

# Report on a Collection of Amphibians and Reptiles from Sichuan, China

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## Abstract

A collection of amphibians and reptiles was made in Sichuan Province, P.R.C., in 1987 by a team from Chengdu Institute of Biology and Field Museum of Natural History. At the principal site, forested slopes and top of Wa Shan 40 km WNW of Mt. Emei, 18 species of amphibians and 12 species of reptiles were collected between 1000 and 2520 m in four weeks. Twelve species of amphibians and one reptile were collected at Qiliba, about 240 km S of Wa Shan, between 2950 and 3140 m in five days. One new species of snake, *Amphiesma metusia*, is described. The amphibian fauna at Wa Shan shows ecological segregation based on types of breeding sites and perches and on altitudinal distribution.

## Introduction

In 1987 Chengdu Institute of Biology and Field Museum of Natural History initiated a joint program of field studies on the herpetofauna of Sichuan, thus renewing an old association that had led in 1950 to the publication by Field Museum of "Amphibia of Western China" by Liu Qeng Qao. The current program began with a period of collection and observation by the present authors from May 21 to July 3, and the first results are summarized in this paper.

We chose to begin this program with an intensive study of microhabitat distribution of amphibians and reptiles at one site, as previous fieldwork in Sichuan has concentrated on elucidating the geographic distribution of the fauna. The site ultimately chosen was Wa Shan (29°38'N,

102°56'E), a mountain 40 km WNW of Mt. Emei which had been explored herpetologically by Liu and his associates. The field party worked at Wa Shan for four weeks, 22 May–16 June. While looking for an appropriate site, we visited Qing Cheng Shan (76 km NW of Chengdu in Guan Xian) and collected there for two days. After leaving Wa Shan, we worked five days at Qiliba (27°53'N, 102°34'E), 35 km E of Xichang City, which is 500 km S of Chengdu. Localities are shown in Figure 1.

Most of the collecting at Wa Shan was carried out between 1200 and 1500 m. The steepest slopes throughout and the less steep ones around 1400 m were covered with evergreen angiosperm forest having dense undergrowth of herbs, ferns, and shrubby angiosperms. This original forest is being actively logged. As areas are cleared, conifers are planted. Below 1300 m the flatter areas have stands of these conifers, some as large as 30 cm DBH. There is little undergrowth beneath the conifers, although needles and dead branches cover the soil. The groves of conifers meet angiosperm forest at places, particularly along small, steep watercourses, to form patches or strips of mixed forest. On some slopes seedling conifers had just been planted, leaving these areas as clearings. The largest stream (ca. 8 m wide) in our working area was flanked in spots by flat patches supporting grass, bamboo, and shrubs. We also collected along several small streams (1–2 m wide) flowing through angiosperm forest. We spent two days collecting in a conifer-rhododendron forest on the rather flat top of Wa Shan at 2520 m (fig. 2).

Qiliba is on an undulating plateau 2500–3200 m ASL with marshy grassland in flat areas and chaparral-like, shrubby vegetation (fig. 3) on steeper slopes. Scattered small trees occur on some slopes. Small streams (1–3 m wide) are common,

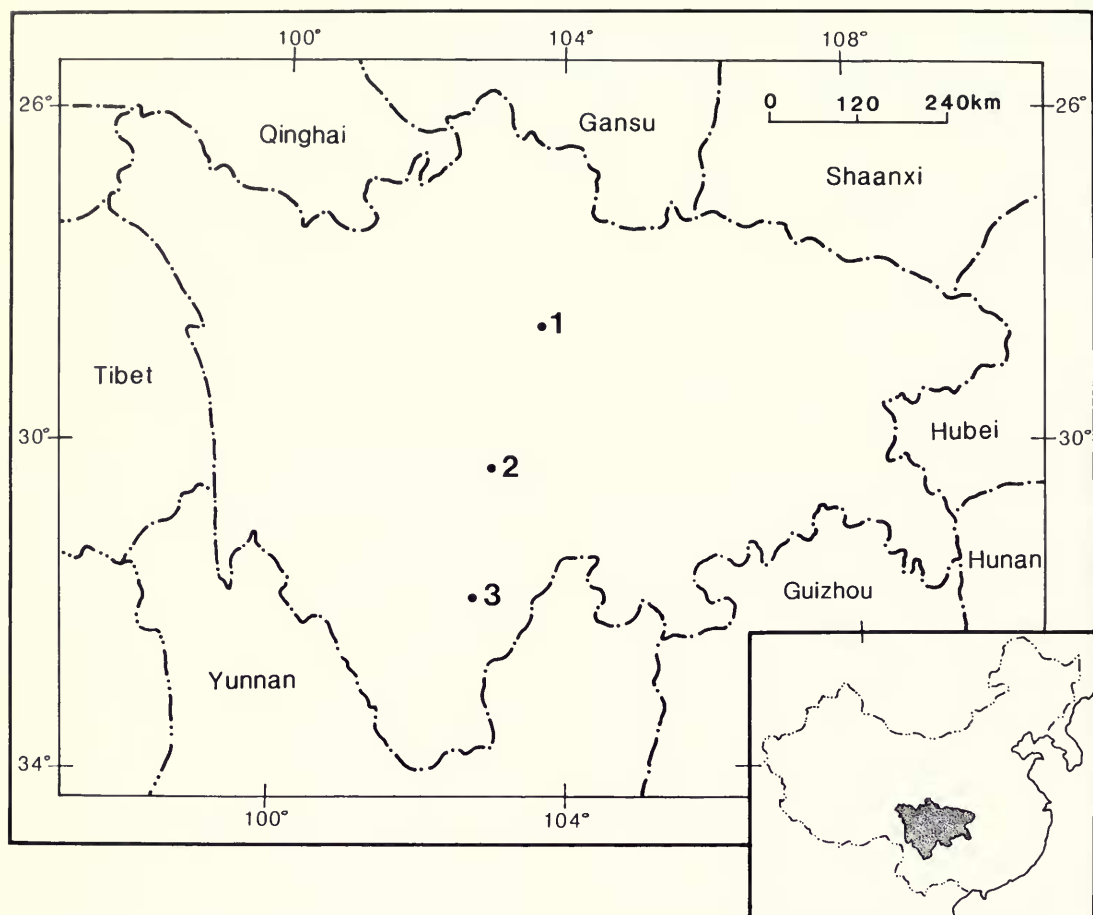


FIG. 1. Sichuan Province, People's Republic of China. 1, Qing Cheng Shan; 2, Wa Shan; 3, Qiliba.

and ponds (2–10 m in diameter) dot the flat areas (fig. 3).

## Materials and Methods

The location of each specimen was recorded following the habitat classification scheme described elsewhere (Inger & Colwell, 1978), modified to include the vegetation types encountered in Sichuan. Each specimen was bagged separately as captured and usually preserved in formalin within three hours. With few exceptions, all specimens from Wa Shan were weighed to the nearest gram prior to preservation. Snout-vent length (SVL) and total length were measured for snakes before preservation. Lizards and amphibians were measured

after preservation. When the number weighed is less than the number measured, the former is given in parentheses. Denticle counts of tadpoles follow the system used by Liu (1950) and Liu and Hu (1961).

