja California, and more than 360 from California. Woodbury (1931) lists seven localities from Utah, (some published previously) and perhaps saw relatively few specimens. Rodgers and Fitch (loc. cit.) carefully studied and reported a large series of specimens from California. Thus when the present study was begun in 1950, only a few specimens were available for taxonomic study and these from widely separated localities.

Preliminary comparisons of the Utah series (Utah County), with the few specimens available from Oregon (Clackamas, Marion and Douglas Counties), indicated at the outset that there were substantial variations. In order to determine the extent of these differences and to discover, if possible, other variables in the populations of this species, extensive field work was undertaken in Utah and adjoining areas. The additional specimens collected, and those seen and borrowed from other museums, have provided a series of over 300 specimens from areas north and east of California. All of the distributional gaps are not yet filled. There are data available, however, to indicate significant varations within this widely distributed species, as well as unrecorded ecological notes. Additional collecting should be done in the extreme northeastern part of California, northern Nevada, southeastern Oregon, and Idaho.

For the privilege of examining and of borrowing specimens for use in this study, I wish to thank the following: Doctors George S. Myers, Jay M. Savage, and Mr. A. E. Leviton, Stanford University (SU); Mr. Joseph R. Slevin, California Academy of Sciences (CAS); Dr. Stephen D. Durrant, University of Utah (UU); Drs. Ross Hardy and Richard B. Loomis, Long Beach State College (LBSC); Dr. Doris M. Cochran, U. S. National Museum—for permitting the loan of types and for pertinent information concerning them (USNM); Dr. Ira LaRivers, University of Nevada (UN); Dr. George E. Hudson, The State College of Washington (SCW); Director of Idaho State Museum (ISM); Mr. Arthur Bruhn, Dixie Junior College (DC); Dr. Norman Hartweg, University of Michigan (UM); Mr. Louis Schellback, Grand Canyon National Park (GCNP); Dr. Robert C. Stebbins, Museum of Vertebrate Zoology, University of California (MVZ); Dr. Robert M. Storm, Oregon State College (OSC) who has provided me with an unusually large series from Oregon; and to Drs. Henry S. Fitch and Edward H. Taylor, University of Kansas (KU); and my colleagues at Brigham Young University (BYU) for their criticisms of the manuscript and aid in the field work.

Types and Type Locality

According to the records in the United States National Museum, the specimens used in the original description of this species now bear the number 3172. There are two specimens, both separately tagged, but in accordance with earlier procedures, both have the same

number. One is an unusually large specimen, 83 mm snout to vent, whereas the other is of average adult size, 64 mm.

The following general characteristics obtain in the cotypes In each case the first figure refers to the larger specimen. Scale rows, 25-26; dorsals, 63-60; ventrals, 45-46; width of the first nuchal (distance from parietal across first nuchal to edge of second nuchal), 1.4-1.5 mm.; width of the dorsolateral line (taken near or just before the middle of body), 2.0-1.2 mm; percent of dorsolateral line on second scale row, ½-½; superalabials, 7-7, 8-8; infralabials, 6-7, 6-7; lateral line edged ventrally by a narrow dark stripe, not so in the larger but present in the smaller specimen.

In the original description (Baird and Girard, Proc. Acad. Nat. Sci., Philadelphia, 6:69, 1852)[2], the Reverend George Gary is listed as their collector, and the habitat (type locality) is listed as Oregon. Unfortunately, the description is brief and deals only in generalities, thus giving no clues as to which of the two specimens now listed as cotype may have received the most consideration, or if other specimens were at hand for examination.

As a part of the report on reptiles made by Baird (1853:349-50) (appendix C, Stansbury Expedition to the Great Salt Lake; fig. 4-6), the characteristics of this species are discussed at greater length, and a specimen of this species is figured. The larger cotype is apparently the one figured, inasmuch as the tail is broken at approximately the same place; the dark edge below the lateral stripe is absent and most important of all the head plates (as figured) are identical for this specimen. The latter is significant because the larger cotype has several aberrant head scales. These are particularly noticeable in the nuchals. An examination indicates that the nuchals, as figured by Baird (pl. 4 fig. 6) are nearly identical, even to the small dark spots along the sutures of the head plates.

Cope (1900) lists the locality for the types as "California." Stejneger and Barbour, (check list, 1917-1943), and Schmidt (1953), lists the type locality as "Oregon." To add to the uncertainty, the two specimens (cotypes) were entered in the catalogue (USNM) on July 21, 1858, and California is given as the locality. This led Taylor (*loc. cit.*) to question the validity of the larger cotype and to designate the smaller type as the lectotype. Dr. Doris M. Cochran informs me that Dr. Stejneger numbered the specimens "A" and "B", and wrote on the file card, "Spec. A is the one figured" in Stansbury's Expl. Surv. Valley of the Great Salt Lake, 1853, pp. 349-50, pl. 4, fig. 4-6. On this same card, "California" is crossed out and "Oregon" is written in. I have seen both types and have compared them, particularly the larger one, with the description and figures. Although the larger specimen is aberrant in having only one pair of small nuchals and in lacking the dark stripe below the lateral stripe, otherwise it is a normal specimen when compared with skinks from north central Ore-

2. According to Taylor (loc. cit.) this description actually appeared in 1853 perhaps only shortly before the Stansbury Expedition report by Baird.

gon. Also the smaller cotype is an average specimen when similarly compared (see below). There is, I believe, no real reason to longer doubt their validity as types.

As to the type locality the following statements from Baird and Girard's report (1863; p. 350) leave little doubt. "This species inhabits the same location in Oregon as *Elgaria scincicauda*. The specimen figured, together with several others were collected by Rev. George Gary, and sent by him to Dr. Avery J. Skilton, . . ."

On page 349 the locality for *Elgaria scincicauda* is given as follows: "This species inhabits Oregon, about the Dalles of the Columbia River, where it has been collected by Rev. George Gary." (1st sentence only).

A comparison of the cotypes with specimens from various localities in north central Oregon has shown a greater similarity between the types and those specimens which come from that tier of counties extending south from the vicinity of the Dalles, along the Deschutes River (Hood River, Wasco, Jefferson, and Deschutes Counties). Skinks from these counties tend to average more ventrals, ranging from 40 to as many as 46 in a few specimens, and commonly to have 60 or more dorsals. The dorsolateral stripe is slightly wider, and when compared with the width of the first nuchals (see Plate 2), yields on the average a smaller figure than do specimens seen from the more western part of Oregon.

A sizeable series from the lower Williamette Valley, east of Salem and Oregon City, vary with the series from the Deschutes Basin and with the cotypes in that there are fewer venrals, usually 40-43, rarely more, and there are usually less than 60 dorsals. In the series from western Oregon, the dorsolateral stripe is perhaps the narrowest found in the species.

On the basis of all data now available, it is seemingly possible to establish the type locality in Oregon, and most likely from the area around The Dalles, or from that area immediately to the south of The Dalles in the Deschutes River Basin.

As the skinks from California and Baja California are examined and compared, one is impressed with the differences between those from San Bernardino and Orange Counties north, and those from extreme southern San Diego County, northern Baja California, Todos Santos Island and the various Cornado Islands. Both Taylor (*op. cit.*) and Rodgers and Fitch (*op. cit.*) found the interparietal enclosed by the parietals in a high percentage of the specimens seen from the southern part of the range. For San Diego County 70 per cent were enclosed. In addition I found an extension of the body pattern onto the tail. Both of the above studies have treated the distributional variations of the skinks from California and Lower California more completely than those of the populations existing in the Columbia River Valley and Great Basin areas. However, it should be pointed out that the former study was based in many instances on insufficient material (Taylor 1935:414) thus necessitating some tentative conclusions. The study by Rodgers and Fitch (*op. cit.*) was by it very

nature not designed to engage in a study of the entire problem of variation in the species *Eumeces skiltonianus*, but rather to resolve certain taxonomic problems existing in the species *Eumeces gilberti* and to restate in view of the new data, the variations between the species belonging to the *skiltonianus* group.

With an increase in material it is now possible to make a comparative study of the variations within the species *Eumeces skiltonianus* Baird and Girard.

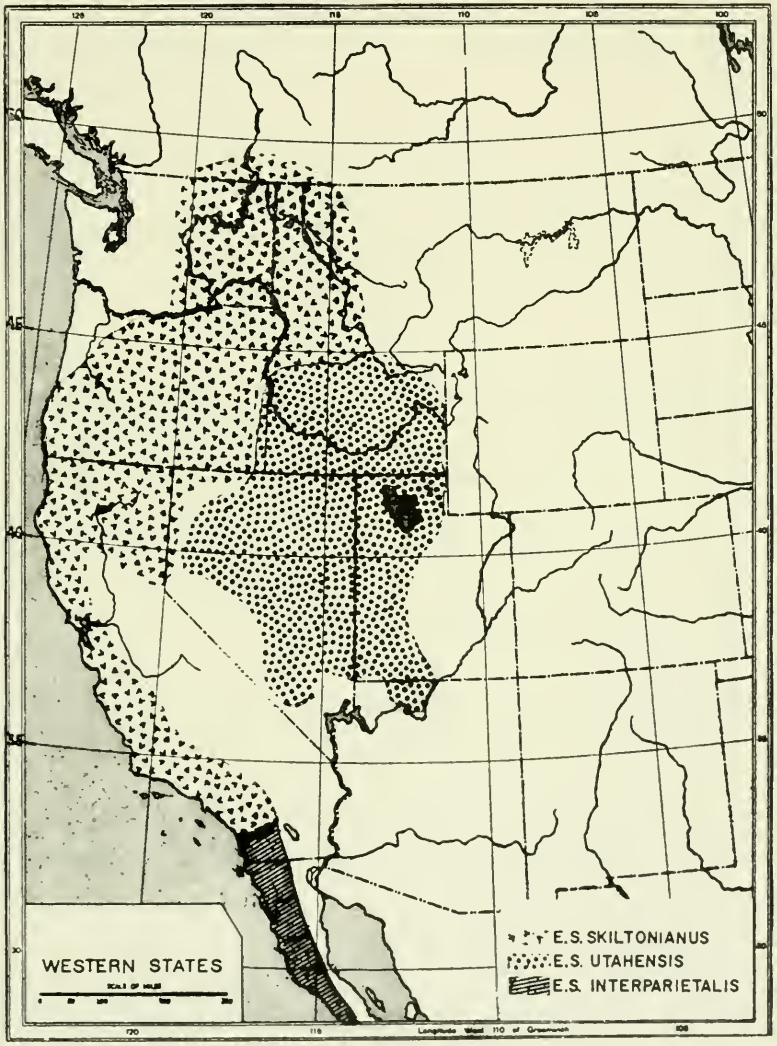

Plate 1. Distribution of the subspecies of *Eumeces skiltonianus*.

In the course of gathering data on the species *Eumeces skiltonianus*, a series of *Eumeces lagunensis* have been seen and compared with other species of the *skiltonianus* group of skinks. Although the data thus gathered do not provide us with all variations expected in this species, the increased material does give a better understanding of this skink than we have had previously. I am, therefore, including *lagunensis* in this study in order to properly relate it to the other species in the *skiltonianus* group and also to add to the known variations.

Eumeces skiltonianus is here considered to be a polytypic species (see plate 1), closely related to *gilberti*, a contiguous and at some areas an overlaping or sympatric species. Its precise relationship to *lagunensis* is still in doubt. On the basis of size, color patern (except for tail color) and in most scale formulae, *skiltonianus interparietals* and *lagunensis* are similar. Some of the differences (see species account) are seemingly significant as is also the wide geographical separation of the populations. Until additional information, particularly data concerning reproductive isolation, is available, further changes in the nomenclature seem ill advised. I am, therefore, considering *lagunensis* as a disjunct allopatric species.

Key to the Species and Subspecies

1. Seventh labial broadly in contact with the upper secondary temporal; tail of juveniles pink or salmon colored never blue; interparietal enclosed by parietals. ..... *Eumeces lagunensis* Van Denburgh

   Seventh labial rarely in contact with the upper secondary temporal; tail of juvenils either pink or blue; interparietal enclosed or not by the parietals. 2

2. Tail of young red, pink or blue; snout to vent length 80 or more mm; stripes of body pattern faded or absent in adults; nuchals usually 1-1. ..... *Eumeces gilberti* Van Denburgh (and its subspecies—see Rodgers and Fitch 1947:177).

