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NOTES ON REPRODUCTION OF THE SIDE-BLOTCHED LIZARD *UTA STANSBURIANA STANSBURIANA* IN SOUTHWEST IDAHO

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Abstract.— In 1968 and 1973 in southwestern Idaho, 275 *Uta stansburiana* were collected. *Uta* occupies low hills with rocky outcrops and flat sparse vegetation consisting of the following shrubs: *Artemisia tridentata, Grayia spinosa, Atriplex confertifolia, Chrysothamnus nauseosus,* and *Atriplex canescens.* Emergence from hibernation occurs from mid-March to early April and the first yolked follicles appear in early April, with oviducal eggs present in late April. Testicular cycle begins with the emergence of males, and spermatozoa are produced from April through July. *Uta* reaches sexual maturity in one year at a SVL of 40.0 mm in males and 43 mm in females. Overall clutch size is 3.75 eggs (1–2 clutches per year). Fat body size at emergence is not known, but what is present shows a decline in males and females until July, when a substantial increase occurs. Sex ratios are about 1:1 in all months and seasons except June 1968, according to chi-square analysis.

This study has limited scope for two reasons: (1) the years of study are five years apart; (2) in 1968 there were only six trips to the field (which was about 10 miles from the 1973 area) in May and June, whereas in 1973 field trips were made once each week from 4 April through 25 July. In view of this, the 1968 data are minimized to some extent in drawing our conclusion and emphasis is on the 1973 data. Despite these limitations, the study sheds some light on the reproductive cycle of *Uta stansburiana* in the northern portion of its range.

Uta has been studied in considerable detail in Texas (Tinkle 1961, 1967a, Hahn and Tinkle 1965), Colorado (Tinkle 1967b), southern Nevada (Hoddenbach and Turner 1968, Turner, Hoddenbach, Medica, and Lannom 1970, Medica and Turner 1976, Tanner 1972), and Oregon (Nussbaum and Diller 1976). Our results show that latitudinal (and therefore climatic) differences exert observable modifications of the reproductive cycle as compared to that of southern populations in Colorado, Nevada, and Texas, which are 800–1200 km south of our study, respectively. In the case of the northern population studied by Nussbaum and Diller (1976), our results are similar in some aspects, as would be expected, since their study area is only 225 km further north.

Physical and Biotic Environment

These counties included in the study area are part of the Snake River Valley (Fig. 1). Elevations of study sites and collection areas range from 530 to 750 m. Dominant topographical features consist of small canyons, which are a part of the Snake River Drainage, low rolling hills, boulder-strewn areas, rocky outcroppings, and intermittent streams that form sandy washes and/or alluvial fans

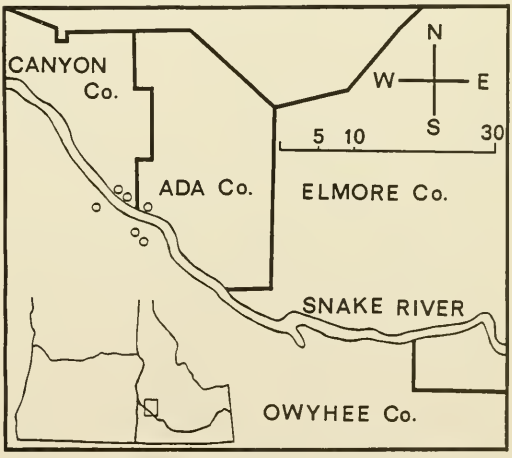

Fig. 1. Geographic location for capture sites (hollow circles) of *Uta stansburiana* in southwestern Idaho. Insert shows the portion of Idaho where collections were made.

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where they reach the desert floor. Annual rainfall varies from 10.1 to 30.4 mm; most of this occurs as snow in winter (Shreve 1942). Summers are typically hot and dry, with few overcast days. Frost free days average 150 per year from April to September.

The dominant floral description for the study areas is that of "cold desert formation" (Shreve 1942). The dominant floral associations consist of several different combinations of the following desert shrubs: *Grayia spinosa* (Hook.), *Atriplex canescens* (Pursh, Ex. Nutt.), *Atriplex confertifolia* (Torr.), *Artemisia tridentata* (Nutt.), and *Chrysothamnus nauseosus* (Poll.). These shrubs reach heights of 1 to 1.8 m and grow in a clumped pattern that creates open areas (Burkholder and Walker 1973). Many species of annuals are present in the open areas between the shrubs, the majority of which flower during the early and midspring rainy period. Others flower during the occasional rainy periods of late spring and summer.