For testing statistical significance of ecological distributions in the last part of this paper (Summary of Habitat Distribution of Anurans at Wa Shan), we used chi-square tests, mostly in the format of  $2 \times 2$  tables in which occurrence of a given species in a particular type of microhabitat was compared against that of "all others." Synonymies are presented in the following sequence: original description, first use of present combination (if different from original), synonyms.

The collection has been divided, half deposited in Chengdu Institute of Biology and half in Field Museum of Nature History.



FIG. 2. Vegetation at Wa Shan, Sichuan. *Above*, broad-leaved evergreen forest at about 1400 m; *below*, pine, rhododendron, axalea forest at 2520 m.



FIG. 3. Vegetation at Qiliba, Sichuan. *Above*, chaparral at 3020 m; *below*, wet meadow flanked by chaparral at 3140 m.

## Species Accounts

### CAUDATA

#### HYNOBIIDAE

##### *Batrachuperus pinchoni* (David)

*Dermodactylus pinchoni* David, 1871, *Nouv. Arch. Mus. Nat. Hist. Nat.*, 7: 95. Type locality: Muping (= Baoxing), Sichuan.

*Batrachuperus pinchoni* Stejneger, 1925, *Proc. U. S. Nat. Mus.*, 66: 5.

*Batrachuperus longdongensis* Liu and Tian, 1983, *Acta Zootaxon. Sinica*, 8: 210. Type locality: Longdong, Mt. Emei, Sichuan.

Four adult males, SVL 90–120 mm; tail length/total .43–.49 (mean .459); weight 21–25 g (N = 3, mean 23.7); head width/SVL .15–.18 (mean .172). Two subadult males, SVL 60–61 mm; tail length/total .46–.47; weight 7 g (N = 2). Five adult females, SVL 90–114 mm; tail length/total .45–.48 (mean .465); weight 18–27 g (N = 2); head width/SVL .16–.19 (mean .173). Four subadult females, SVL 55–72 mm; tail length/total .44–.47; weight 6–10 g. Sixteen juveniles, no external gills or gill slits, SVL 31–53 mm. Five larvae with external gills, SVL 20.3–31.5 mm. Thirty-two from Wa Shan, 3 from Longdong, 1 from Qiliba.

The Longdong specimens, topotypes of *Batrachuperus longdongensis*, were collected at 1250 m in the same spring-fed, rocky, 10 m stream from which the types came; it is bounded by fields on one side and young secondary forest on the other. The Qiliba salamander was in a small (.5 m) gravel-bottom stream flowing through chaparral and marshy grassland at 3140 m. All the Wa Shan animals were in streams .5–2.0 m wide. Thirty were collected at 2520 m, 29 in a fir forest and one in marshy grassland. Two were in broad-leaved evergreen forest at 1530 m. We found two egg cases and the five larvae on the top of Wa Shan (2520 m) May 31–June 1.

The original description of *B. longdongensis*, reported only from the type locality within the range of *pinchoni*, differentiated it on the basis of large size (114–265 mm) and an unstated percentage ("most") of neotenic adults. Our three topotypes are adults (total lengths 184–201 mm), without gill slits or external gills. They fall within the size range of the Wa Shan sample (total lengths 172–213 mm). A few adults with gill slits have been found at Baoxing, the type locality of *pinchoni*, in recent years. We believe *longdongensis* is conspecific with *pinchoni*.

### ANURA

#### DISCOGLOSSIDAE

##### *Bombina maxima* (Boulenger)

*Bombinator maximus* Boulenger, 1905, *Ann. Mag. Nat. Hist.*, (7), 15: 188, pl. 13. Type locality: Tong Chuan Fu (= Malong), Yunnan.

*Bombina maxima* Schmidt, 1927, *Bull. Amer. Mus. Nat. Hist.*, 54: 556.

Three males, SVL 42–54 mm (mean 50.0). Collected at Qiliba.

These were caught in chaparral at 2950–3000 m. One frog was in a small permanent pond and the others in grass.

#### PELOBATIDAE

##### *Leptolalax pelodytoides oshanensis* (Liu)

*Megophrys oshanensis* Liu, 1950, *Fieldiana: Zool., Mem.*, 2: 197. Type locality: Mt. Omei (= Emei), Szechuan (= Sichuan).

*Leptolalax pelodytoides oshanensis* Dubois, 1983, *Altyes*, 2: 149.

Thirty males, SVL 26–30 mm (mean 27.8); one female, SVL 31 mm. All were collected at Wa Shan.

All individuals were caught at night in forest (broad-leaved or mixed broad-leaved and coniferous) at 1200–1400 m on banks of small streams, 1–1.5 m (16 individuals), 2 m (14), and 3 m (1) wide. Males were calling from gravel (9 individuals), low herbs (8), rocks (7), and small dead sticks.

Dubois (1983) provisionally considered *oshanensis* to be conspecific with *pelodytoides*. Previously, he had made *Leptobranchium minimum* Taylor a synonym of *oshanensis* (Dubois, 1981). Because specimens from Vietnam, Laos, Thailand, and China had less webbing than the types of *pelodytoides*, Dubois recognized these populations as constituting the subspecies, *pelodytoides oshanensis* (Liu). Liu (1950) had stated that *oshanensis* completely lacked webbing. Only one of the Wa Shan frogs has webbing at the base of the third to fifth toes. One-third of adults we have examined from the type locality of *minimum* (Doi Suthep) and adjacent areas of Chiang Mai Province, northern Thailand (FMNH 213933–38, 216077–83) have webbing at the bases of the outer toes. Liu and Hu (1961) show webbing at the bases of the outer toes in Yunnan frogs they refer to *pelodytoides* (their

fig. 5). Thus if there is a geographic break in this character, it seems to be between Sichuan frogs on the one hand and all those to the south on the other.

Liu (1950) said that larval *oshanensis* had only four rows of denticles (I:3+3) on the upper lip as opposed to five or six in *pelodytoides* from Thailand (presumably based on Smith, 1917). Nine larvae from Wa Shan (Gosner stages 25–38) have I:2+2 (2 tadpoles), I:2+3 (2), or I:3+3 (5). Liu and Hu (1961) reported upper denticular formulas of I:2+2 (2), I:3+3 (8), and I:4+4 (3) for larval *pelodytoides* from Yunnan. Larvae from Chiang Mai Province, Thailand (FMNH 212386, USNM 103402) have I:3+3 (2, stages 26, 32) and I:4+4 (stage 37). Again, the break in character-state distribution seems to lie between Sichuan (maximum number of upper labial rows = 4) and the populations from Yunnan southward (maximum number of rows >4).

Liu and Hu (1961) illustrate differences in serration of larval beaks, *oshanensis* having finer serrae than *pelodytoides* from Yunnan (cf. their figs. 4–5). We confirm this difference. The larvae from Wa Shan have more finely serrated beaks than those from Thailand. Again, the change in character-states takes place immediately south of Sichuan.