   Tail of young blue; snout to vent length less than 80 mm; stripes of body pattern present in adults; nuchals usually 2-2. *Eumeces skiltonianus B. & G.* (and its subspecies) 3

3. Dorsolateral stripe occupying more than half of the second scale row and being nearly one half the diameter of the dark dorsal interspace. Dark stripe below lateral light stripe rarely present. Diameter of the dorsolateral stripe usually greater than the length of the first nuchal. ..... *Eumeces skiltonianus utahensis*, n. subsp.

   Dorsolateral stripe narrow not occupying more than half of either the second or third scale rows, diameter of stripe naticeably less than half the width of the dark dorsal interspace. Dark stripe below the lateral light stripe usually present. Diameter of the dorsolateral stripe usually less than the length of the first nuchal 4

4. Interparietal enclosed by the parietals in 80 per cent of the population. Stripes of the body pattern extended onto anterior half or more of tail ..... *Eumeces s. interparietalis*, n. subsp.

   Interparietal rarely enclosed by the parietals. Usually less than 10 per cent even in Los Angeles and San Bernardino Counties; and/or stripes of body pattern not extended on more than the base of the tail. ..... *Eumeces s. skiltonianus* B & G

Eumeces skiltonianus skiltonianus Baird and Girard
Western Skink

Plestidon skiltonianum Baird and Girard, Proc. Acad. Nat. Sci. Phila., 1852:60, Original description, type locality, Oregon; Baird and Girard, in Stansbury's Expl. Surv. Val., Great Salt Lake, Rept. App. C, 1863:349-350, pl. 4, fig. 406.

Plestidon skiltonianus Van Denbrugh (part), Vol. I 1922:578-587.

Eumeces quadrilineatus Hallowell, Rept. U.S. Expl. Surv. R.R. Pt. 4X, 1859:10, pl. IX, fig. 3 (type locality, Mojave River, San Bernardino Valley, California.

Eumeces skiltonianus amblygrammus Cope, Ann. Rept. U.S. Nat. Mus., 1898 (1900):643, type locality, Fort Humboldt, Humboldt County, California.

Eumeces skiltonianus skiltonianus Taylor (part), University Kansas Sci. Bull. 1935:23, 415-428.

Eumeces skiltonianus Rodgers and Fitch (part), University of California Publs. Zool., 169-209, 1947.

Range: Extreme south central British Columbia, Washington east of the Cascade Mountains, western edge of Montana, northern Idaho, Oregon, except northwestern corner, edge of northwestern Nevada, northeastern California south to Placer and Yuba Counties, and western California south along the coast into northern San Diego County.

Diagnosis: Dorsolateral stripe narrow usually occupying no more than one half of the second scale row; dorsolateral stripe at middle of the body less than one half of the dark dorsal interspace. First nuchal noticeably larger than the second, length of the first nuchal greater than the width of the dorsolateral line. Lateral light stripes bordered ventrally by a narrow dark stripe.

Description of the subspecies: Scales smooth, rows around middle of body, 24 or 26, occasionally 25 or 27, rarely 28; dorsals, from parietals to base of tail, usually 58, 59, or 60 ranging from 53 to 63, average 59; ventrals ranging from 39 to 46, average 42.0; total dorsal-ventral scales 95-108, average 101; supralabials 7-7, 7-8, or 8-8, rarely 6 or 9, plate 3; infralabials 6-6, rarely 5 or 7; postlabials 1 or 2, rarely 3 or 4; postnasal and postmentals present; parietals divided by interparietal; usually two pairs of nuchals, occasionally one or three pairs, first pair noticeably larger than succeeding pairs; distance across first nuchal, 0.6-1.0 mm in young, 1.2 to 1.8 mm in adults; length of first nuchal greater than diameter of dorsolateral stripe.

Head distinct; body subcylindrical, slender and elongate; snout-to-vent lengths 25-28 mm in hatchlings, 60-78 mm in adults (excepting 83 mm in cotype); tail long, 1½ to approximately 2 times the snout to vent length; limbs well developed, when adpressed to body touching or overlaping in juveniles, males, and in most females.

Color patern consisting of four narrow light stripes and three broad brownish stripes; dorsolateral light stripes originate on supranasals, extend across supraoculars, temporals, parietals, nuchals, and along second and third scale rows, and for a short distance onto tail; lateral light stripes originate on supralabials, and extends posteriorly through ear, and along fourth and fifth scale rows to tail;

a narrow dark stripe borders ventral edge of lateral stripe; ventral scales grayish or mottled with bluish-green; lateral dark stripe a uniform chocolate brownish, extending from nasal to tail, less obvious on head and tail in older specimens; mid-dorsal dark stripe medium to light olive brown, extending from frontonasal posterior to base of tail, in subadults and adults edged with darker brown, similar to color of lateral dark stripes; tail bright blue in juveniles and subadults, faded blue-grayish or brownish in older adults; males with red on labials and temporals, pronounced in old males during mating season.

Habitat: Occurs in a variety of habitats from the Upper Sonoran, through the transition and into the lower limits of the Canadian Life-zone. Western skinks are more abundant in brush areas where rocks and logs provide opportunity for burrowing and concealment. Heavily forested areas do not carry dense populations of skinks.

Specimens examined: A total of 198 as follows:

CALIFORNIA: *San Bernardino Co.*: Fish Creek, San Barnardino Mts. (MVZ 674-6); Barton Flats, San Bernardino Mts. (MVZ 4293); 5.5 mi. N 3.5 mi. W San Gorgonio Peak (MVZ 44559); S Fork, Santa Ana River (MVZ 677); Santa Ana River (MVZ 708); San Bernardino Mts. (SU 5422). *Los Angeles Co.*: Los Angeles (AMNH 24298); Fish Canyon, San Gabrial Mts. (AMNH 9088); San Pedro (MMZ 3820). *San Benito Co.*: Canyon W of San Juan Bautista (MMZ 58898); Laguna Mts. (AMNH 22734). *San Luis Obispo Co.*: 60 miles W of Maricopa (MMZ 75672-3). *Monterey Co.*: Big Sur (MMZ 90717); Los Ranchitos, Carmel Valley (BYU 13901). *Santa Cruz Co.*: 3 mi. N of Corralitos (MMZ 66666-9). *Alameda Co.*: (KU 7279). *Santa Clara Co.*: Palo Alto (MMZ 53634 two specimens). *Marin Co.*: Mt. Tamalois St. Park (MMZ 107252, KU 8212); *Mendocino Co.*: 7 mi. W of Willits (MMZ 102651, SU 9222-4); Comptche (AMNH 20440-1). *Placer Co.*: Red Point (SU 4 and 5). *Tahama Co.*: 29.5 mi. E of Red Bluff (BYU 12467-76), 17 mi. E of Red Bluff (BYU 12466). *Sierra Co.*: Sierraville (UN 3117). *Shasta Co.*: Ft. Crook (USNM 45166). *Siskiyou Co.*: 2 mi. NE of Bartle (MMZ 110145). *Modoc Co.*:Ft. Bidwell (USNM 29609).

OREGON: *Josephine Co.*: 1 mi. E Cave Junction (OSC 9196). *Jackson Co.*: Lower Table Rock (OSC 1418-9), 1 mi. E of Sam's Valley (OSC 9270), Upper Table Rock (OSC 9350-2), 10 mi. N 1 mi. W Medford (OSC 9370-3). *Douglas Co.*: Junction Steamboat and Umpqua Rivers (BYU 2892), 4 mi. N of Drain (OSC 5887-9), 18 mi. NE of Tiller (OSC 6063), Boomer Hill 5 mi. SW of Myrtle Creek (OSC 9240), Umpqua Rivers, 7 mi. W of Elkton (OSC 9257), 15 mi. E of Roseburg (OSC 9227 and 9113), 3.3 mi. below Milo (OSC 9353). *Klamath Co.*: Between Ashland and Klamath Falls (USNM 25919). *Lake Co.*: Albert Rim (AMNH 73035). *Harney Co.*: Diamond (USNM 61417). *Lane Co.*: 3 mi. SW Monroe (OSC 1507-8), 6 mi. SW Monroe (OSC 1422, 9234), 3 mi. S, 2 mi. W Monroe (OSC 5918, 9301), 2 mi. SW Monroe (OSC 6421); 5 mi. S Eugene (AMNH 63984). *Deschutes Co.*: Deschutes River (USNM 13774), Cline Falls St. Park (OSC 9403-21), Dry Canyon (OSC 8022-26), 8 mi. E of Sisters (OSC 6473-4, 6557). *Linn Co.*: 5.3 mi. ESE Sodaville (OSC 8692-4), Trout Creek Camp, 8 mi. E Cascadia (OSC 1673-4, 1678, 1681, 778-9, 1505, 1530, 1541), Idanha (OSC 9282-3, 9299, 9295, 9172, 9207, 9272), Crawfordsville (OSC 8712-3), 1.5 mi. SW Stayton (OSC 5148), 5 mi. E Idanha (OSC 9278), 5 mi. E Sweet Home (OSC 6436), Ward Butte (OSC 9099), 1 mi. S Foster (OSC 1517). *Benton Co.*: 3 mi. E Kings Valley (OSC 5976), 4 mi. SW Apline (OSC 9292). *Marion Co.*: near Idanha (OSC 8751-2, 9308, 9261, 9250), 1 mi. E Idanha (BYU 11550), Salem (USNM 16176-7). *Yamhill Co.*: McMinnville (AMNH 73034). *Claskamas Co.*: Oswego (BYU 652), 1 mi. E. Clackamas (OSC 1550, 1556). *Hood River Co.*: 6 mi. SW Hood River (OSC 6222-3). *Wasco Co.*: SE Tygh Valley (OSC 8801-2). *Jefferson Co.*: 2 mi. E of Grissly (OSC 9286, 9289), Deschutes River (KU 38570).

Baker Co.: 12 mi. E Baker (OSC 9711-2). *Union Co.*: Perry (OSC 9805), 3 mi. S Elgin (OSC 9810-2, 9766), 1 mi. NE Thief Valley Reservoir (OSC 9815, 9865, 9765), Thief Valley Reservoir (OSC 9781, 9806). *Wallowa Co.*: (OSC 6938).

IDAHO: *Bonner Co.*: Clark Fork, Lower Kootenay River (USNM 6282); Pack River (WSC 48-26). *Nez Perce Co.*: Lake Waha (WSC 48-393). Locality unknown (USNM 66145).

WASHINGTON: *Asotin Co.*: Near Wood Spring (OSC 1498). *Grant Co.*: Dry Falls (UW 4 specimens, no numbers). *Okanogan Co.*: Okanogan (WSC 41-40). *Whitman Co.*: Pullman (WSC 48-142, 35, G.P. -16, one specimen no number, 41-43, 41-46, 47-85, and 28); Wilma (WSC 36). *Spokane Co.*: Spokane (WSC 42-192, 42-193). *Yakima Co.*: Selah (KU 23138 and 26033).

NEVADA: *Humboldt Co.*: 10 mi. N Paradise (UN 289). *Washoe Co.*: 5 mi. NW Reno (UN 290); Reno (UN 302 and 2162). *Douglas Co.*: Genoe (UN 2163).

BRITISH COLUMBIA: West Branch of Kootenai River (AMNH 26855).

Remarks: The type of *Eumeces quadrilineatus* Hallowell (USNM 3168) is in poor condition. The scales have been lost, the body is soft and the skull is broken in the parietal region. It was not possible to determine if the interparietal is completely enclosed by the parietals, if so then barely so. The supralabials are 7-7, other scale formulae could not be accurately determined and the color pattern is completely obliterated.

In the original description Hallowell (1859) refers to both the parietals and interparietals but does not give details as to their relationship to one another. The dorsal view of the head, plate 9, fig. 3-d, shows the interparietal dividing the parietals, and making a rather wide contact with the dorsals. The figure does not indicate the presence of nuchals in the type.

A series of specimens from the Majave River Valley, San Bernardino County are much more closely related to typical *skiltonianus* than to *interparietalis* (described below), both as to the nature and size of the interparietal and in the color pattern.