Methods and Materials

Specimens for this study were collected in 1968 and 1973 in Canyon, Ada, and Owyhee counties of southwestern Idaho. All lizards were weighed, measured (SVL), and autopsied (except hatchlings). The ovaries and oviducts of the females were removed and counts were made of yolked ovarian follicles, oviducal eggs, and corpora lutea. Yolked follicles and oviducal eggs were measured to the nearest 0.1 mm and weighed to the nearest .01 g. In males, one testis was removed and used to determine sexual maturity by a squash preparation using aceto-orcein stain. Clutch size data followed the procedure outlined by Tinkle (1961). Fat bodies were also removed and weighed to the nearest .01 g.

Table 1. Sex ratios for six samples of *Uta stansburiana* in 1968 and 1973. Each year total was tested for goodness of fit by the chi-square statistic as well as the month of June, where the largest differences occurred. All fit the 95 percent confidence limit except June 1968.

Month	Year	Females	Males
May	1968	14	13
June	1968	20	37
Total		34	50
Chi-square test .95 = 5.06 for June			
Chi-square test .95 = 3.04 overall			
April	1973	20	16
May	1973	29	33
June	1973	23	32
July	1973	18	20
Total		90	101
Chi-square test .95 = 1.472 for June			
Chi-square test .95 = .632 overall			

Results

Sex ratio.— Sex was determined in 275 specimens by the examination of gonads. In May and June 1968, 34 females and 50 males were collected. The April through July 1973 sample consisted of 90 females and 101 males. Both years combined resulted in 124 (45.1 percent) females and 151 (54.9 percent) males. Data for sex ratios are summarized in Table 1. Statistical analysis for fitting the expected ratio of 1:1 are also included in Table 1.

Size at maturity and at hatching.— Size of individuals when reaching sexual maturity was determined by analyzing the gonads. In females, yolked ovarian follicles, oviducal eggs, and corpora lutea were used as criteria for maturity. From this analysis, it was determined that the smallest sexually mature female was 43 mm SVL for the 1973 sample and 44 mm SVL for the 1968 sample.

Size at sexual maturity in males was determined by analysis of a single testis removed from each male. An aceto-orcein squash preparation was performed to check for the presence of mature spermatozoa. All male specimens, even the smallest at 40 mm SVL, yielded a positive test for spermatozoa. The

Table 2. Data for hatchling *Uta stansburiana* captured in July 1973. Two lizards not listed were observed on 26 June but not captured.

SVL (mm)	Date Captured
26.0	3 July
25.5	18 July
25.0	23 July
25.0	23 July
26.0	23 July
31.0	23 July
31.0	23 July
31.5	23 July
36.0	23 July
28.0	25 July
29.0	25 July
31.0	25 July
33.0	25 July

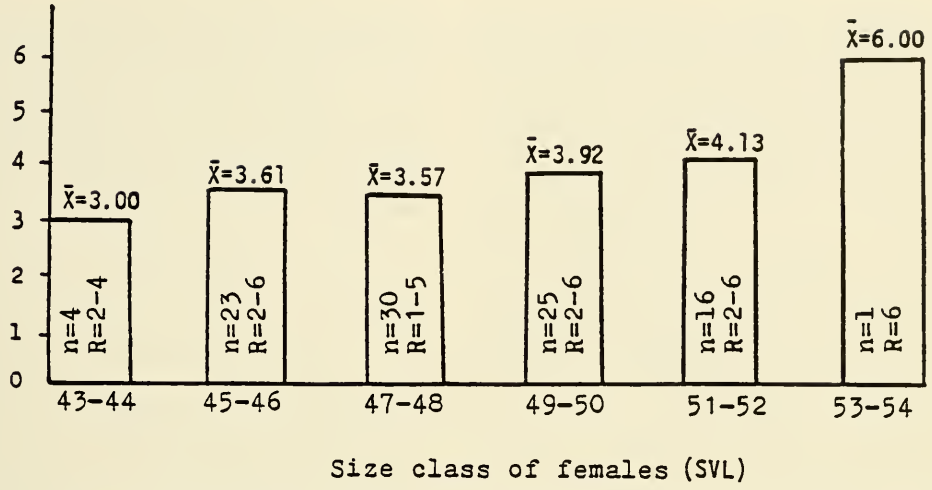

Fig. 2. The mean number of yolked ovarian follicles, oviducal eggs, and corpora lutea for six arbitrarily sized classes of females. N = number of individuals, R = range, and X = mean 1968 and 1973 females combined.

12 hatchlings were not sexed but were assumed not to be reproductively mature.

The first hatchlings were observed, but not collected, on 26 June 1973. Twelve specimens were collected from 3 July 1973 to 25 July 1973. The data for hatchlings is presented in Table 2.