Liu (1950) said that males of *oshanensis* had paired vocal sacs and thus differed from *pelodytoides*. We have dissected six males from Wa Shan, all having single vocal sacs. As Wa Shan is very close (ca. 50 km) to the type locality (Mt. Emei), we think this character of *oshanensis* needs reinvestigation.

The similarity of the Wa Shan series with adults we have seen from Thailand in size, color pattern, size and distribution of glands, and other external features is striking and leads us to accept Dubois's assessment of conspecificity of *pelodytoides*, *oshanensis*, and *minimum*. However, as we have shown above, changes in character-states are such that the subspecies *pelodytoides oshanensis* should be restricted to Sichuan.

### Megophrys omeimontis Liu

*Megophrys omeimontis* Liu, 1950, Fieldiana: Zool., Mem., 2: 191. Type locality: Mt. Emei (= Emei), Szechwan (= Sichuan); 3600 ft.

Fourteen males, SVL 47–57 mm (mean 51.1); weight 8–16 g (mean 12.2). Four females, SVL 60–

76 mm (mean 67.8); weight 17–36 g (mean 28.0). Two juveniles, SVL 27, 48 mm. All from Wa Shan.

Eight frogs were collected 1200–1360 m and 12 at 1400 m, 17 in broad-leaved forest and three in mixed broad-leaved and coniferous forest. Three were found at some distance from water, 15 in or on the banks of small (1–2 m) streams and two on the banks of a larger (8 m) stream.

### Megophrys shapingensis Liu

*Megophrys shapingensis* Liu, 1950, Fieldiana: Zool., Mem., 2: 194. Type locality: Shaping, Opienhsien (= Ebian County), Szechwan (= Sichuan).

One juvenile, SVL 52 mm. From Qiliba, on bank of small (2 m) stream in chaparral.

### Oreolalax omeimontis (Liu and Hu)

*Scutigera omeimontis* Liu and Hu, 1960, Scientia Sinica, 9: 767. Type locality: Changshenggou, Mt. Emei (= Emei), Szechwan (= Sichuan).

*Oreolalax omeimontis* Hu et al., System. Index Amph. China, p. 31.

Thirty five males, SVL 40–55 mm (mean 49.4); weight 7–16 g (N = 25, mean 12.0). One female, SVL 62 mm. One juvenile, SVL 33 mm. The female and seven males are from Mt. Emei, the rest from Wa Shan.

All of the Emei specimens were caught by day under rocks on the bank of a small (3 m) stream at 1600 m. Most (21) of the Wa Shan frogs were caught in broad-leaved forest at 1360–1530 m, six were in mixed broad-leaved and coniferous forest at 1290 m, and two were in a small clearing at 1400 m. All 28 adults were caught in or on the banks of streams .5–4 m wide, the juvenile under dead leaves 5 m from a small stream. Seven males captured during the day were in water. Males calling at night were in water (5), under large rocks (10), on large rocks (4), or in gravel (2).

### Oreolalax pingii (Liu)

*Scutigera pingii* Liu, 1943, J. West China Border Res. Soc., ser. B, 14: 35. Type locality: Yenwot'ang (= Yanwotang), Chaochiao (Zhaojue County), Szechwan (= Sichuan).

*Oreolalax pingii* Myers and Leviton, 1962, Copeia, 1962: 289.

Seven males, SVL 41–45 mm (mean 43.3). Five females, SVL 37–46 (mean 41.8). Six juveniles, SVL 26–35 mm. All from Qiliba.

These frogs were collected in chaparral at 2950–3020 m. Only one was collected at night, in a stream 4 m wide. The others were caught in or on the banks of small (.5–2 m) streams, two at the edge of a permanent pond, and one 8 m from a stream. All except one were under cover, mainly large rocks.

#### **Oreolalax popei** (Liu)

*Scutiger popei* Liu, 1947, Copeia, 1947: 125. Type locality: Lungtung (= Longdong), Pao-hsing (= Baoxing County), Sikang (now Sichuan).  
*Oreolalax popei* Myers and Leviton, 1962, Copeia, 1962: 289.

One female, SVL 63 mm. From Wa Shan in broad-leaved forest at 1400 m. The frog was in a small shallow depression about 5 m from a small stream.

#### **Oreolalax rugosus** (Liu). Figure 4.

*Scutiger rugosus* Liu, 1943, J. West China Border Res. Soc., ser. B, 14: 37. Type locality: Yenwot'ang (= Yanwotang), Chaochiao (= Zhaojue County), Szechwan (= Sichuan).  
*Oreolalax rugosus* Myers and Leviton, 1962, Copeia, 1962: 289.

One male, SVL 49 mm. Four females, SVL 47–53 mm (mean 50.3). All from Qiliba at 2960–3020 m in chaparral. These specimens were collected in or on the banks of small (.5–2 m) streams during the day. Two were under large rocks and one under a mat of moss.

#### **Oreolalax schmidti** (Liu)

*Scutiger schmidti* Liu, 1947, Copeia, 1947: 123. Type locality: Mt. Omei (= Emei), Szechwan (= Sichuan), 7800 feet.  
*Oreolalax puxiongensis* Liu and Fei, in Liu et al., 1979, Acta Zootaxon. Sinica, 4: 84, figs. 7, 8. Type locality: Puxiong, Sichuan.

Twelve males, SVL 41–47 mm (mean 43.3); weight 5–8 g (N = 9, mean 6.4). Two females, SVL 47–51 mm; weight 10 g (N = 2). Three males were caught on Mt. Emei, and the rest of the specimens at Wa Shan.

The Mt. Emei frogs were collected in coniferous forest at 2280 m on the bank of a small (1.5 m

permanent stream under a layer of moss. The 11 frogs from Wa Shan were caught in a coniferous forest at 2520 m in or on the banks of small (1–2 m) permanent streams. Males were calling during the day from under rocks or thick (20 cm) mats of moss. With one exception, those not actually in the stream (8 individuals) were within 20 cm of the water's edge. Both females had ovulated; one was under a large rock and the other under a mat of moss at the stream margin.

The only differences between *Oreolalax puxiongensis* and *O. schmidti*, according to Liu and Fei (in Liu et al., 1979), involved the number of spinules on the backs of males and the color of the ova. Males of *puxiongensis* were said to have more clusters of black spinules on the back than males of *schmidti*. However, Liu and Fei also noted variation in the spinosity of male paratypes of *puxiongensis* from Mianning Xian, about 75 km southwest of the type locality. (Puxiong is about 75 km southwest of the type locality of *schmidti*.) The nine males we collected at Wa Shan (40 km west of Mt. Emei) show a wide range of variation in spinosity, from few clusters of melanic spinules on the back and almost none ventrally to clusters covering most of the rear two-thirds of the back, the dorsal surfaces of the hind limbs, the ventral surface of the thigh, and the chin. One of us (GW) found similar variation in 30 male *schmidti* from Baoxing, 100 km northwest of Mt. Emei.