Eumeces skiltonianus utahensis, n. subsp.
Great Basin Skink

Type: Brigham Young University No. 6945, an adult female, collected at the southeastern edge of Cedar Valley, approximately one half mile directly west of Chimney Rock, Utah County, Utah, on June 10, 1944, by Wilmer W. Tanner.

Diagnosis: Differing from the typical *skiltonianus* in having a dorsolateral stripe much wider and occupying more than half of second scale row, usually varying from three-fifths to as much as five-sixths of scale row near middle of body. Diameter of dorsolateral stripe equal to approximately half of dorsal interspace. Lateral stripe in adults blended with ventral color and without a dark stripe below it. First nuchal usually larger than the second, often equal or smaller, always shorter than the width of the dorsolateral stripe.

Description of type: Rostral as seen from above equal to approximately half the length of frontonasal; supranasals large, one and one half times as long as wide, in contact laterally with anterior loreals, barely failing to contact frontal; prefrontals moderate, each nearly as large as the frontonasal, in narrow contact medially, about

equally in contact with frontal and frontonasal. Frotnal normal, approximately one-fifth longer than its distance to snout, in contact on each side, with three supraoculars; frontoparietals subrectangular, smaller than prefrontals, median suture distinctly less than half their length; interparietal with a triangular anterior and wedge-shaped posterior, not enclosed by parietals; parietals large, contacting primary temporals on left side. Two pairs of nuchals, anterior pair as long but not as wide as posterior pair. Secondary temporals large, lower plate extending posterior to eighth supralabial; upper tertiary temporal larger than lower one; and nearly as wide as first nuchal, lower scale in contact with upper postlabial, separated from ear by one small scale; ear with three lobules, median largest.

Supralabials 8-8, separated from ear by two small postlabials. Infralabials 6-6, mental wider than rostral, postmental divided, followed by three progressively larger chinshields and an elongate postgenial.

Body scales in parallel rows, median dorsal rows only slightly wider than second or adjacent rows; 60 dorsals; 44 ventrals; 26 rows around middle of body; 14 rows around base of tail; ventral tail scales enlarged, 69 in series; (tail appears to have been broken twice and regenerated).

Body scales on sides of neck and above front legs with one or two small, often very faint, pits; if two pits, close together and always near median posterior margin of scale; all other body scales smooth.

Dorsolateral lines originating on the prefrontals, and anterior loreals, rather obscure anterior to posterior supraoculars; line extending posteriorly across parietals and nuchals to second scale row and mesial tips of third row. Dorsolateral line occupies almost all (four-fifths to nine-tenths), of second row, and caudad to ninth dorsal scale, at least three fifths of third row; dorsolaterad line and dorsal interspace extending only three or four scales on to tail before becoming obscure. Width of dorsolateral line equal to approximately half of width of middorsal dark stripe and wider than length of first nuchal. A series of dark brownish spots bordering middorsal stripe on mesial edge of the scales of second row; anteriorly these spots, are close together forming a triangle or mesial corner of each scale; posteriorly becoming more rounded and father apart, appearing as small spots occupying posterior margin of scale. Center of dark dorsal stripe much lighter than margins, posterior part only slightly darker than dorsolateral stripes; an irregular series of dark spots on mid-posterior margin of most of scales of both dorsal rows produces two irregular and broken dark stripes.

Lateral line originating on fifth supralabial and extending caudad passing through ear, and extending caudad along sixth and seventh rows, becoming obscure for most of distance between legs in some adults. Space between dorsolateral and lateral stripes uniform brown except for an occasional irregular lighter spot, less than

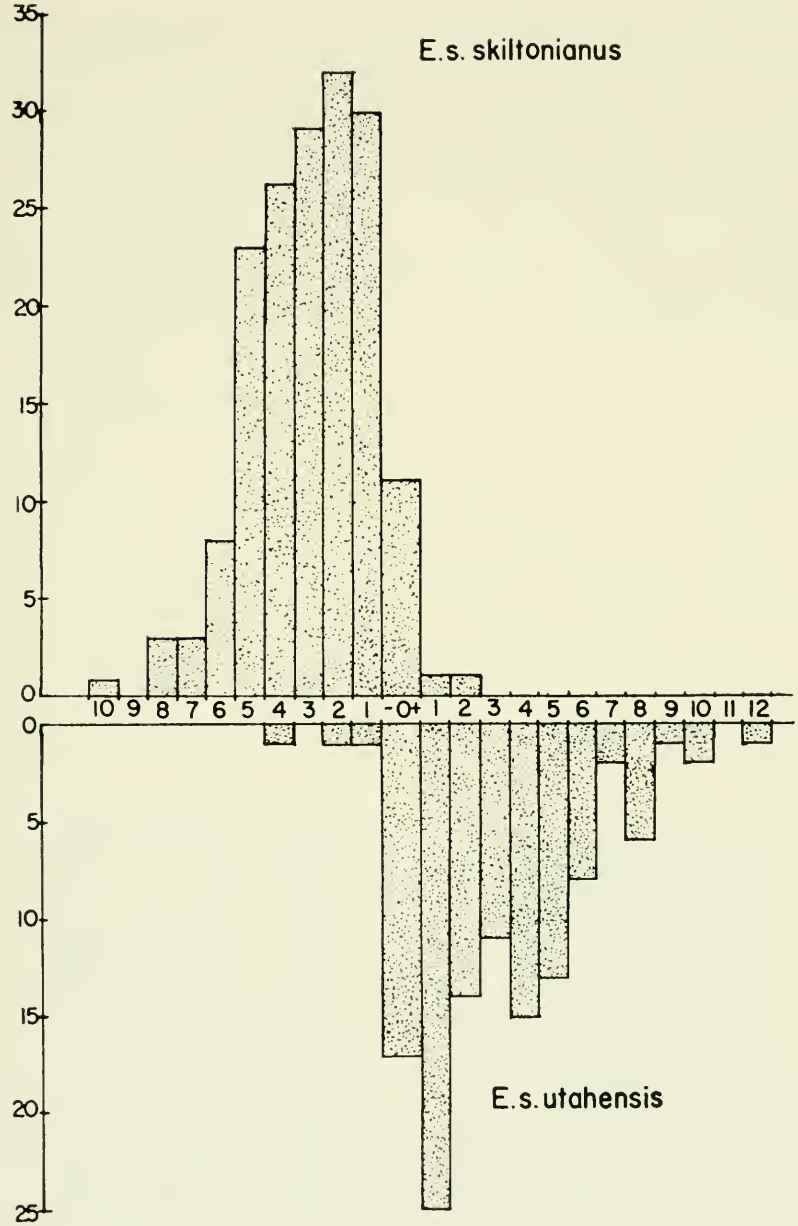

Plate 2. Histogram comparing in millimeters the length of the first nuchal minus the width of the dorsolateral stripe. A long nuchal and a narrow stripe produces the negative value in *skiltonianus*.

twice the diameter of dorsolateral stripe; dark lateral stripe extending caudad from posterior loreal; no narrow dark stripe below lateral line. Dorsal head plates brown with a few darker brown spots on sutures of some plates. Tail grayish with an infusion of greenish-blue near base of each scale; ventral plates cream colored on throat, becoming darker on venter.

Variations in Scalation: Head plates normal for the species except for the following: supralabials more often 7-8 or 8-8 (plate 3); interparietal always dividing parietals. Dorsal scale rows only slightly larger than adjacent rows; anterior nuchals usually but not always larger than posterior nuchals; dorsals, 54-63 (average 59.4), ventrals 40-47 (average 43.2). Scale rows 23-26 (average 25); total dorsal-ventral scales 96-109 (average 102.6).

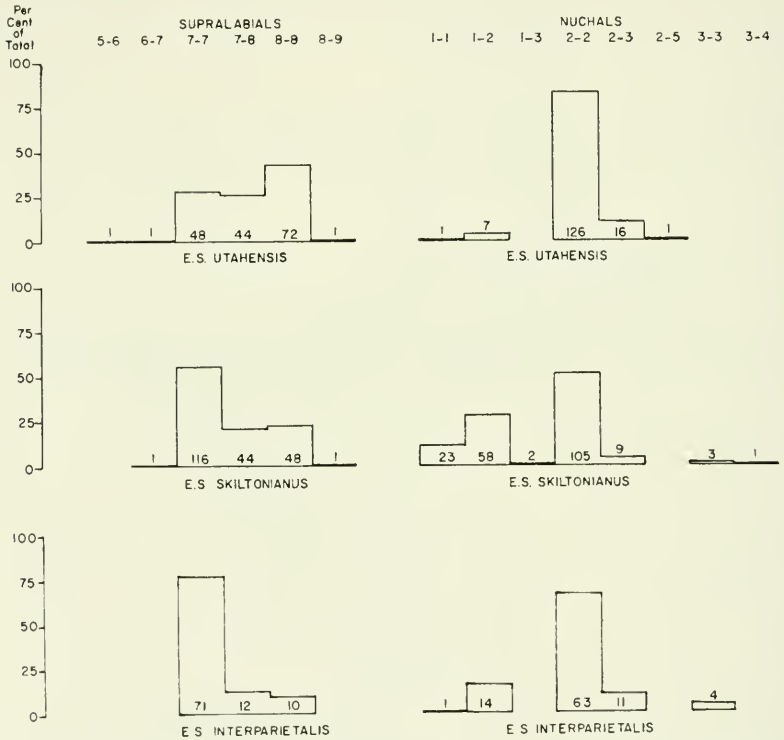

Plate 3. Histograms comparing the numbers of supralabials and nuchals in the subspecies of *Eumeces skiltonianus.*

Color pattern: Dorsolateral line originating on the supranasals or the lateral edge of frontonasal and anterior loreal in young and subadults, obscure in some adults anterior to supraoculars, extending caudad across the edges of the supraoculars, parietal and onto second and third scale rows All but mesial edge of each scale of second row

(usually three fifths to four fifths) in dorsolateral line, and caudad to 9th scale from the parietal one half to three fourths of third row in the dorsolateral line, only occasionally as little as half of either row. Dorsolateral lines extending only 4 to 19 scale lengths on to tail of adults and rarely more than 7 to 12 scales before blending with blue in younger age groups. In adult these lines are frequently difficult to trace beyond base of tail. Dorsolateral lines or dorsal interspace rarely extending caudad to foot when legs are adpressed against tail.

Each dorsolateral line equaling approximately half of dorsal interspace. Two irregular lines of dark dots on middorsal rows extending from nuchals to base of tail in a few specimens. When present each dot is located near middle of scale and extending to its posterior edge. In most specimens dorsal interspace inside of lateral border is nearly uniform in color.

Lateral line extending caudad from middle of ear to above front leg, involving part or all of both 6th and 7th rows; in juveniles and subadults this line is visible from ear to tail; in a few adults it is traced with difficulty beyond front leg. Anterior to front leg a slightly darker strip below lateral line separating ventral color and lateral stripe. In adults, ventral color blending with lateral stripe and in many adults obscuring it between legs. Customary dark stripe below lateral line, in *skiltonianus*, is absent in most *utahensis*, or with only a faint or irregular stripe.

Tail in young, Marine to Spectrum Blue (Ridgeway 1912), in young adults less intensive and becoming faded or grayish-blue. Older adults with drab colored tails, usually grayish with flecks of greenish-blue or at times with a faint tinge of salmon; ventral scales

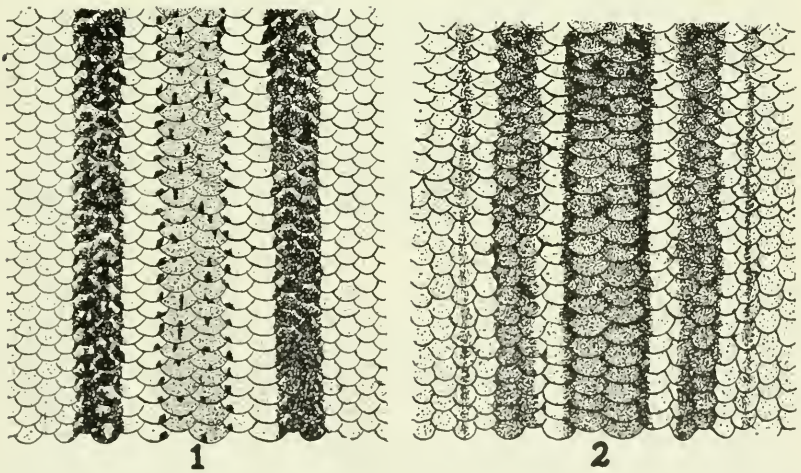

Plate 4. *Eumeces skiltonianus*: A - Dorsal pattern of *utahensis* type; B - Dorsal pattern of an Oregon specimen of *skiltonianus* (BYU 11550), 3X.