MEAN SIZE OF MATURE INDIVIDUALS.— The largest male specimen was 57.5 mm SVL and the smallest 40.0 mm SVL. The largest female was 53.0 mm SVL and the smallest was 43 mm SVL. Table 3 summarizes the remaining data related to mean size of mature individuals.

REPRODUCTION IN FEMALES.— Counts were made of oviducal eggs, corpora lutea, and yolked ovarian follicles in the ovaries of 124 females. Figure 2 shows a comparison of six arbitrary size classes that indicates that clutch size increases with size of the female, with the two smallest categories (43–44 and 45–46 SVL) presumably being first-year reproducive females, and those 47 and over second-year females. Using 1973 female data alone, because it covers the entire reproductive season, there was an attempt to determine the number of clutches per year, which is difficult in multiple clutch species.

The 1973 data appears to indicate a two-clutch ability by some individuals. The first clutch group is clustered between 23 April and 22 May (based on shelled oviducal eggs). The second clutch group is clustered between 2 June and 10 July. Between the period of 22 May and 2 June, there are females with oviducal eggs but these are late individuals reproductively, which will probably produce only one clutch because of time constraints. To substantiate the double clutch, we began with the correlation of the first appearance of hatchlings, assuming a 45–50 day incubation period, which is based on Burkholder and Tanner's (1974) work on *Sceloporus graciosus*, which has a mean incubation period of 49 days (from laboratory and field incubation data). If the females of the first group laid eggs from 23 April through 22 May, with a 50-day incubation period, the hatchlings would appear as early as 11 June and as late as 10 July. The first hatchlings

TABLE 3. The mean SVL in millimeters of sexually mature males and females for 1968 and 1973, based on spermatozoa in testis and epididymus and yolked ovarian follicles, oviducal eggs, or corpora lutea, respectively.

	Males			Females		
Year	$\bar{x}$	N	R	$\bar{x}$	N	R
1968	49.27	51	44–57	47.70	34	44.5–52
1973	49.66	100	40–55	48.06	99	43–53

were observed on 26 June and 3 July (Table 2), which falls within the predicted time. The second clutch hatchlings would appear 21 July through 28 August. The smallest hatchlings captured between 23 July and 25 July (Table 2) fit into this category.

The second point that supports two clutches is that of the time span between the first and second onset of vitellogenesis. Turner, et al. (1970) state that 31 days are sufficient for production of a second clutch. If the days are counted between the proposed first and second clutch (clustering of females with shelled oviducal eggs), there are 42 days, which would appear to be ample time.

The only nonsupportive evidence is the absence of corpora lutea when the second production of yolked ovarian follicles occurs. However, it is our opinion, based on observations of autopsied individuals, that corpora lutea in *Uta* disappear very quickly (1–5 days), which would explain the lack of overlap.

Along with the double clutch phenomena is the feature of clutch size fluctuation. The mean size of the first clutch (based on oviducal eggs only) was 4.40 (N = 14) and the second was 3.81 (N = 16). This corresponds to that reported by Tinkle (1967b) for Texas populations, Turner et al. (1970), and Medica and Turner (1976) for Nevada, and Nussbaum and Diller (1976) for Oregon, though the difference is not as significant.

The earliest onset of vitellogenesis is 14 April (1973). This is based on yolked ovarian follicles of 2 mm diameter or larger and a definite yellow color. Table 4 summarizes the numbers of yolked ovarian follicles, oviducal eggs, and corpora lutea for the determination of clutch size (1968 and 1973 data were pooled). Reproductive potential was not calculated; the actual numbers of females laying a second clutch was not determined.

FAT BODIES.— The fat bodies decrease in weight from the time of emergence of adults through the end of the reproductive period in both males and females (Table 5)

TABLE 4. Data for yolked ovarian follicles, oviducal eggs, corpora lutea, and mean clutch size per female for the years 1968 and 1973.

Year	Ovarian yolked follicles	Oviducal eggs	Corpora lutea	Mean clutch size
1968	45(N = 12)	65(N = 17)	0	3.79
1973	112(N = 33)	135(N = 33)	7(N = 2)	3.74
Total	157(N = 45)	200(N = 50)	7(N = 2)	3.64
Mean	3.49	4.00	3.50	3.75
	Clutch size			3.75
	Clutches per year			1–2

DISCUSSION

Although the volume of data and length of time are much less than studies which we will use for comparison and contrast, this study provides some additional information concerning the total knowledge of natural history of *Uta stansburiana*. In essence, the comparisons made with regard to *Uta* concern that of northern vs. southern populations and the changes that occur along that continuum.