Ova of *O. puxiongensis* were described as having purplish gray animal poles (Liu et al. 1979). But this was the color of ova within the female. One of us (GW) has collected egg masses of six species of *Oreolalax*—*major*, *omeimontis*, *pingi*, *popei*, *rugosus*, and *schmidti*—and all had white or creamy white ova. Tian (1983) also reported creamy white egg masses of *O. chuanbeiensis*. Ovarian (and, therefore, immature) eggs examined by us are grayish at the animal pole. We believe that the eggs of the types of *puxiongensis* were immature, ovarian ova. Besides the evidence from other species in the genus, it would be surprising indeed if eggs deposited under rocks, the pattern for all *Oreolalax*, were pigmented.

Since in all other respects *puxiongensis* agrees with *schmidti*, we believe them to be conspecific and treat the former as a synonym.

#### **Scutiger chintingensis** Liu and Hu

*Scutiger chintingensis* Liu and Hu, 1960, Scientia Sinica, 9: 770. Type locality: Chinting (= Jinding), Mt. Omei (= Emei), Szechwan (= Sichuan).



FIG. 4. *Oreolalax rugosus* (Liu); snout-vent length 47 mm.

Three males, SVL 44–47 mm (mean 46.3); weight 7 g (N = 3). One female, SVL 54 mm; weight 11 g. All were collected on top of Wa Shan at 2520 m in conifer-rhododendron forest. They were in or on the banks of a small (2 m) stream. The three out of water were under a root mat, under a large rock, and in grass.

## BUFONIDAE

### *Bufo andrewsi* Schmidt

*Bufo andrewsi* Schmidt, 1925, Amer. Mus. Novit., no. 175, p. 1. Type locality: Likiang (= Lijiang County), Yunnan, 8500 feet.

Our samples from Wa Shan and Qiliba differ enough to oblige us to present information on them separately.

**Wa Shan**—Eleven males, SVL 63–78 mm (mean 70.6); weight 30–53 g (N = 10, mean 39.5). Eight females, SVL 90–101 mm (mean 95.6); weight 84–116 g (mean 97.8). Nine juveniles, SVL 20–46 mm; weight 1–10 g.

Half (14) of the toads were found in groves of conifers, the rest roughly evenly distributed in broad-leaved, mixed, and bamboo forests and in clearings. Two were collected at 1550 m and the remainder at 1150–1300 m. Juveniles and adults had similar distributions in these vegetation types and altitudinal zones. Four were caught on stream banks, two in a grassy marsh, and the rest more than 5 m from water. All were at ground level on soil and dead leaves except for seven under cover.

**Qiliba**—Nine males, SVL 61–68 mm (mean 64.8). Two females, SVL 72, 80 mm. One juvenile, SVL 24 mm.

These toads were collected at 2950–3020 m in a mixture of chaparral and wet grassland, the latter



dotted with small ponds. Four were in a temporary pond, four on the banks of a permanent pond, and the others scattered. All but one of the terrestrial toads were in grass.

The Qiliba and Wa Shan toads differ in several respects. Those from Qiliba are smaller and have relatively shorter legs and narrower heads (table 1). They have few or no melanic spinules dorsally, and few of the ventral spinose tubercles are tipped with melanin. Most of them have rounded glands on the dorsal surface of the head. In contrast, the Wa Shan toads have melanin-tipped spinose tubercles on the belly and throat, as noted by Schmidt (1927) in the description of *andrewsi*; the top of the head is usually smooth.

At Wa Shan we collected many tadpoles (and saw thousands) in moderate-sized (5–8 m) clear rocky streams; none of the rows of denticles were divided in 98% (356/363) of these larvae. At Qiliba we collected tadpoles in small (1–2 m) slow streams (3 lots) and small permanent ponds (2 lots); 85% (63/74) have the inner upper row of denticles divided.

Our samples agree for the most part with Matsui's (1986) definition of *Bufo andrewsi* and differ from *B. gararizans popei* Matsui in their well-developed webbing and smaller size (males <88 mm, females <103 mm). Larvae from Wa Shan also fit Matsui's definition of *andrewsi*; they live in streams and lack divided toothrows. Larvae from Qiliba are more like those of *gargarizans popei*. Although we believe both samples represent *andrewsi*, the differences between them indicate that a clear definition of *andrewsi* is still not in hand.

## HYLIDAE

### *Hyla annectans* (Jerdon)

*Polypedates annectans* Jerdon, 1870, Proc. Asiat. Soc. Bengal, 1870: 84. Type locality: Khasi Hills, Assam, India.

*Hyla annectans* Günther, 1875, Proc. Zool. Soc. London, 1875: 576.

Four males, SVL 32–39 mm (mean 36.3); weight 3, 7 g (N = 2). Three from Wa Shan at 1200–1500 m, one from Xichang City at 1500 m. One of the Wa Shan frogs was on the ground in a grove of conifers; the other three were at ground level in large clearings. We heard males calling from conifers frequently at Wa Shan.

TABLE 1. Comparison of body proportions of Qiliba and Wa Shan samples of adult male *Bufo andrewsi*. Too few females were available to warrant analysis. Data are given as thousandths of SVL.

	N	Range	Median
		Tibia/SVL*	
Wa Shan	11	403–463	449
Qiliba	9	405–440	432
		Head width/SVL**	
Wa Shan	11	346–390	366
Qiliba	9	328–367	337

\* Mann-Whitney  $U = 21, P < .05$

\*\* Mann-Whitney  $U = 10, P < .05$

## MICROHYLIDAE

### *Calluella yunnanensis* Boulenger. Figure 5.

*Calluella yunnanensis* Boulenger, 1919, Ann. Mag. Nat. Hist., (9), 3: 549. Type locality: Yunnanfu (= Kunming), Yunnan.

Nineteen males, SVL 29–37 mm (mean 33.75). All were collected at Qiliba in permanent (9) and temporary (10) ponds at 2950 m. Males called from the water's surface at night.

## RANIDAE

### *Rana boulengeri* Günther

*Rana boulengeri* Günther, 1889, Ann. Mag. Nat. Hist., (6), 4: 222. Type locality: Ichang (= Yichang), Hupei (= Hubei).

Nineteen mature males with spines on first two or three fingers and on chest, SVL 84–136 mm (mean 107.3); weight 88–370 g (N = 18, mean 203.3). Five males with spines on first finger only, SVL 65–78 mm (mean 71.66); weight 44–72 g (mean 56.25). Thirty-two mature females, SVL 80–122 mm (mean 102.4); weight 76–264 g (N = 26, mean 153.4). Eight subadult females, SVL 69–79 mm (mean 73.40); weight 44–70 g (mean 56.0). Seven unsexed juveniles, SVL 27–66 mm; weight 3–46 g. Seven from Qing Cheng Shan, 64 from Wa Shan.

All from Qing Cheng Shan were caught at 990 m in water or on rocks at water's edge of a tree- and shrub-lined creek (10 m wide) flowing through cultivated fields. Upstream the creek passed

TABLE 2. Comparison of body proportions in males of *Rana chaochiaoensis* and *R. japonica* from Qiliba and Wa Shan, Sichuan, respectively. Data are given as thousands of SVL.