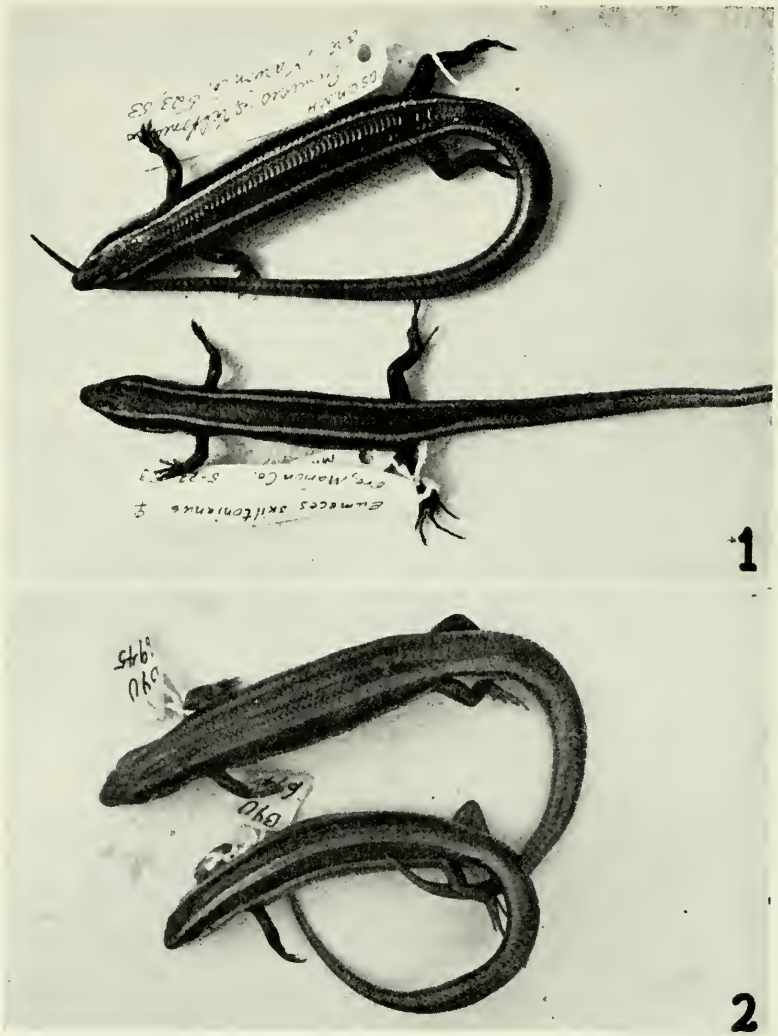

Plate 5. *Eumeces skiltonianus.* 1 - *skiltonianus* from Oregon; 2 - *utahensis,* type and paratype.

grayish tinged with bluish-green; gulars and labials of adult males pink to red; more obvious in spring and early summer. (A series taken May 18, 1957, at West Canyon. Utah County had a Light Coral Red on gulars and labials.)

Range: Southern Idaho, Nevada except the western edge from Lake Tahoe north, Great Basin in Utah, the drainage basins of the Virgin River and Kanab Creek, and Kaibab Plateau of southern Utah and northern Arizona.

Paratypes: Total 69 as follows: *Juab Co.*, Cherry Creek (BYU 9067). *Tooele Co.*, Government Creek (BYU 11969); Foust Canyon (UU 1671); 5 mi. N of Ibapah (UU 2637). *Utah Co.*, topotype (BYU 6946, 10402, 11970); West Canyon, north end of Cedar Valley (BYU 2217-39, 2292-3, 2849-50, 12652-9, 13133-8, 13738-51); Cedar Valley (BYU 537, 2099); Mercur Canyon (BYU 12651); Diamond Fork Canyon (BYU 2780); Spanish Fork Canyon (BYU 536, 1795-6).

Other Material: Total 126 as follows:

ARIZONA: *Coconino Co.*, Bright Angel Point north Rim Grand Canyon (BYU 11532, GCNP 367 and R 3737); 5 mi. E of Jacobs Lake (BYU 13142).

IDAHO: *Bannock Co.*: Lava Hot Springs (BYU 11645); Pocatello (KU 8258). *Brigham Co.*, (UU 201); *Cassia Co.*, between Malta and Idahome (MMZ 107240). *Ada Co.*, 5 mile Creek E of Boise (ISM 90). *Boise Co.*, Stack Rock (ISM 89). *Jerome Co.*, Jerome (AMNH 57697).

NEVADA: *Clark Co.*, Indian Springs Ranch, Pintwater Range (MMZ 90710). *Elko Co.*, 2 mi. N of Jarbridge (UN 210); W side of Ruby Mts. (KU 23363). *Eureka Co.*, Cortez Range W of Carlin (MMZ 43872-5). *Lincoln Co.*, Pioche (BYU 533). *Nye Co.*, Eden Creek Mine, Kawich Range (UN 3433-6). *White Pine Co.*, Canyon of Nigger Creek, Snake Mountains (UN 3555); Cleve Creek, Spring Valley (UN 3556); Lehman Caves, National Monument (BYU 13753-5); Lund (UN 4027).

UTAH: *Beaver Co.*, 12 mi. N of Beaver along Highway 91 (BYU 12661-4, 12705-6, 12725-6); Milford (BYU 535); Sulphurdale (BYU 8736). *Box Elder Co.*, 1 mi. W of Rosette (UU 2652). *Duchesne Co.*, Strawberry River, 2 mi. E of Timber Canyon (BYU 13782). *Kane Co.*, 22 mi. S of Alton (BYU 11625); 5 mi. N of Glendale (BYU 11541-8, 11551); 4 mi. N of Glendale (BYU 12667-75); Orderville (DC 227). *Piute Co.*, near Circleville (UU 1326). *Salt Lake Co.*, E of Salt Lake City (UU 361). *Sanpete Co.*, Ephriam (UU 189). *Sevier Co.*, 9 mi. SE of Sigurd (BYU 11639-42, 11759-60); .3 mi. E of Sevier-Millard line on Highway 13 (BYU 12660). *Summit Co.*, Peoa (BYU 648). *Washington Co.*, Pine Valley (BYU 650, 11549, 11743-52, 11968, DC 3, 111-5, 155, 169 a & b, 239 and 8 unnumbered specimens, 4 specimens from student collections (unnumbered RH two specimens); Pinto (BYU 10540); Mill Creek, Belveve (AMNH 22878-80); Dameron Valley (DC) (two specimens); Beaver Dam Summit (DC); Castle Cliff (DC); Water Cress Springs (DC) (two specimens); St. George (DC 235); Zion National Park (BYU 532, 647, 1797, 8763, 11972, DC unnumbered).

Eumeces skiltonianus interparietalis, n. subsp.
Coronado Island Skink

Type: California Academy of Sciences No. 13576, an adult male, collected on South Coronado Island, Baja California, Mexico, 7 April 1908, by Rollo Beck.

Diagnosis: This form is most closely related to typical *skiltonianus* with which it intergrades in San Diego and Riverside counties California. It is different to all other *skiltonianus* in having the interparietal reduced in size and enclosed posteriorly by the parietals, the median and lateral dark stripes extend from the body to or beyond the middle of the tail.

Description of type: Anterior and dorsal head plates normal for the species except for the following: interparietal reduced and enclosed posteriorly by enlarged parietals; nuchals 2-2, first noticeably larger and longer than width of dorsolateral stripe; supralabials

7-7, seventh largest; infralabials 6-6; one postlabial, separated from ear by a row of small scales; scale rows at middle of body 26, at base of tail 16; dorsals 60; ventrals 40; snout to vent 69.5 mm. total length 180 mm., ratio tail into total length 1.63.

Dorsolateral light stripe originating on the supranasals, faint anteriorly, but distinct from supraoculars posteriorly across the parietals, nuchals, and onto second and third scale rows. Dorsolateral stripe occupying slightly more than one half of second and third rows on body and for a short distance on tail; median and lateral dark stripes distinct and margined laterally by a darker brown stripe; and with these stripes extending beyond middle of tail; lateral light stripes distinct and margined ventrally by a row of brownish scales; ventral scales light olive, becoming lighter on throat.

Variations in Scalation and Color Pattern: Head plates normal for the species except for the following: supralabials usually 7-7, seventh largest, one or two postlabials, primary temporal usually in contact with lower secondary temporal, in a few specimens (CAS 13422, 55802, 57043) the upper secondary temporal is in narrow contact with the seventh supralabial; nuchals usually 2-2 (plate 3), first always largest and with a length equal to or greater than diameter of dorsolateral stripe near middle of body; scales in 24 or 26 rows; dorsals 52-61; ventrals 40-43; total dorsoventrals 92-103, average 99.3. Largest specimen examined 69.5 mm. snout to vent.

Dorsolateral and lateral light stripes distinct in adults; dorsolateral stripe occupying approximately one half of each of second ond third scale rows; median and lateral dark stripes of approximately same color and with the centers a lighter brown than margins, dark margins continuous, not broken up into small marginal spots as in some *skiltonianus* and most *utahensis*. Tail in young blue, in subadults and adults with dark stripes extending from the body to at least its middle.

Remarks: The extension of the striped pattern onto the tail is also seen in specimens of *skiltonianus* from the coastal ranges of California. However, specimens from north of San Diego County are generally less obviously striped on the tail and if so then with only an occasional one having the interparietal enclosed.

Specimens from the coastal ranges, and seemingly in the coastal environment have retained as adults, more pigment in the median and lateral stripes than occurs in the adults of other population of the species. This was first noted by Rodgers and Fitch (1947:196) in specimens from Northern Baja California and from San Diego, Ventura, Monterey, Sonoma and Mendocino Counties, California. Melanistic skinks undoubtedly occur further north and may explain why Cope (1898:643) described the variety *amblygrammus* from Humboldt County.

Range: North and western Baja California including the Coronado and Todos Santos Islands, and southern San Diego County, California.

Specimens Examined: A total of 124 as follows:

MEXICO. *Baja California*, South Coronado Island (CAS 13560-1, 13563-6, 13570, 13572-5, 13577; LMK 4813-4, 20072-3; MVZ 51197-51207, 5400); East Coronado Island (CAS 13462-7, 13470, and AMNH 5186); North Coronado Island (CAS 53953; AMNH 22721; USNM 52412, 75082, MVZ 64609-11, and 16716); Coronado Islands (CAS 13595-600 and USNM 64410); North Todos Santos Lsland (CAS 56841-2); South Todos Santos Island (CAS 5636-8, 56840 and SU 12107); Todos Santos Islands (USNM 37686 and MVZ 10487-9, 51191-6); San Pedro Mts. (USNM 23723); La Grulla (MVZ 9803 and 51118); San Jose (CAS 65812-4, MVZ 9654 and LMK 24402-3 and 5099); 6 mi. SE of Cape Colnett (CAS 57556); Ensenada (CAS 13422), 17 mi. N of Ensenada (MVZ 63504); Arroyo Ensenada (CAS 57043-4); San Quentin (CAS 55802); Alcatraz (CAS 57331); La Encantada (LMK 6101).

CALIFORNIA: *San Diego Co.*: Barona Ranch Alpine (KU 8794-5); (LMK 28628); Dulzura (SU 5239); El Capitan (LMK 21211 and 21215); Laguna Mts. (LMK 27095 and 27097); San Diego (LMK 28329, KU 113-4708); Palomar Mts. (KU 7306-10, MMZ 67361); Intergrades *skiltonianus x interparietalis; San Diego Co.*: Escondido (WSC 47-47); Oceanside (BYU 8335-8, 8719-25); Poway (MMZ 76865 five specimens). *Riverside Co.*: San Jacinto, (SU 21-26, 29 and 1252); Andreas Canyon S of Palm Springs (SU 11192); Snow Creek (SU 7936); Palm Springs (SU 11658).