The first feature is that of sex-ratio. On a yearly basis, all (1968 and 1973) fit the

TABLE 5. Fat body weight changes in 1973 male and female *Uta stansburiana* April–July in grams. Single asterisk means that all had yolked follicles or oviducal eggs. Double asterisk means the two at < .01 still had oviducal eggs and corpora lutea and the one at .08 corpora lutea only, and the rest had no reproductive activity. Triple asterisk means the .25 specimen had just begun vitellogenesis; the two at < .01, two at .02, and two at .03 had not started vitellogenesis, whereas all others had.

	April	May	June	July
Males	16 = <.01	32 = <.01	26 = <.01	3 = <.01
		1 = .08	1 = .01	2 = .01
				1 = .03
				2 = .04
				1 = .05
				2 = .06
				2 = .07
				1 = .08
				2 = .09
				1 = .10
				1 = .15
N	16	33	32	18
Females	11 = < .01	18 = < .01	14 = < .01	1 = <.01
	4 = .03	2 = .04	1 = .05	1 = .02
	1 = .05	2 = .03	2 = .03	2 = .05
	3 = .02	2 = .02	1 = .02	1 = .06
	1 = .04			1 = .07
	1 = .25			1 = .08
				1 = .09
				2 = .10
				2 = .11
				1 = .12
				1 = .15
N	21***	24*	18*	15**

expected ratio of 1:1. Monthly fluctuations are not as consistent, especially in June for both years. These data indicate a 3:2 ratio of males to females, which is similar to what Tinkle (1961) recorded in Texas. Tinkle (1961) attributed this to territorial vigilance in males, and this appears to be true for those in Idaho. In addition to this, the difference may be further enhanced by female oviposition in June. By July these activities (male and female) cease, and the ratio returns to 1:1.

Idaho *Uta* attain sexual maturity in one year; they hatch, over winter, and emerge as adults (Tinkle 1961, Tanner 1972, Medica and Turner 1976). Nussbaum and Diller (1976), however, observed that in north central Oregon some *Uta* that hatched late in the year (late August) would not have sufficient time for growth and therefore would not be sexually mature by the time the next reproductive season arrived. We think that this is rare in Idaho, based on size of earliest individuals collected, because they had yolked ovarian follicles, spermatozoa, and larger SVL than the minimum SVL as determined for sexual maturity of Oregon Uta. The longer growth period of Idaho vs. Oregon is most likely the basis for the differences in the two populations.

The remainder of our findings concerning Idaho *Uta* have been added to Table 6, which is a modification from Nussbaum and Diller (1976). Table 6 calls attention to several areas of interest. The elevation is as low or lower than all the previous studies, though further north than all but the one in Oregon. Length of growing season and therefore length of reproductive season are longer than that found in Oregon but less than the four southern studies. These physical aspects put the Idaho population in a somewhat intermediate position between that of Oregon and

TABLE 6. Comparison of data for six *Uta* populations.

	Texas	Colorado	Nevada (Rock Valley)	Nevada (Rainier Mesa)	Oregon	Idaho (1973)
Elevation (ft)	2900	≅4250	3400	7840	2400	1722–2437
Length of growing season (days)	215	175	225	200	110–140	150–180
Length of reproductive season (days)	121–141	120	135	–	70	90–100
Habit	arenicolous	saxicolous	–	–	saxicolous	saxicolous
Sexual dichromatism	high	103	–	–	high	high
Aggressiveness	high	103	–	–	low	–
Social structure	territorial	dominance	–	–	dominance (?)	dominance (?)
Density (individuals/acre)	36.109	17.5	24	10	71	–
Male home range (acres)	0.50	0.27	–	–	0.54	–
Female home range (acres)	0.17	0.23	–	–	0.43	–
Hatchling size (mm(SVL)	22	≅22	≅22	≅22	22	26°
Size range mature males (mm)	40–60	42–	–	40–56	40–53	40–55
Size range mature females (mm)	40–60	37–	40+	–	41–49	43–53
Average size adult males (mm)	–	–	–	49	48.4	49.6
Average size adult females (mm)	48.9	42.8	–	–	45.4	48.0
Clutch size	≅4.0	3.20	.6–.4	4.85	3.33	3.75
Clutch frequency	3.5	3	3–5	–	1–2	1–2
Percent males fail to breed first season	0.0	<25	–	–	= 19.0	–
Percent females fail to breed first season	0.0	<25	–	–	= 47.0	A
Percent males two years old and older	7	33	18–28	36–65	57.6	–
Percent females two years old and older	7	33	18–28	36–65	69.4	–
Date hatchlings appear	20 June	25 June	25 June	17 July	17 July	26 June