	N	Range	Median
<b>Head width/SVL*</b>			
<i>chaochiaoensis</i>	16	308–404	352
<i>japonica</i>	11	302–335	326
<b>Head depth/SVL</b>			
<i>chaochiaoensis</i>	5	249–295	263
<i>japonica</i>	5	194–237	215
<b>Tibia length/SVL**</b>			
<i>chaochiaoensis</i>	16	530–622	577
<i>japonica</i>	11	609–671	642

\* Difference between species significant at  $P = .02$ ; Mann-Whitney  $U$  test.

\*\* Difference between species significant at  $P < .01$ ; Mann-Whitney  $U$  test.

through disturbed broad-leaved evergreen forest. Altitudinal distribution at Wa Shan was: 1150 m (5), 1200 m (25), 1250 m (4), 1290 m (20), 1360 m (10). Most of the Wa Shan frogs were caught in (35) or at water's edge of (18) rocky streams flowing through coniferous, broad-leaved, or mixed forests. Stream widths varied from .5 to 8 m; 25 frogs were caught on streams <1.5 m wide and 26 on streams 8 m wide. The three largest females (111–122 mm) and two of the three largest males (126, 136 mm) were at streams <1.5 m. Of the 25 females from Wa Shan, five had ovulated, 17 held mature ovarian eggs, and three were spent or just beginning development of ova.

### *Rana chaochiaoensis* Liu

*Rana chaochiaoensis* Liu, 1946, J. West China Border Res. Soc., Ser. B, 16: 7. Type locality: Chaochiao City (= Zhaojue), Sikang (non Sichuan).

Sixteen males, SVL 49–59 mm (mean 52.8); tibia length, head width, and head depth given in Table 2. Two females, SVL 60, 62 mm; tibia length/SVL .54, .55; head width/SVL .34, .35. All from Qiliba.

These frogs were caught in a mixture of chaparral and grassland at 2950–3140 m. Nine were in a shallow pool in the floodplain of a small stream meandering through grass; there were a dozen egg masses in the pool. Three other frogs were captured in small streams, two in permanent ponds and four in grass at the edge of ponds.

Liu and Hu (1959) treated this taxon as a subspecies of *Rana japonica*, a status it maintained in subsequent publications (e.g., Liu & Hu, 1961; Hu et al., 1977; Tian & Jiang, 1986). But Zhao et al. (1987) reported numerous differences in the karyotypes of *japonica* and *chaochiaoensis* involving centromere positions in five chromosomes and the positions of AgNORs and C-bands. Differences between these taxa in larval denticles are illustrated by Liu and Hu (1961), though they still considered them as subspecies. In addition, we have observed differences in coloration and body proportions. *Rana chaochiaoensis* has dark spots on the sides and a dark inverted V on the back; *japonica* lacks both features. The dorsolateral fold is thick in *chaochiaoensis* and thin in *japonica*. Head width and depth relative to SVL are greater in *chaochiaoensis* and tibia length greater in *japonica* (table 2). Considering the many differences between these two taxa, we believe they should be treated as distinct species.

### *Rana daunchina* Chang. Figure 6.

*Rana musica* Chang and Hsu, 1932, Contr. Biol. Lab. Sci. Soc. China, Zool., 8: 157. Type locality: Hountsinping (= Hongchungping), Mt. Omei (= Emei), Sichuan.

*Rana daunchina* Chang, 1933, China J., 18: 209 (substitute name).

Three males, SVL 44–46 mm (mean 44.9), weight 12 g (N = 2). One female, SVL 54 mm, weight 15 g. All from Wa Shan in large clearings at 1200 m. Two were in a permanent pond and two at the edge of a smaller pond.

We follow Hu (in Frost, 1985) in treating this taxon as a species distinct from *Rana adenopleura*. Liu (1950) and Liu and Hu (1961) noted the differences between Fujian *adenopleura* and Sichuan *daunchina* in breeding behavior, though still regarding the two as conspecific. Fujian and Sichuan populations have distinct calls. Eggs of *adenopleura* are laid as a globular cluster in ponds or flooded rice fields, but those of *daunchina* are placed in small burrows (see measurements in Liu, 1950) excavated by males next to ponds. We observed one 4 cm burrow at the edge of a pond measuring 100 × 70 × 20 cm and another 20 cm from a pond measuring 300 × 300 × 40 cm.

*Rana adenopleura* has been reported from central southern Sichuan (Shi & Zhao, 1982). One of us (GW) has collected frogs of this group at those Sichuan localities and in southeastern Guizhou



FIG. 5. *Calluella yunnanensis* Boulenger; snout-vent length 33 mm.

and southeastern Hunan. In all those places the frogs have the typical *adenopleura* call. In the only area where egg masses were seen, Hunan, they were laid directly in ponds.

As currently understood, *daunchina* is known only from Mt. Emei and Wa Shan.

#### ***Rana japonica* Günther**

*Rana temporaria* var. *japonica* Günther, 1859, Cat. Batr. Sal. Brit. Mus., p. 17. Type locality: Ningpo (= Ningbo) and Chusan (= Zhou Shan Is.), Zhejiang, and Japan.

*Rana japonica* Boulenger, 1879, Bull. Soc. Zool. France, 1879: 190.

Two males, SVL 59, 62 mm; weight 20, 21 g. Both from Wa Shan at 1200 m, where they were caught at the edge of a road passing through mixed conifer and broad-leaved evergreen forest. In addition nine males (SVL 42–58 mm) and seven

females (SVL 43–62 mm) were caught by children in and around rice fields in nearby Bin Ling at 980 m.

The relationship of this taxon to *R. chaochiaoensis* is discussed under that species.

#### ***Rana margaretae* Liu**

*Rana margaretae* Liu, 1950, Fieldiana: Zool., Mem., 2: 303. Type locality: Panlungshan (= Mt. Panlong), Kwanhsien (= Guan County), Szechwan (= Sichuan).

Thirty-one males, SVL 66–95 mm (mean 75.5); weight 27–94 g (mean 40.7). Forty-nine females, SVL 71–110 mm (mean 90.8); weight 32–102 g (N = 44, mean 76.2). Four juveniles, SVL 39–60 mm; weight 6–19 g. Four are from Qing Chen Shan, 80 from Wa Shan.

The four females from Qing Chen Shan were on rocks at water's edge on a tree-lined, 10 m creek

flowing through cultivated fields at 990 m. The Wa Shan frogs were at 1150–1360 m. A juvenile was caught 30 m from a stream, but all the rest were in water or on large rocks forming the banks of streams flowing through broad-leaved, coniferous, and mixed forests. The majority (62) were along a creek 8 m wide, and the rest along streams 1–5 m wide.

### ***Rana shuchinae* Liu**

*Rana shuchinae* Liu, 1950, Fieldiana: Zool., Mem., 2: 313. Type locality: Lolokou (= Jiefang Gou), Chaochiaohsien (= Zhaojue County), Sikang (now in Sichuan).

Eight males, SVL 31–34 mm (mean 32.1). Three females 27–39 mm (mean 34.3). All from Qiliba at 2960 m in a mixture of chaparral and grassland. We caught eight in or at the edge of permanent ponds, two in amplexus in a temporary pond, and one in an intermittent stream (.5 m).

### ***Rana yunnanensis* Anderson**

*Rana yunnanensis* Anderson, 1879, Anta. Zool. Res. Yunnan, p. 839. Type locality: Hotha (= Husa), Yunnan.