Eumeces lagunensis Van Denburgh
San Lucan Skink

Eumeces lagunensis Van Denburgh, Proc. Cal. Acad. Sci. (2), V. 1895: 134, pl. XIII (type locality, San Francisquito, Sierra Laguna, Lower California, Mexico); Taylor, University Kans. Sci. Bull. 1935, 23:431-437.

Plestiodon lagunensis Van Denburgh and Slevin, Proc. Cal. Acad. Sci., Ser. 4, 1921, XI; 52; Van Denburgh, Occ. Papers Cal. Acad. X, 1922; 1:587-589.

Plestiodon skiltonianus lagunensis Nelson, Mem. Nat. Acad. Sci., 1921, XVI:114-115.

Eumeces skiltonianus Loveridge, Copeia 1930:111-112.

Eumeces skilonianus lagunensis Linsdale, Univ. Cal. Publ. in Zool. 1932, 38:374.

Range: In the southern third of the peninsula of lower California, from the Sierra de La Laguna north to Comondú.

Diagnosis: A member of the *skiltonianus* group but differing from *skiltonianus* in the following characters: seventh labial much enlarged, often nearly twice that of sixth labial; primary temporal reduced in size and separated from smaller, lower, secondary temporal by a broad contact between upper secondary temporal and seventh supralabial; interparietal reduced in size and enclosed posteriorly by parietals; usually 2-2 nuchals, first noticeably larger than the second; two lateral and two dorsolateral light stripes as in *skiltonianus*, all retained in adults; tail of young pink.

Description of the species: For a detailed description of this species, see Van Denburgh (1922) and Taylor (1935). The present description is brief, but is, because of the increased number of specimens available, given as a supplement to previous descriptions: Scale rows around middle of body 24; dorsals 57-(58.2)-60; ventrals 40-(42.1)-46; nuchals 2-2, occasionally 1-1, 1-2, or 3-3; first nuchal larger than second and its length equal to or greater than diameter of dorsolateral stripe; dorsolateral stripe on one half of second scale row; interparietal reduced and enclosed posteriorly by parietals.

primary temporal reduced in size and separated from lower secondary temporal by a broad contact of seventh supralabial and upper secondary temporal; postlabial single or double and separated from ear by one or two rows of small scales; lamellae fourth finger. 10-(11.1)-13, fourth toe 13-(15)-16; adpressed legs overlap in juveniles usually not in adults.

Color patern distinct in adults; dorsolateral stripes edged with a dark brown, darker in juveniles and becoming lighter in adults; lateral stripe usually with a dark ventral margin; tail of young pink, becoming olive brown in adults; stripes, both dark and light, extending onto base of tail, and in a few, visible for half the length of the tail.

Remarks: Except for the broad contact between the seventh supralabial and the upper secondary temporal, and the pink tail, all other characteristics are similar to those found in *E. s. interparietalis*. It is not as yet clear whether we should retain *lagunensis* as a distinct species or regard it as a subspecies of *skiltonianus*. Several characters suggest the latter, particularly the following: reduced and posteriorly enclosed interparietal, size of nuchals, reduced number of ventrals, supralabials reduced to seven, and the color pattern of the adults which is very similar, particularly between *lagunensis* and *s. interparietalis*. The similarities indicated are of such a nature as to actually imply a north-south clinal distribution between the later two. Furthermore, there are a few specimens of *s. interparietalis* in which the seventh supralabial and the upper secondary temporal are in narrow contact, however, not a single *skiltonianus* has been seen which would approach *lagunensis* in the broadness of this contact.

In the single young specimen which I have seen with the tail still pink (SU 19119), there is no evidence of blue having been present. Although it may be that we have some supspecies in *Eumeces skiltonianus* with blue tails and some with pink tails, as in *Eumeces gilberti*, this has not as yet been shown to be the case. There is a rather large area, between Comondú and approximately thirty degrees north latitude, from which material is not available. In as much as there are still some doubts concerning the true relationship of this skink, it is considered best to continue to recognize *lagunensis* as a distinct species.

Specimens examined: A total of 16 as follows:

MEXICO: *Baja California*: La Laguna, Sierra de La Laguna (SU 19119). Comondú (CNHM 25837-44, and MVZ 13760), trail between Loreto and Comondú (USNM 67398-403).

Ecology and Life History

The following observations have been made during the past fifteen years and are concerned primarily with the Great Basin Skink. Other subspecies of this species have not been carefully studies as yet, although it is suspected that much of the data presented below will be applicable to all segments of the species.

Habitat: Although *skiltonianus* has a wide distribution its habitat is restricted primarily to the scrub oak, sage brush and open grassy slopes in the Upper Sonoran, Transition and the lower part of the Canadian Life zones. One is not likely to find this skink in heavy brush; rather they occur in the open areas usually the rocky ridges or other small openings where shelter is present. However, brushy areas adjoining open rocky habitats are often used for foraging. They do not appear to inhabit lower valleys where deep soils or sands occur. In the Great Basin the alkaline valleys are uninhabited by skinks. As soon, however, as the rocky slopes bearing *Artemisia tridentata* or *Juniperus utahensis* are reached one may encounter skinks. I have been most successful while collecting in rocky areas in which oak brush (*Quercus gambellii* Nutt) forms a loose vegetative cover in association with sage, grasses and juniper. Such a habitat in the Great Basin occurs at an elevation of approximately 4500 to 7000 feet, although specimens have been taken at lower elevations in Washington County, Utah. Elevation is not the important factor in determining distribution since favorable habiats at much lower elevations in the coastal regions are ideal. Apparently rainfall sufficient to provide suitable vegetative cover and physical conditions which will provide loose rock for cover and soil for burrowing and nesting determine in general, the occurrence of these lizards. According to Rodgers and Fitch (1947:174), *skiltonianus* in the Great Basin "is spotty in occurrence and is restricted to the cooler, higher areas of certain mountain ranges." Such is undoubtedly true for the broken and isolated block ranges of Nevada and western Utah. However, along the central uplands of southern Idaho, Utah and northern Arizona the range of *skiltonianus* is nearly continuous as in the coastal regions, and not necessarily restricted to higher areas.

A specific area of habitat (plate 6) in northwestern Utah Co. indicates the type of vegetative cover which seemingly provides a near optimum habitat for this species. The photo was taken approximately fifty yards up the canyon from the nesting habitat described by me in 1939. The latter is now grown up with a heavy cover of sage brush leaving only small open areas and covering or shading the rocks previously used for shelter and nesting. Although some time was spent looking for skinks in the very same area where they were numerous in 1939, only one was found. This is in contrast to the five nesting females and seven other males and females found in 1939. From the marginal area, part of which is shown in fig. 1, my wife and I collected thirteen skinks: seven gravid females, three adult males and three juveniles. Since the adjoining area is of approximately the same size it is obvious that the western skink prefers a habitat with some open rocky patches, some shade, but not heavy brush. Concentrated skink populations have been found in many places throughout Utah and on a small open ridge 29 miles west of Red Bluff, California.

Such habitats tend to support a rather uniform population as

suggested by the population counts. However, some excepions have been found and will be indicated below.

In Oregon Fitch (1936:634) found skinks of the Rogue River area to sometimes occur in concentrated colonies in rocky open places in the forest. Skinks were seemingly common on grassy hillsides and in pastures which were strewn with flat rocks. On the basis of catalog entries made for skinks in western Oregon, Robert M. Storm indicates a rather wide use of decaying fir logs, with many being found by removing loose bark.

Habits and Behavior: Most skinks are secretive in habit and are usually not seen unless disturbed by turning stones or other types of cover. This is particularly true of *skiltonianus*, a form rarely seen abroad, although there are evidences to suppor a belief that they are commonly out foraging during the day. Their ability to escape detection is attested to by the rarity of their observation by people living in their habitat. Sportsmen and ranchers see them rarely or not at all. In more than ten years of field observation during which a considerable number of hours have been spent in areas inhabited by western skinks only seven animals have been seen abroad; three were adult males, two adult females, one sub-adult and one a juvenile less than a year old. Quite in contrast to the suggestion of Stebbins (1954:281), four were seen between 10 a.m. and noon, one, a female, was seen between 2 and 3 p.m. When collecting, one occasionally finds a skink under a loose rock or between rocks where there is no sign of burrowing. In a few instances such animals have, when disturbed, returned to their burrows under a nearby rock. These animals were undoubtedly foraging, and had used any nearby shelted for a temporary hiding place. Records concerning skinks found under rocks in which a tunnel was not found were only recently kept.

Dr. Stephen L. Wood has recently related to me his observation of this lizard, while vacationing at the Lehman Caves National Monument in eastern Nevada. His observations were made during July and the first of August in 1939. By quietly sitting on the steps of the ranger's cabin, skinks could be observed while foraging. If the observer remained quiet, close observation over a relatively long period of time was possible.

The habitat consisted of a rock wall on the downhill side of the trail leading away from the cabin steps and a few loose rocks along the foundation of the cabin. Within a relatively small area in front of the cabin as many as three adults were seen abroad at one time. After the first of August, a clutch of five young ones appeared and were often observed on the lower steps.

Dr. Wood assured me that his observations were made between the hours of 10—12 a.m. and again in the late afternoon between 5 and 7 p.m. Skinks were seldom seen during the warmer hours of the day and then only in shaded areas. These data plus the few lizards seen abroad indicate that *E. skiltonianus* may forage throughout

the day, but with a preference during the summer for the warming morning and cooling afternoon hours.

Linsdale (1938:29) reports a similar experience for the Toyabe region of southcentral Nevada. "On the afternoon of June 18, 1931, a skink came into the house at Mohawk R.S. It was frightened and ran quickly down a hole in the floor. On June 21, between 9 a.m. and noon, five skinks were shot and at least one other was seen, all within 15 feet of the northeast corner of this house. They were active along the east side of the house and along the base of an adjacent rock wall. On July 6, 1931, along North Twin River, 6500 feet, a skink was seen, but not captured, in midafternoon in leaf litter on rocky ground beside a trail in the bottom of the cañon."

Grinnell, Dixon and Linsdale (1930:148) report having seen one on a rock in a tumbled-down rock fence. The fence bordered an open, grassy pasture (April 27). On June 22, two western skinks were seen, momentarily before taking cover beneath large rotting logs. The latter was at mid-day on the floor of an open woods among black oaks, yellow pines, and incense cedars.

Zweifel (1952:9-10) found this species to be out foraging throughout the day but particularly so on days when the sun was obscured by high fog.

Caged specimens observed in the laboratory were active throughout the day, but were invariably under cover at night. Lizards placed in gallon jars with only a thin layer of loose soil were surprisingly capable of working themselves into the soil and gaining complete or partial cover. I have returned to the laboratory at night on many occasions and found them in hiding if cover was available.

The western skink is usually adept at burrowing in the loose soil of a rocky hillside. Burrows are nearly always made by tunneling along the side of a rock or if the slope is steep, under the rock from the lower side. Usually the tunnel terminates on the uphill side of the rock, often a few inches in the soil from the rock. Such is typical for females and most males, although in a few instances the tunnels of the latter have been found in rocky soil where they descend for eight to ten inches below the surface and are as much as fifteen to eighteen inches long. A few burrows have been found under prostrate sage or oak brush limbs. In such cases the tunnel runways extended into the roots of the sage or the base of the oak trunk. By far the greater number of burrows found in the areas studied have been associated with rock.

Tunnels dug by males average longer and are smaller in diameter, often being only slightly larger than the diameter of a pencil. Female burrows are shorter and terminate in enlarged chambers, which serve as "nests" during the incubation of eggs (Tanner, 1943:83). Such chambers may be three to four times the horizontal diameter of the skink, and provide considerable room for movement. The terminus of male burrows provides barely enough room for turning around. One burrow was terminated by making a loop around a small rock.