Texas and Colorado (Tinkle 1961, 1967a, b, 1969a, Tinkle and Woodward 1967)
Oregon (Nussbaum and Diller 1976)
Nevada—Rock Valley (Turner et al., 1970, Medica and Turner 1976)
Nevada—Rainier Mesa (Tanner 1972)
Idaho—(this study)
°Smallest individual caught 3 July 1973

the four southern populations, even though it is not located halfway between from the standpoint of miles. Because of these factors and others (i.e., precipitation and primary production), there should be some influence on reproductive cycle, average adult size, date of hatching, appearance, etc.

In reference to the above-mentioned parameters and the information in Table 6, it becomes apparent that Idaho *Uta* do lay more than one clutch per year. This is based on the broad period of time when females have oviducal eggs present (the same is true for yolked ovarian follicles) and the appearance and size (SVL) of hatchlings from 26 June through late July. The percentage of females laying a second clutch is speculative because of incomplete data, but it would appear to occur in the majority of the population as compared to a small percentage in the Oregon population as reported by Nussbaum and Diller (1976). It is doubtful if any could produce a third clutch, as is the case in Colorado *Uta* (Tinkle 1976), due to length of reproductive season, though the possibility does exist if favorable conditions prevail.

Coupled with this is the fairly high overall clutch size of 3.75 or, if based on oviducal eggs only (first and second clutch), 4.40 and 3.81/female, which approaches the size if not equals that of the Texas, Colorado, and Nevada (Rock Valley) populations. The only difference is the number of clutches per year. The size is significantly higher than that of Oregon. The explanation for the similarity to populations much farther south and the difference from the more northern Oregon population is complicated but again probably is within the realm of the response of *Uta* to changes in the elevation and/or latitude, length of growing and reproductive seasons, annual precipitation as it affects primary production, and general habitat. Because of the limitation of this study, we feel inadequate to speculate on these interrelationships at this time.

Average size of males and females (SVL), as well as size range for mature males and females, does not appear to deviate dramatically from other populations. Fat body cycle follows that reported first by Hahn and Tinkle (1965) and by many subsequent authors with regard to various lizard species.

Literature Cited

Burkholder, G. L., and W. W. Tanner. 1974. Life history and ecology of the Great Basin sagebrush swift, *Sceloporus graciosus graciosus* Baird & Girard, 1972. BYU Sci. Bull., Biol. Ser. 19(5):1–42.

Burkholder, G. L., and J. M Walker. 1973. Habitat and reproduction of the desert whiptail lizard, *Cnemidophorus tigris* Baird and Girard at the northern part of its range. Herpetologica 29:76–83.

Hahn, W. E., and D. W. Tinkle. 1965. Fat body cycling and experimental evidence for its adaptive significance to ovarian follicle development in the lizard *Uta stansburiana*. J. Exp. Zool. 158(1):79–86.

Hoddenbach, G. A., and F. B. Turner. 1968. Clutch size of the lizard *Uta stansburiana* in southern Nevada. Amer. Midl. Nat. 80(1):262–265.

Medica, P. A., and F. B. Turner. 1976. Reproduction by *Uta stansburiana* (Reptilia, Lacertilia, Iguanidae) in southern Nevada. J. of Herpetology 10(2):123–128.

Nussbaum, R. A., and L. V. Diller. 1976. The life history of the side-blotched lizard, *Uta stansburiana* Baird and Girard, in north-central Oregon. Northwest Sci. 50(4):243–260.

Shreve, F. C. 1942. The desert vegetation of North America. Bot. Rev. 8:195–246.

Tanner, W. W. 1972. Notes on the life history of *Uta stansburiana*. BYU Sci. Bull., Biol. Ser. 15(4):31–39.

Tinkle, D. W. 1961. Population structure and reproduction in the lizard *Uta stansburiana stejnegeri*. Amer. Midl. Nat. 66:206–234.

———. 1967a. Home range, density, dynamics, and structure of a Texas population of lizard *Uta stansburiana*. Pages 5–59 *in* W. W. Milstead, ed., Lizard ecology: a symposium. Univ. of Missouri Press.

———. 1967b. Life and demongraphy of the side-blotched lizard. Univ. Michigan Misc. Publ. Mus. Zool. 132:1–182.

Turner, F. B., G. D. Hoddenbach, P. A. Medica, and J. R. Lannon. 1970. The demography of the lizard *Uta stansburiana* Baird and Girard in southern Nevada. J. Anim. Ecol. 39:505–519.