*Rana phrynooides* Boulenger, 1917, Ann. Mag. Nat. Hist., (8) 20: 413. Type locality: Tongchuan fu (= Malong), Yunnan.

*Rana (Paa) sichuanensis* Dubois, 1986, Alytes, 5: 47. Type locality: Ning Yuan Fu (= Xichang City), Sichuan.

Two males, SVL 75, 83 mm, 5 females, SVL 92–117 (mean 104.3), 5 juveniles SVL 46–79 mm. Head width/SVL .38, .42 in males, .38–.40 in females. All from Qiliba.

All were collected in a mixture of chaparral and grassland at 2950 m. One juvenile was caught on the bank of a small permanent pond, one female in a temporary pond, and the rest in (6) or on the banks (4) of small streams .5–1.0 m wide. Those on the banks were in grass less than 30 cm from the water's edge.

Liu and Hu (1961) believed *Rana phrynooides* Boulenger and *Rana yunnanensis* Anderson were conspecific. This opinion has been shared by subsequent authors (e.g., Frost, 1985; Dubois, 1986). Dubois (1986) based *sichuanensis* on two specimens collected in 1914 in the mountains near Xichang. Besides minor differences in body proportions, *R. sichuanensis* was said by Dubois to

differ from *yunnanensis* in having a very distinct tympanum, the webbing more excised between the toes, the tips of the digits slightly but clearly dilated, the dorsum set with many short narrow longitudinal folds, and the skin fold along the outer margin of the fifth toe ending proximally at the level of the basal subarticular tubercle.

As Qiliba is in mountains near Xichang City, our specimens are very nearly (if not actually) topotypes of *sichuanensis*. One-third (4) have short narrow longitudinal folds on the back and sides; all have many round wartlike tubercles, each capped with a small whitish cone (presumably equivalent to Dubois's "petites granulosites cornees"). The skin fold along the fifth toe ends proximally, as Dubois describes, at the basal subarticular tubercle. The tips of the digits are slightly dilated. However, the tympanum is obscure and not, as Dubois says, very distinct.

In addition we have examined the following specimens in the collection of the Chengdu Institute of Biology: (1) 17 males from Longling County, Yunnan, 75 km from the type locality of *yunnanensis*; (2) 7 males from Jingdong and Xiping counties, Yunnan, 300–400 km E of the type locality of *yunnanensis* and 220–300 km SW of the type locality of *phrynooides*; (3) 12 males from Binchuan, Dengchuan, and Lijiang, NW Yunnan, approximately equidistant among all three type localities; (4) 11 males from Huili and Huidong, S Sichuan, approximately midway between the type localities of *phrynooides* and *sichuanensis*; (5) 7 males from Zhaojue (= Chaochiao) 55 km E of Xichang City near the type locality of *sichuanensis*; (6) 10 males from Jiulong, Muli, and Luguhu in the hills 110–150 km W of Xichang City; and (7) 5 males from Weining, Guizhou, 175 km NE of the type locality of *phrynooides*. These localities are shown in Figure 7.

These frogs and the ones from Qiliba are clearly conspecific. The only consistent geographic variation we can detect is in the dorsal skin. Frogs from areas (1) and (2) have round, warty tubercles, whereas those from areas (3)–(7) are like those from Qiliba and have short skin folds or scattered round spinose tubercles. Large males from southwestern (area 1) and southern (2) Yunnan have black spines in two patches on the breast and on the chin (as illustrated by Liu and Hu, 1961, fig. 48, p. 163); smaller males have them only on the breast. Males from the other areas usually have spines on the breast only; a few have weak spines on the chin. Otherwise, there is individual variation in distinctness of tympanum and in the length



FIG. 6. *Rana daunchina* Chang; snout-vent length 46 mm.

of the skin fold on the fifth toes. These observations confirm the conclusion of Liu and Hu (1961), though with *yunnanensis* as the prior name, and lead us to place *sichuanensis* Dubois in the synonymy of *yunnanensis*.

#### ***Amolops chunganensis* (Pope)**

*Rana chunganensis* Pope, 1929, Amer. Mus. Novit., no. 352, p. 3. Type locality: Kuantun, Chungan Hsien (= Chongan County), Fujian.

*Amolops chunganensis* Matsui in Frost, 1985, Amph. Species of the World, p. 453.

Nine males, SVL 34–38 mm (mean 36.3); weight 5–6 g (N = 8, mean 5.1). One female, SVL 52 mm; weight 16 g. All from Wa Shan.

All frogs were along streams flowing through coniferous and mixed broad-leaved and coniferous forests at 1170 (6), 1200 (3), and 1400 m (1). Only one was actually in water and the rest 1–5 m from water's edge on rocks (5), shrubs (2), a small log (1), and soil (1). Males were actively

calling on several nights. The abdominal cavity of the single female was filled with full-sized ova which were not in gelatinous envelopes. The breeding season may have been starting.

The geographic range of *Amolops chunganensis* extends from Gansu Province in the northwest to Fujian Province in the southeast; however, its distribution is apparently disjunct. One center lies in northeastern Sichuan, southern Shaanxi, Gansu, and north-central Sichuan; a second lies in western Hunan and northern Guanxi; and a third in northwestern Fujian. Our specimens agree with the type series, which we examined in the American Museum of Natural History.

#### ***Amolops loloensis* (Liu)**

*Staurois loloensis* Liu, 1950, Fieldiana: Zool., Mem., 2: 353. Type locality: Lolokou (= Jiefangao), Chaochiaohsien (= Zhaojue County), Sikang (now Sichuan).

*Amolops loloensis* Matsui, in Frost, 1985, Amph. Species of the World, p. 455.