When foraging, this skink moves slowly and with a somewhat jerky motion. Observations indicate that they are quiet, making very little noise unless disturbed. Stebbins (1954:281) suggests that "When moving rapidly to escape capture, they progress largely by snakelike undulations of the body." This wriggling tail and snakelike undulating body may appear to unsuspecting observers to be their main method of movement, however, when deprived of the usefulness of their legs, they are immobilized. Observations indicate that the use of snakelike body undulations occur primarily when they are surprised while feeding, suddenly disturbed by turning a rock, or when attempting to escape immediate capture. Skinks seen in the open and those permitted to escape move with very little body undulaion or tail wriggling. Tail wriggling is more in evidence in juveniles and subadults. This is because of the long bright blue tail, which is made the most conspicuous part of the animal as it attempts to make its escape. Beginning students are often fooled by this habit and secure not the skink but only the wriggling tail. Meanwhile the less conspicuous animal has often found shelter and is saved. The older females and males with their more drab colored tails do not attract the same attention and actually do not appear to provide as much tail wriggling as do the juveniles. It has been suggested by others (Jopson 1938:90 and Stebbins, [Zweifel] 1954:283) that the blue tail and the habit of wriggling it has a survival value for skinks in general as well as for the western skinks. Whether native predators are attracted by the blue color and/or by the wriggling tail, as the case with many collectors, is still only surmised.

Feeding Habits: Data gathered previously (Tanner 1943:87) and that of recent years indicate the food of these lizards to consist almost entirely of insects. An occasional spider, centepede or sow bug is also taken. According to Zweifel (loc. cit.) they are occasionally cannibalistic. I have not observed this in the Great Basin Skink in nature nor in captivity. Caged specimens of various sizes and ages have been kept together for as long as three weeks without food and yet gave no indication of cannibalism. Small *Sceloporus* and *Uta* have also been unharmed.

Observations made during the beginning of the study had so impressed me with the apparent secretive methods employed by this species that I had suspected much of their feeding to occur in sheltered or covered areas. There inherent shyness, which compel them to remain close to the shelter of bushes, grass and rock, rarely being so bold as to venture over a rock or into an open area, does not prevent them from feeding on a rather wide variety of terrestrial arthropods.

While turning rocks in search of skinks I have always been impressed by the number of ant beds uncovered. Yet I have found only an occasional ant in the stomach contents of Utah skinks. Knowlton (1946) found no ants in four stomachs examined in the course of his studies of Utah lizard species feeding on ants. Taylor (1936:61), after examining the stomach contents of representatives

of this genus was surprised to find no ants although a wide variety of other anthropods were represented. Food items consist primarily of crickets, beetles, moths, grasshoppers, and other available arthropods. The following list of authors have found this species to be insectivorous and have indicated the following items of food: Van Denburgh (1922:583) states the food to be insects and that plant materials come from caterpillers eaten by the lizards. Woodbury (1931:61) observed caged specimens as they fed on flies. Fitch (1936:643) kept a specimen in a terrarium for three years. Its diet consisted of cutworms, maggots, earthworms, flies and cockroaches. Ferguson (1954:151) found them to readily feed on moths and other insects.

An examination of the stomach contents of twenty-five skinks taken in Utah during the years 1955-57 is as follows: Insect eggs, click beetle larvae, several different kinds of caterpillers with much finely ground plant tissue, cutworms, moths, maggots, beetles (carabids, scarabs, and weevil), grasshoppers, crickets, spiders and one had eaten four small yellowish-brown ants.

Reproduction: It is evident from records, both published and from my own field data, that the mating season in Utah may range through May and into the first part of June. This will vary from year to year depending on the earliness of the spring and from one locality to another depending on elevation.

During the spring and summers of 1955, 1956 and 1957 several series, taken at intervals, have been examined. Most have come from northwestern Utah County, although some have been seen from Beaver, Kane, Sevier and Washington Counties, Utah. By the first of May at least two or three weeks after emergence from hibernation, males have developed the reddish color (Light Coral Red, Ridegeway 1912) on the labials and gulars. As the season progresses the color covers a greater area and becomes more intense. At this time all adult males (two year old) can be distinguished from the females and from the subadult males (one year). The latter have the same color as adult males (see above), but with less area covered and without the intense color of the adults and can be easily segregated from adults by means of gular color and by their smaller size. Furthermore, the older males are found in larger numbers during April and May than at any other time. The finding of a male and female under the same rock is not uncommon in May, it has not been observed during July, August or September.

The seasonal change in the size and appearance of the testes also indicate that the mating season occurs principally during May. Actually the increase in size of the testes corresponds very closely to the increase in the labial and gular red color with both reaching their maximum size and intensity at approximately the mating season. Table 1 indicates the size of testes during and after the breeding season.

Unfortunately only one probable field record is available of mating in this species. A pair was observed in apparent copulation

on May 18, 1957. When first seen, the male was laying along the side of the female and with the posterior part of the body and tail curved under the female. They were discovered in an expanded cavity under a large flat rock. Both remained motionless for approximately 10 seconds after which both scurried for cover. The above record should not imply that mating in this species occurs only under cover. This species is apparently an active forager throughout most of the day during the spring when mating occurs. There is no reason to suspect that mating does not occur while they are abroad.

In the females, at the time of emergence from hibernation, the ovaries are filled with many small, but differently sized eggs. At this early date it is difficult to determine which eggs will actually develop or even those which may be potential. In some, a single ovary may contain 15 to 23 eggs ranging in size from .1 mm to 1.0 mm. In general they appear very much like those examined in females taken in late August and September. The larger eggs measure

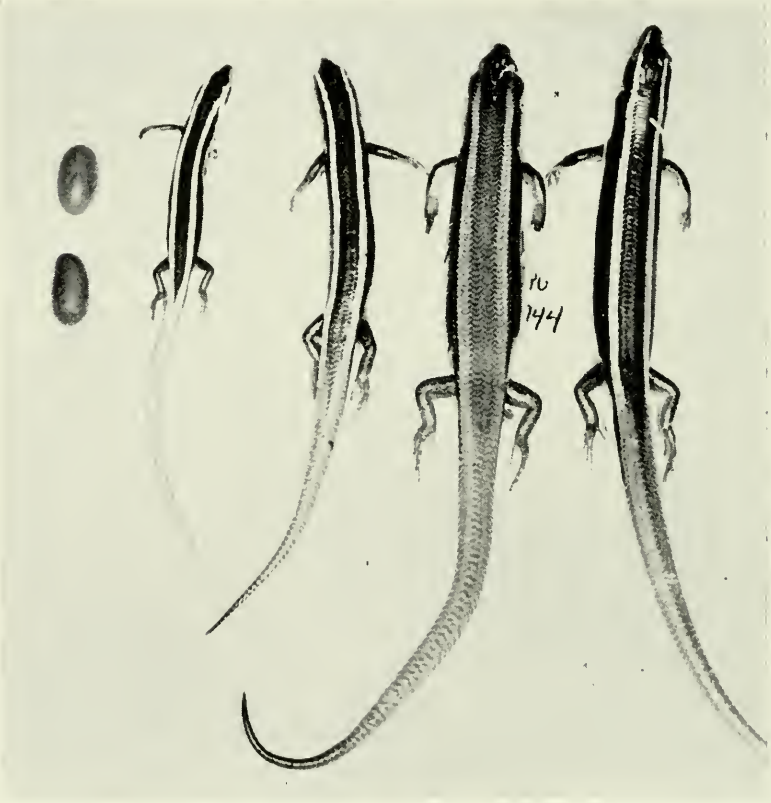

Plate 6. Age groups of *Eumeces s. utahensis* as they occur in late April or early May. Eggs are day old, layed July 11, 1957.

TABLE 1

Fluctuations in the sizes of testes from April to August in Adults of the Great Basin Skink.

Date	Museum Number	Length of Testes	Width of Testes	Snout to Vent	Approx. Age
27 Apr. 55	12468	6.5	3.7	67.6	Adult
27 Apr. 55	12476	6.8	3.1	64.0	Adult
27 Apr. 55	12473	7.6	3.5	60.1	Adult
27 Apr. 55	12474	6.4	3.5	58.8	Young Adult
2 May 56	13137	6.7	2.7	57.8	Young Adult
7 May 52	11545	7.0	3.4	62.0	Adult
10 May 52	11551	5.8	3.5	63.0	Adult
18 May 57	13744	7.2	3.9	64.0	Adult
18 May 57	13745	6.8	3.8	68.1	Adult
18 May 57	13746	7.0	3.8	60.5	Adult
18 May 57	13747	6.1	3.5	58.3	Young Adult
18 May 57	13749	6.7	3.5	62.9	Adult
25 June 57	13751	4.1	1.9	58.6	Young Adult
28 June 57	13756	4.7	2.7	64.0	Adult
28 June 57	13758	4.6	2.4	65.5	Adult
28 June 57	13761	4.5	2.0	62.8	Adult
4 Aug. 39	2237	4.5	2.3	61	Adult
23 Aug. 55	12671	5.4	2.7	65.2	Adult

TABLE 2

The numbers of potential eggs from early to late ovarian development.

Development Stage	Number of Potential eggs	Size of eggs max.	Size of eggs min.	Snout to Vent	Date	Museum Number
Early Ovarian	7 11	1.3	0.7	61.0	1 Jan. 47	8719
Early Ovarian	5 6	1.0	0.6	70.0	26 Apr. 52	11550
Early Ovarian	4 4	2.5	2.2	70.3	18 Apr. 53	11970
Early Ovarian	3 5	1.5	1.0	59.0	4 May 53	11968
Early Ovarian	6 5	1.6	1.0	65.0	5 May 53	11549
Early Ovarian	4 4	2.7	1.4	68.0	7 May 52	11541
Early Ovarian	4 6	2.5	1.2	64.0	7 May 52	11542
Early Ovarian	6 7	2.1	0.9	64.0	7 May 52	11543
Early Ovarian	3 4	3.0	2.1	62.0	14 May 54	11760
Early Ovarian	5 5	1.1	0.7	60.4	27 Apr. 55	12472
Early Ovarian	5 5	2.0	1.1	70.5	18 May 57	13753
Early Ovarian	4 4	2.4	1.6	66.4	18 May 57	13748
Early Ovarian	5 6	2.0	1.3	69.2	18 May 57	13766
Middle Ovarian	2 4	5.3	2.2	65.0	18 May 57	13750
Middle Ovarian	2 4	3.8	2.4	65.2	20 May 55	12639
Late Ovarian	3 3	8.6	7.3	65.5	6 June 52	11743
Late Ovarian	2 3	11.6	9.8	67.1	6 June 52	11744
Late Ovarian	2 2	9.6	8.2	61.5	6 June 52	11745
Late Ovarian	1 3	10.1	7.5	66.7	27 June 57	13762
Late Ovarian	2 3	10.0	8.2	63.5	27 June 57	13757
Late Ovarian	0 3	7.2	5.5	65.4	27 June 57	13759
Late Ovarian	2 3	10.0	8.5	62.2	27 June 57	13763
Late Ovarian	2 2	10.5	7.8	66.0	27 June 57	13764
Late Ovarian	2 2	13.7	11.1	57.5	2 July 55	12652

approximately 2.0 mm. in early May. By the middle of May the larger ones may measure 5-6 mm. This growth continues until the eggs are from 12 to 14 mm. long at which time they are layed. Egg laying occurs usually during the first two weeks of July in Utah.

According to Stebbins (1954:283) skinks taken in the vicinity of Berkeley, California contained from 7 to 10 eggs ranging in size from 2 to 6 mm. in diameter. Unfortunately, dates were not given. However, these figures correspond very closely with the development I have observed in Utah during the first two weeks of May. The normal occurrence of 7 to 10 eggs in the ovaries at this early date is not however, indicative of the numbers actually layed. Obviously there are more eggs produced by the ovaries, and then partly developed, then can be finally produced. Most of the ovarian eggs measured (Table II) had received varying amounts of yolk. During May and June the differentiation in size becomes greater, with fewer eggs being fed yolk until by the last of June, large, yolk laden eggs have been reduced to at last six and occasionally only two. Most fmales produce 3, 4, or 5 eggs. Table II will indicate the development and size of ovarian eggs.

There is a dearth of information concerning reproduction of this species from the coastal states. Van Denburgh (1922:584) reports a clutch of five eggs found in a burrow beneath a flat rock in a rock pile. This find was at Pacific Grove, California about June 15, 1898. The eggs were far advanced in incubation and were probably witihn two weeks of hatching.

Rodgers and Memmler (1943:64) have presented some data on egg laying and hatching dates for skinks taken within two miles of Bald Peak in the Berkeley Hills of extreme western Contra Costa County, California. These data are summarized as follows: Three clutches were laid in captivity on July 5, 11, and 14. Three nests were found in the field on July 15, July 21 and on August 9. There is no indication as to the numbers of eggs in each clutch. Those found in the field on July 15 hatched on August 16, 1942.