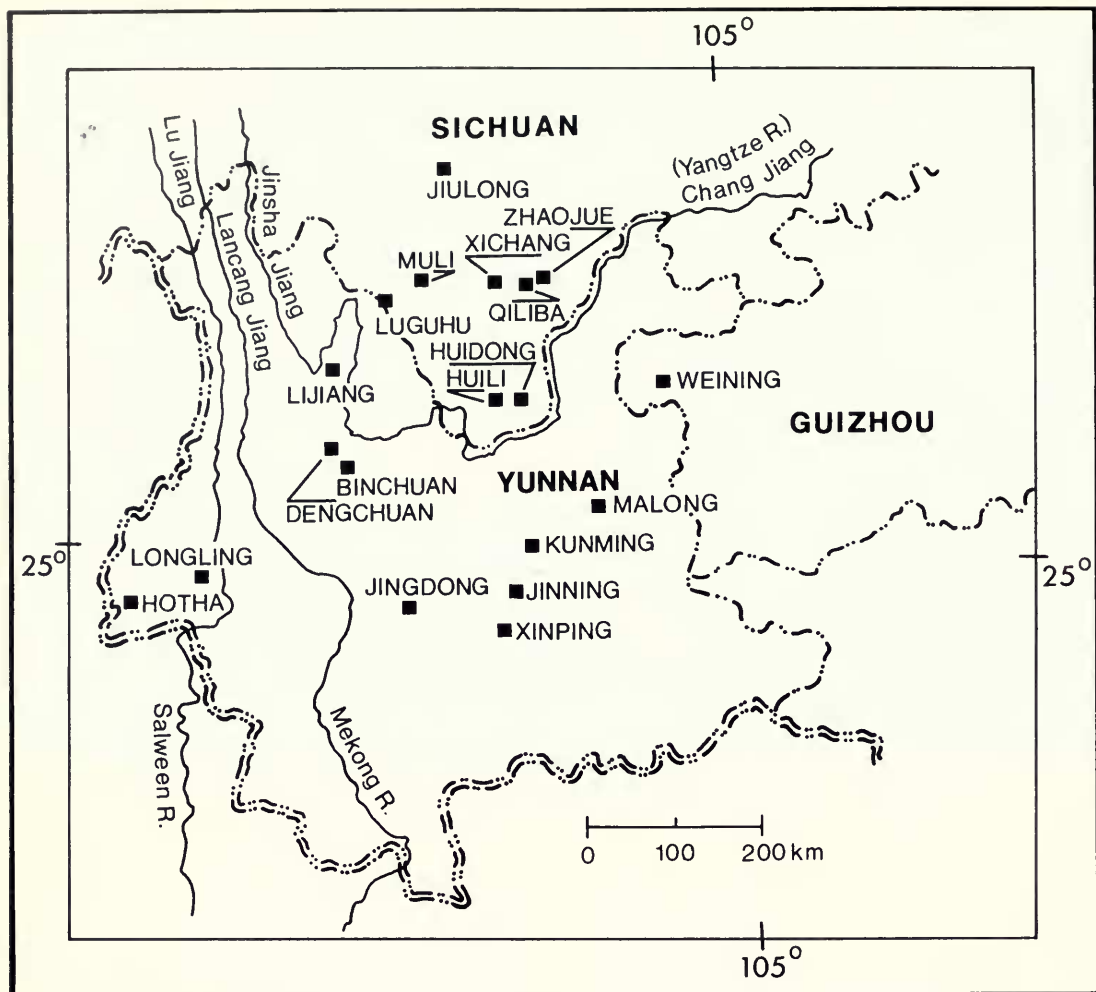


FIG. 7. Southern Sichuan and adjacent provinces showing localities of samples of *Rana yunnanensis*. Type localities: Hotha = *R. yunnanensis* Anderson; Malong = *R. phrynoides* Boulenger; Xichang (approximate) = *R. sichuanensis* Dubois.

Two females, SVL 43, 61 mm. From Qiliba at 2950 m, 5 m from a stream bed. One was under an overhanging rock and one on a large rock.

**Amolops mantzorum** (David)

*Polypedates mantzorum* David, 1871, Nouv. Arch. Mus. Natl. Hist. Nat. Paris, 7, Bull.: 45. Type locality: Muping (= Baoxing), Szechwan (= Sichuan). *Amolops mantzorum* Matsui, in Frost, 1985, Amph. Species of the World, p. 455.

Five males, SVL 51–53 mm (mean 51.6), weight

11–13 g (mean 12.0). Eleven females, SVL 60–70 mm (mean 65.7), weight 23–30 g (N = 8, mean 26.3). All from Wa Shan.

All were caught along stream courses, two in water and the rest within 2 m of water's edge. Only one was perched on a shrub, 12 on large rocks, and one on gravel. Half were on an 8 m stream and half on small streams .5–2 m wide. Five of those at small streams were in forest clearings at 1400–1470 m. Ten were in broad-leaved evergreen forest at 1250 (9) and 1400 m (1). One was in mixed conifer and broad-leaved forest at 1250 m. We did not hear males calling. None of the females was gravid; all were in middle stages of



FIG. 8. *Polypedates chenfui* (Liu); snout-vent length 51 mm.

ovarian development with ova clearly not full-sized.

#### RHACOPHORIDAE

##### *Polypedates chenfui* (Liu). Figure 8.

*Rhacophorus chenfui* Liu, 1945, J. West China Border Res. Soc., ser. B, 15: 35. Type locality: Hui-ting-sze (= Hui-deng-si), Mt. Omei (= Emei), Szechwan (Sichuan).

*Polypedates chenfui* Jiang, 1987, Acta Herpet. Sinica, 6: 37.

Thirteen males, SVL 31–39 mm (mean 35.2); weight 3–4 g (N = 10, mean 3.6). Two females, SVL 47, 51 mm; weight 9, 13 g. One juvenile, SVL 21 mm; weight 1 g. All from Wa Shan at 1200 m.

All but one of these frogs were caught in clearings surrounded by broad-leaved and coniferous forests. Ten were in herbs and low shrubs at the margins of ponds, and of these, seven were caught in a mixed chorus with *P. omeimontis*. Six were at a distance from any body of water and four of these were in vegetation 0.6–2.0 m above ground.

##### *Polypedates dugritei* David

*Polypedates dugritei* David, 1871, Nouv. Arch. Mus. Natl. Hist. Nat. Paris, 7: 95. Type locality: Muping (= Baoxing), Sichuan.

Eleven males, SVL 36–45 mm (mean 40.1); weight 5–7 g (N = 8, mean 5.5). One female, SVL 43 mm; weight 6 g. One juvenile, SVL 21 mm. Four from Qiliba, nine from Wa Shan.

The Qiliba frogs were at the margins of ponds in mixed chaparral and grassland at 2960 m. One was in grass, two on low shrubs, and the juvenile under a rock. The Wa Shan frogs were caught at 2520 m, one in a small pond in a coniferous forest and the others in grass around ponds in a large marshy area surrounded by coniferous forest.

##### *Polypedates omeimontis* Stejneger

*Polypedates omeimontis* Stejneger, 1924, Occ. Pap. Boston Soc. Nat. Hist., 5: 120. Type locality: Shin-kai-sze (= Xin-kai-si), Mt. Omei (= Emei), Szechwan (= Sichuan).

Thirteen males, SVL 54–67 mm (mean 59.5), weight 11–24 g (N = 10, mean 14.1). Two from Qing Chen Shan, 11 from Wa Shan.

The two from Qing Cheng Shan were in low vegetation at the margin of a small (2 m) pond on a farm at 990 m. One foam nest was attached to grass at the pond's edge. The Wa Shan frogs were collected at 1200–1260 m, five in shrubs and herbs .05–1 m above ground at the edge of a 3 m pond in a grassy clearing. Males called from this pond on several nights, including one when male *P. chenfui* also were calling. Five to 10 foam nests were attached to shrubs overhanging this pond throughout our stay at Wa Shan. We collected many tadpoles of *omeimontis* from this pond. Five males were caught in shrubs and small trees 1–2 m above ground on the banks of streams in coniferous and broad-leaved forest. Only one was found more than 10 m from any body of water.

## SAURIA

### SCINCIDAE

#### *Scincella monticola* (Schmidt)

*Leiopisma monticola* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., 54: 496. Type locality: Snow Mountain Village, Likiang (= Lijiang), Yunnan.  
*Scincella monticola* Greer, 1974, Australian J. Zool. Suppl. Ser., no. 31, p. 7.