According to Gordon (1939:71) "eggs are few in number and deposited in the ground."

Apparently egg laying may begin during the latter part of June and extends into July. Here again, the season and elevation will have a decided effect on the date. In Utah nesting activities may begin in late June but records for this are only for July and August. One female (BYU 12652) taken July 2, 1955, extruded two eggs while being caught. Apparently the pressure applied in pressing her to the ground was sufficient to force out the nearly mature eggs. There were four eggs to be layed including the two extruded ones. The largest egg measured 14 mm. long, and the smallest is 11 mm. Eggs found in the field after the fifteenth of July have measured 15 or more mm., and have increased in size until 17 or 18 mm. was reached before hatching. This increase in size results from the stretching of the pliable membranous shell when water is absorbed by the egg from the soil.

Plate 7. General habitat areas of *Eumeces skiltonianus*. Fig. 1 - General view of West Canyon area. Fig. 2 - Nesting area of 1939, now grown up with sage (*Artemisia* and *Chrysothamnus*).

It is during the mating season that skinks are most easily found and apparently most often seen abroad, since nearly all collection records are for May, June and July. In April and May, males and females can be taken in approximately equal numbers in the habitat. In late June and until September, more females are taken than males. This is based on many series taken during these months over the past

ten years. On June 28, 1957, thirteen skinks were taken from a small area; of these three were adult males (see table I), seven were gravid females and three were subadults. A series of approximately fifty adults taken in four different localities during the months of July and August is thought to be significant in as much as the ratio between females and males is approximately 2:1.

On occasional years adverse weather conditions may reduce the hatch; for example, following the drought of 1956, only a few young were seen in the spring of 1957. The young of the previous year usually represent a uniform percentage during the summer. By late July or early August the hatchlings begin to appear, their numbers increasing until the entire season's hatch is completed in middle or late August.

In a previous study (1943:83) I described several nests of this species from the north fork of West Canyon in northern Cedar Valley, Utah County, Utah. Two additional nests are described below, both coming from widely separated areas in Utah.

On August 21, 1955, 12.3 miles north of Beaver, Beaver County Utah, 100 yards west of highway 91, a nest of five eggs and the attending female were found. The largest egg measured 18 mm. and the smallest 16 mm. long. The female has a snout-vent length of 65.5 mm. The locale is on a south slope with scattered oak, service berry and junipers among the dominent sage. Occasional patches of loose rock in open areas provided the specific habitat for the skinks. The nest was found on the uphill side of a rounded rock. The rock was approximately 15' x 15' and about 8' thick. The opening to the tunnel was on the side of the rock. By dipping slightly it then extended around the rock to the nest. The opening to the nestling chamber was 3 3/4 inches below the surface and 3 inches above the floor of the hole left by the rock. Two eggs in the mouth of the chamber were clearly visible. This chamber was extended into the soil for approximately 5 inches and was slightly enlarged posteriorly. Not until the first egg was removed from the narrow opening did the female appear, nor could she be seen. Because of recent rains the soil was wet and loose, and the eggs were coated with an almost uniform layer of mud, indicating that they had been tumbled about by the adult. Whether the turning of the eggs by the attending female is a common procedure or is done accidently is not known. Air temperature was 32 degrees C., soil temperature among the eggs was 30 degrees C. One egg was broken, presumably by the female at the time of collecting. The others began hatching in the laboratory on August 26, at 10:30 a.m. At this time two heads were out. For several hours little activity was noted. In each case the young skink lay with its head out as if it were resting. At 2:00 p.m. one had left the shell. The next morning both hatchlings were chilled and measured. Snout-vent lengths were 29 and 28 mm., the total lengths were 67.5 and 65.0 mm. respectively. Both were kept in a small cage with moist towels and a small dish of water, but no food. Every few days they were measured, in all, four measurements were taken over a

period of two weeks. For the first ten days growth was observed, each lizard gaining approximately 2 mm. in their snout-vent length. Presumably there was enough yolk available to the hatchling to maintain its normal metabolism for the first 10-15 days after which normal feeding must occur. After several days the remaining two eggs were opened, one contained a dead, but apparently mature skink, the other contained a live embryo, but yet several days from hatching. It had a snout-vent length of 26 mm. and the yolk sac was not yet absorbed. In other clutches of eggs hatching was completed within 24 hours.

On August 23, 1955, at 11 a.m., 4.1 miles north of Glendale, Kane County, Utah, a nest of five recent hatchlings was found with an adult female under a large, flat, limestone rock. The locale was on a steep southeast slope, with oak and juniper as the predominant plant cover. Because of the steepness of the slope the uphill portion of the rock was covered with soil. Again the nesting chamber was at the uphill edge of the rock, and extended for approximately nine inches along the rock and from two to three inches beyond the rock into the loose moist soil. On moving the rock, the hatchlings scattered in several directions, while the female remained to run back and forth in her now exposed chamber.

Two gravid females taken in north fork of West Canyon, Oquirrh Mts., Utah Co., Utah, were placed in a cage June 27, 1957. Loose sod and rocks were placed in the cage to provide opportunities for shelter and nesting. Tables I and II give the size of eggs and testes in others taken at the same time. On July 9th one female was killed by the other while attempting to nest. One egg had been layed and was near the edge of a rock previously used by both skinks as a shelter. The scarred and twisted skin around the head and neck of the dead one indicated a rather ferocious struggle. Three eggs were still in the oviducts of the dead female. On July 11th the remaining female layed 4 eggs in a small cavity between the two rocks used for shelter and presumably where the first female had attempted to nest. The eggs were layed between 11:30 a.m. July 10th and 10:00 a.m. July 11th. The eggs measured 14.6 x 7.3; 13.1 x 7.2; 12.8 x 8.1; 12.8 x 7.9 mm. The eggs weighed 6.0, 4.6, 5.5, and 5,5 grains respectively, averaging 5.4 grains. The single egg layed by the other femals was 12.5 x 7 mm.

During the first two weeks the room temperature varied between 77° and 80° F. By removing a small cap rock the nest could be observed. For the first two weeks no perceptible changes occurred except that the eggs were moved by the female each day. On July 24, the nest had been noticeably deepened and only three eggs remained. No trace of the fourth egg could be found. By this date the eggs were preceptably larger, and measured as follows: 15.1 x 8.5 (previously this egg was 14.6 x 7.3); 13.8 x 8.2; 13.6 x 9.6. They now weighed 8.5, 10.0 and 9.8 grains respectively. The longest egg could be easily differentiated from the others and was thus observed to have increased in size by .5 x 1.2 and to have gained 4.1 grains in weight.

This was approaching twice the weight of the egg at the time of laying. The eggs were now taut and would roll on a smooth surface.

Several hours after returning the eggs to the nest, a check was made to see if the female was continuing to expand and deepen the nest. She had moved the eggs again and a second had been broken. It contained a live embryo which was well formed. The legs were

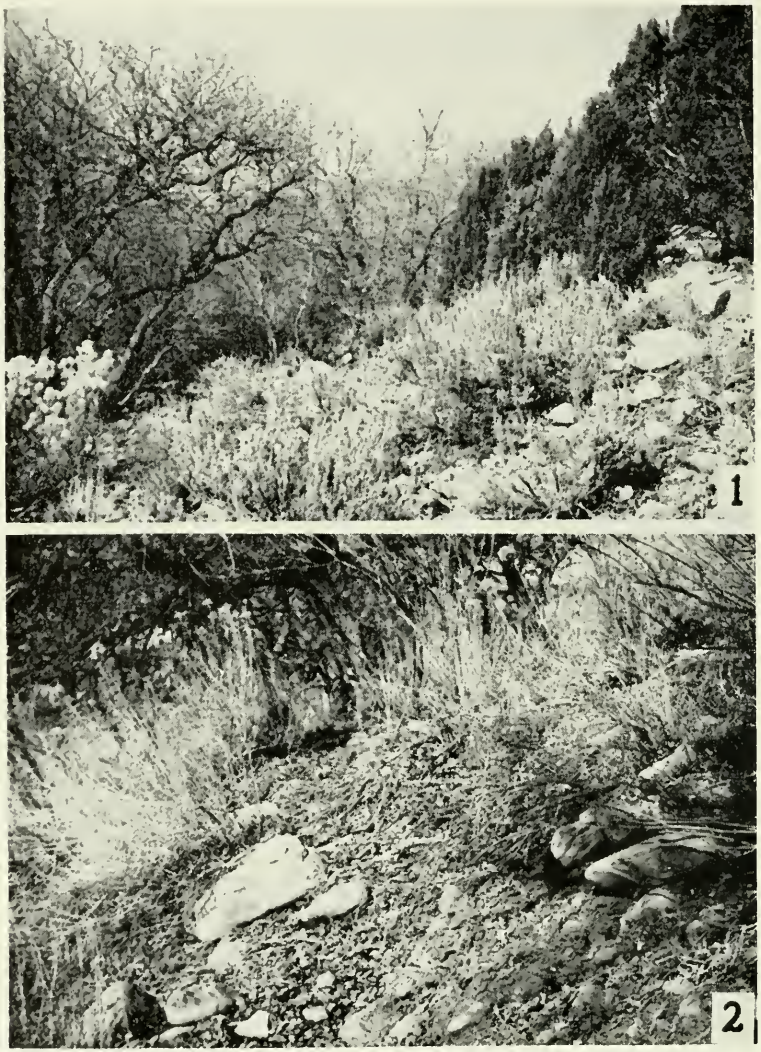

Plate 8. Specific habitats in West Canyon nesting area. Fig. 1 - Nesting area a short distance up canyon from Plate 7, Fig. 2 - where gravid females were taken June 27, 1957. Fig. 2 - rocks and brush relationships in the specific habitat.

present but with webbed toes, tail long, head large with large eyes, and with the parietal and occipital centers bulging; snout, jaws and nasal openings were well formed. The circulatory system was in evidence in the membrane of the yolk sack. Body and head scales had not yet formed.

For the first two weeks the female was relatively docile. Each day she appeared to be content to remain in the original nest with the eggs. Once she began to dig (July 24) her activities continued until all of the eggs were broken. The third on July 27, and the last on July 29.

Females disturbed while brooding their eggs vary in their response. Some remain in the nest, others dart in and out, and some desert their nest. Where it has been possible to leave the nest and return for further observations each deserted nest has been re-entered and repairs made, often resulting in considerable digging and moving of the eggs. In one case (Tanner, *op. cit.*) the female refused to leave her eggs and offeered resistance by biting a stick used to roll an egg from the nest. After several attempts, one egg was rolled a few inches away from the others and lay on the edge of the enlarged chamber. At this time the female darted out, seized the egg, bit it and returned into the nest. The egg membrane was ruptured by the bite.

On the basis of seven nests observed in the field and one in captivity it appears that all females do not occupy their nest nor brood their eggs in exactly the same manner. Two were seen to coil around the eggs, three lay along side of them, but in the posterior part of the chamber. In one, the eggs were in a nest to one side of the chamber with a slight ridge of loose soil separating them from the other part of the chamber and the female. In nests bearing recent hatchlings it was not always possible to ascertain the brooding positions; however in most cases the chambers are so constructed as to provide for the nest near the middle. In cases where the eggs were left in the nest and observed for several days after disturbing them, a reconstruction and extension of the chamber usually resulted in producing a different brooding position than was first observed. Although conclusive evidence is not yet at hand, that now available and particularly that obtained from the female in captivity, suggests a turning of the eggs and perhaps several positional changes of the eggs during the course of the incubation period.

All nesting chambers have been found under similar environmental conditions. Five nesting areas known to me are all with a south exposure in open rock areas where considerable warmth from the sun may be received. On clear days the soil for several inches below the surface is warm to the touch with a temperature on the floor of the nests of 28° C to 33° C late in the afternoon.

Field data suggests a definate tendency toward gregariousness in this species. Upon several occasions areas which appeared to be ideal were barren. Whereas an open area of similar size and type a short distance away produced a series of skinks an hours later, often

with less effort. As indicated by Fitch (1936), there is a fluctuation in population densities from year to year in a given locality. I have observed this in collecting areas in Kane, Washington, and Utah Counties, Utah.

At first one is inclined to believe in territories for the breeding populations. However, this does not seem to be the case even though the nesting females appear to be evenly spaced in the habitat. Careful collecting has shown that males, barren females (usually subadult) and juveniles inhabit burrows at irregularly spaces distances making the protection of territories seem quite impossible. Once a nest is established some females do offer resistance to intruders by biting and by digging the burrow deeper.

SEXUAL VARIATIONS: An individual of either sex has a brightly colored and distinct pattern for the first year or year and a half. Juveniles always exhibit a sharp contrast of four light (whitish) stripes separated by three wider stripes. In the older adults with dull colors, the light stripes become faded, tending to blend with the darker stripes which in turn become lighter in color. Thus the sharp contrasting striped condition is less apparent in adults of the Great Basin Skink than in the Western Skink from northern California and Oregon. Specimens from southern California, particularly in San Bernardino and Riverside counties and an occasional specimen throughout the entire range may show the faded pattern. The blending or fading of the color pattern is not restricted to one sex as in some of the subspecies of *Emueces gilberti*.

Except for the reddish color developed by the males during the mating season there is no other external secondary sex characteristic which will aid in an accurate determination of the sexes. in most genera there are postanal scales or tails with the base enlarged in male animals. This is not true in this skink, in fact the tails and their scale patterns are so alike that I have been forced to dissect to be accurate.

Age Variations. There are at least three age groups which can be recognized in a population. These are perhaps best seen in the spring at which time the following groups are readily recognized in a local population.

TABLE 3

The number of eggs observed in eight clutches of the Great Basin Skink.

Date Collected	Number of Eggs	Maximum Size	Minimum Size	Type of Nest	Date Hatched
3 Aug. 1939	4			Natural	
3 Aug. 1939	4	16x10 mm.	15x9 mm.	Natural	10 Aug. 1939
3 Aug. 1939	4			Natural	
3 Aug. 1939	4			Natural	13 Aug. 1939
4 Aug. 1939	2			Natural	8 Aug. 1939
21 Aug. 1955	5	18x10 mm.	16x9 mm.	Natural	26 Aug. 1955
23 Aug. 1955	5			Natural	25 Aug. 1955
11 July 1957	4	14.6x7.3 mm.	12.8x7.9 mm.	Captivity	

Age Group one: The hatchlings of last August, these are approximately 35-45 mm. snout to vent. The tails are bright blue and the striped body pattern is very distinct.

Age Group two: Yearlings past, these range from 48 to 55 mm. snout to vent, and have the pattern of group one.

Age Group three: Adults, two years old and older, these are from 56 to 70 mm. snout to vent. These are the breeding adults, although there is evidence that many of the males in group two may breed. In this group the tail may be olive to gray or perhaps bluish-green and the dorsal striped pattern is faded, sometimes to the point of obscurity.

The gravid female (BYU 12652) taken on July 2, 1955, and discussed above, was only 56 mm. in snout to vent length. Although there are no field data available, the size of the individuals seem to indicate that a few of the larger females may also mate the second spring, and attain to a snout to vent length of 55 or 60 mm. by the time the eggs are layed. Other females taken during the nesting season either with eggs or newly hatched young, have ranged between 58 to 66 mm. in snout to vent lengths. A series of twenty-one males taken from nesting areas, range from 53-66 and average 60.0 mm. in snout to vent length. Thirty-four females from the same area range from 55-77 and average 63.8 mm.

In general these data colaborate the findings of Rogers and Mennmler (*op. cit.*), and Rogers and Fitch (*op. cit.*) in their studies of age groups in this skink in California. Studies of growth and of age groups are best done on a local population over a period of several years. Preserved specimens taken from many localities, at different times of the year, for many years will provide an age group picture not appreciably different than the one given by Taylor (*loc. cit.*), and for these reasons: First, the difference in elevation and slope exposure will indicate differences in which those populations at 4500 to 5,000 feet will have the hatchlings abroad 10 days to two weeks in advance of those above 6,000 feet. The latter would also be forced into hibernation earlier and would thus be smaller in May than those at lower elevations. Second, some seasons are much earlier providing not only an opportunity for more growth in young ones, but also in providing for earlier hatchlings. Third, the wide distribution of this species from Baja California north of British Columbia and east into the Great Basin provides a terrain so deversified and varied as to climate and seasons that one could not expect to have uniformity of growth in a series taken from such a wide area.

Hatchlings taken on the same date in May, after the first hibernation, but at different years have averaged as much as five mm., more or less, in snout to vent lengths. This is also true as regards

elevation. It is perhaps true also of populations separated by a hundred or more miles in which one has been effected by adverse weather such as an early fall, late spring, or a drought. Factors which interfere with feeding, particularly in hatchlings, retards their growth.

Thus, if series from different localities are analyzed as a unit more age groups are seemingly present than actually exist in a single population.

Growth, as in other reptilian forms is seemingly continuous, although the rate is irregular and much reduced, after the individual attains a snout-vent length of 60 mm. Reliable data are not available to indicate longevity in this species.

Predators and Parasites

There are few recorded instances of predation in this species. Zweifel (*loc. cit.*) found skinks in two of eight rattlesnakes (*Crotalus viridis caliginis*) examined from South Coronado Island. Tanner (*loc. cit.*) removed four hatchlings from a small garter snake (*Thamnophis elegans vagrans*) in western Utah County, Utah. Although there are many other probable predators in the habitats occupied by skinks, actual predation has not been recorded.

On the basis of predation in other species of *Eumeces* (Fitch 1954 and 1955) one might also expect these skinks to be the pray of certain hawks, mammals and other snakes. Of the several species of hawks seen in the habitat of the Great Basin Skink none are known to be its predators, although all are known to prey upon reptiles. Bulletins referring to the diet of these hawks list all species of lizards and snakes merely as reptiles. I have examined the nests of several hawks (red-tailed and swainsons) without finding evidence of skink predation, although three species of snakes have been identified. In Utah, such snakes as: *Crotalus v. lutosus*, *Hypsiglena t. deserticola*, *Lampropeltis d. taylori*, and *Diadophis r. regalis* have been taken in the same habitat as these skinks and may include skinks in their diet.

Some evidence of attempted predation is apparent in several large series, in which from five to ten percent of the individuals possess either body scars or regenerated tails.

Little is known concerning the kinds of parasites that infest this skink, or their importance in its ecology. In the many parasitalogical studies including hosts of the western United States, I have not found a single reference to parasitism in *Eumeces skiltonianus*. I have not attempted to investigate the internal parasites although some round worms have been seen while examining stomach contents. The following ectoparasites have been identified by my colleague Dr. Dorald M. Allred.

April 27, 1955, ten specimens taken 29.5 miles east of Red Bluff, along Highway 36, Tahama Co., California, were infested with: one numph, *Ixodes pacificus* Cooley and Kohls; seven fully engorged

larvae, 5 slightly engorged larvae and 2 unengorged larvae. The larvae belong to the genus *Ixodes* and are presumably of the species listed above.

August 16, 1955, two of eight specimens taken in the south fork of West canyon, northwestern Utah Co., each were infested by single larval specimens of the chiggar mite *Trombicula belkini* Gould.

August 22, 1955, one of two specimens taken near the forest camp grounds, Pine Valley, Washington Co. Utah, was infested by a single larval chiggar mite also *Tromicula* belkini Gould.

August 23, 1955, two of ten specimens taken 4 miles north of Glendale, Kane Co., Utah, also had a single larvae of the above listed chigger mite.

In each instance the ticks and mites were attached to the exposed skin between the granular scales in the axilla or around the base of the hind legs. Perhaps the smooth tightly fitting body scales prevents body attacks and reduces generally the ectoparasites in this species.

A survey of the data available indicates that the Great Basin Skink is not heavily infested at any time but with some occurring during the late summer, primarily during August. Utah specimens examined during May, June, and July were not ectoparasitized.

Literature Cited

Baird, Spencer S. and Girard, Charles. 1852. Characteristics of some new Reptiles in the Museum of the Smithsonian Institution. Proc. Acad. Nat. Sci. Phila., 6:68-70.

Baird, Spencer F. and Girard, Charles. 1852. Reptiles. *In* Stansbury, Expl. Surv. Val. Great Salt Lake, pp. 348-350, fig. 4-6.

Cope, E. D. 1900. Crocodilians, Lizards and Snakes of North America. Annual Rept. U.S. Nat. Mus. 1898: 640-644, fig. 126.

Erwin, Richard P. 1928. List of Idaho reptiles and amphibia in the Idaho State Historical Museum, Biennial Report, State Hist. Soc. of Idaho. 11:31-33.

Ferguson, Denzel E. 1954. An annotated list of Amphibians and Reptiles of Union County, Oregon. Herpetologica 10:151.

Fitch, Henry S. 1936. Amphibians and Reptiles of the Rouge River Basin, Oregon. Amer. Mid. Nat. 17:643.

Gordon, Kenneth. 1939. The Amphibia and Reptilia of Oregon. Oregon State Monographs. Oregon State College. Studies in Zoology 1:1-82.

Grinnell, Joseph; Dixon, Joseph and Linsdale, Jean M. 1930. Vertebrate Natural History of a section of Northern Calif. through the Lassen Peak Region. Univ. Calif. Pub. Zool. 35:148.

Hallowell, E. 1859. Report upon the Reptiles collected on the Survey. Expl. Surv. R.R. Route to Pacific. 10 (4):10. pl. 9, figs., 3a, b, c, and d.

Jopson, Harry G. M. 1938. Observation of the survival value of the character of the blue tail in *Eumeces*. Copeia, p. 90.

Knowlton, George S. 1946. Lizards Feeding on Ants in Utah. Jour. Entom. 39: (4) 546.

La Rivers, Ira. 1942. Some New Amphibian and Reptile Records for Nevada. Jour. Entom., Zool. 34:62.

Linsdale, Jeam M. 1932. Amphibians and Reptiles from Lower California. Univ. Cal. Pub. Zool. 38:373-374.

——1938. Environmental Responses of Vertebrates in the Great Basin. The Am. Mid. Nat. 19:29-30.

Rodgers, Thomas L. and Fitch, Henry S. 1937. Variations in the Skinks (Reptilia: Lacertilia) of the *skiltonianus* Group. Univ. Calif. Pub. Zool. 48:169-209, fig. 1, pl. 8.

Rodgers, Thomas L. and Memmler, Viola H. 1943. Growth in the western Blue-tailed Skink, Tran. San Diego Soc. Nat. Hist. 10: 63-67.

Rodgers, Thomas L. and Jellison, William L. 1942. A Collection of Amphibians and Reptiles from Western Montana. Copeia, p. 11.

Schmidt, Karl P. 1953. A Check list of North American Amphibians and Reptiles. Univ. Chicago Press, p. 152.

Smith, Hobart M. 1946. Handbook of Lizards. Comstock Publishing Co., pp. 378-384, pl. 106.

Stebbins, Robert C. 1954. Amphibians and Reptiles of Western North America. McGraw-Hill Field Guide series, p. 322, pl. 55.

Steijneger, Leonard, and Barbour, Thomas. 1943. A Check list of North American Amphibians and Reptiles. Bull. Mus. Comp. Zool. Harvard 93:113.

Tanner, Vasco M. 1928. Distributional list of the Amphibians and Reptiles of Utah. Copeia. 163:56.

Tanner, Wilmer W. 1941. The reptiles and amphibians of Idaho No. I. Great Basin Nat. 2:95.

——1943. Notes on the life history of *Eumeces skiltontianus skiltonianus*. Great Basin Nat. 4:81-88.

Taylor, Edward H. 1936. A Taxonomic study of the Cosmopolitan Scincoid Lizards of the genus *Eumeces* with an account of the distribution and relationships of its species. Univ. Kansas Sci. Bull. 23:315-428. fig. 68.

Van Denburgh, John. 1895. Proc. Calif. Acad. Sci. 5:79, 134-135, pl. 8.

——1922. The Reptiles of Western North America. Lizards. Occ. Pap. Calif. Acad. Sci. 1:578-689, pl. 56.

Woodbury, Angus M. 1931. A Descriptive Catalogue of the Reptiles of Utah. Bull. Univ. Utah 5:59-61.

Zweifel, Richard G. 1952. Notes on the lizards of the Coronados Islands, Baja California, Mexico. Herpetologica 8:9-11.