Six males, SVL 37–49 mm (mean 44.0); tail length/SVL 1.56, 1.68 (N = 2); weight 2–3 g (N = 5, mean 2.2); scale rows at midbody 22–24 (mean 23.5), scales parietal to thigh 53–64 (mean 59.0). Four females, SVL 44–51 mm (mean 48.5); weight 1–3 g (mean 2.0), scale rows at midbody 22–24 (mean 23.5), scales parietal to thigh 58–62 (mean 59.8). One juvenile, SVL 36 mm; weight 1 g, scale rows at midbody 24, scales parietal to thigh 58. Supralabials 7 (6/7 in one, 7/8 in one); nuchals 2–3; prefrontals separated in 10, meet at a point in one (as in type); lamellae 10–13 (mean 11.5); scale rows between lateral stripes  $1/2 + 4 + 1/2$ . All from Wa Shan.

Lizards were collected in groves of conifers (8), mixed coniferous and broad-leaved forest (1), and clearings (2) at 1200 (4), 1230–1270 (6), and 1400 m (1). Two were just below the surface of the soil, five under rocks and dead branches, two on the soil, one on a rock, and one on a dead branch. The females had 1–4 enlarged eggs in the oviducts: 44

mm (1 and 2), 49 mm (2 and 2), 50 mm (3 and 4), 51 mm (2 and 3).

#### *Scincella tsinlingensis* (Hu and Zhao)

*Leiopisma tsinlingensis* Hu and Zhao, 1966, Acta Zool. Sinica, 18: 82. Type locality: Lao-hsien-cheng (= Lao-xian-cheng), Chouchih Hsien (Zhouzhi County), Shensi (= Shaanxi).  
*Scincella tsinlingensis* Greer, 1974, Australian J. Zool., Suppl. Ser., no. 31, p. 7.

Three males, SVL 47–49 mm (mean 47.7), none with complete tails, scale rows at midbody 28–30 (mean 28.7), scales parietal to thigh 78–85 (mean 82.3). Six females, SVL 46–59 mm (mean 53.5); tail length/SVL 1.21 (N = 1); scale rows at midbody 26–28 (mean 27.0), scales parietal to thigh 78–80 (N = 4, mean 79.5). Two juveniles, SVL 30, 38 mm; scale rows 26. Supralabials 7 (6/7 in one, 7/8 in one); nuchals 1–3; prefrontals in broad contact (2), meet at a point (5), or separated (4); lamellae 11–16 (mean 13.5); scale rows between lateral stripes  $1/2 + 4 + 1/2$ . All from Qiliba.

These skinks were caught at 2950 (7), 3020 (2), and 3140 m (2) under small rocks and debris in fields around farm buildings (7) or along a road (4) through chaparral and grassland. Four females had one or two developing embryos in each oviduct.

The type locality is an area of broad-leaved forest at 1800 m, unlike the environment at Qiliba. However, two of us (EZ) and (GW) have also caught this species at Hongyuan in northern Sichuan, a region of grassland at about 3000 m.

#### *Sphenomorphus indica* (Gray)

*Hinulia indica* Gray, 1853, Ann. Mag. Nat. Hist., (2), 12: 389. Type locality: Himalayas.  
*Sphenomorphus indicus* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., 54: 494.

Eight males, SVL 64–77 mm (mean 72.5); tail length/SVL 1.64–1.85 (N = 3, mean 1.78); weight 7–12 g (N = 4, mean 9.8); scale rows at midbody 34–36 (mean 34.3). Five females, SVL 69–96 mm (mean 83.0); tail length/SVL 1.80 (N = 1); weight 13, 22 (N = 2), scale rows at midbody 34–36 (mean 35.7). Five juveniles, SVL 41–49 mm, weight 3 g (N = 2). Supralabials 7; nuchals 0–1; prefrontals in broad contact (1), meet at a point (1), separated (12); lamellae under fourth toe 14–18 (mean 16.1);





FIG. 9. *Achalinus meiguensis* Hu and Zhao; snout-vent length 362 mm.

scale rows between lateral stripes  $1/2 + 6 + 1/2$ . Six from Qing Cheng Shan, 12 from Wa Shan.

These lizards had limited altitudinal distribution at both sites: 990 m at Qing Cheng Shan and 1200–1250 m at Wa Shan. All except one were collected in clearings, 6 under rocks, 3 on rocks, and the rest on the ground. Four females contained mature ova, three or four in each oviduct.

## ANGUIDAE

### *Ophisaurus harti* Boulenger

*Ophisaurus harti* Boulenger, 1899, Proc. Zool. Soc. London, 1899: 160. Type locality: Kuatun, Fukien (= Fujian).

One male, SVL 177 mm, tail incomplete 167 mm, 18 scale rows across the back. One female, SVL 221, tail incomplete 245 mm; weight 46 g; 17 scale rows across the back. Two scales between rostral and prefrontal. Size of female's ear opening

varies from left to right sides; maximum diameter on left is .5 mm, on right 1.3 mm.

Both lizards were caught by residents in the village of Bin Ling, 9 km east of the Wa Shan camp. No details of capture site were available.

## SERPENTES

### AMBLYCEPHALIDAE

#### *Pareas chinensis* (Barbour)

*Amblycephalus chinensis* Barbour, 1912, Bull. Mus. Comp. Zool., 40: 132. Type locality: Luluping (= Lulubing, nr. Mt. Emei), Szechwan (= Sichuan).  
*Pareas chinensis* Zhao, 1972, Zhongguo Shenei Jiansuobian, p. 26.

One male, SVL 412 mm; tail length/total .34; weight 18 g. ventrals 172; subcaudals 80. Five females, SVL 410–511 mm; tail length/total .20–.24 (mean .216); ventrals 172–182 (mean 177.0);

subcaudals 65–72 (mean 69.2). Scale rows 15; supralabials 6 (1), 6/8 (1), 7/8 (2), 8 (2); oculars 1–1; temporals 2+3 (5), 2+3/4 (1). All from Wa Shan.

Five were caught in clearings and one in mixed coniferous and broad-leaved forest, 1200–1230 m. Three were under mats of moss and one 20 cm above ground in a small shrub. Vertical positions of two were not recorded. Three females had one egg in the left oviduct and two in the right.

## COLUBRIDAE

### *Achalinus meiguensis* Hu and Zhao. Figure 9.

*Achalinus meiguensis* Hu and Zhao, 1966, Acta Zootaxon. Sinica, 3: 162. Type locality: Meigu, Sichuan.

Two males, SVL 362, 395 mm; tail length/total .25, .21; weight 22, 28; ventrals 152, 155; subcaudals 56, 60. One female, SVL 405 mm; tail length/total .16, weight 22 g; ventrals 165, subcaudals 44. Two juvenile males, SVL 133, 138 mm; tail length/total .21, .20; weight 2 g; ventrals 156, 159; subcaudals 61, 62. One juvenile female, SVL 131 mm; tail length/total .15; weight 2 g; ventrals 163; subcaudals 42. Scale rows 21–21–19 (5), 23–21–19 (1); internasals absent; supralabials 3–2–1; oculars 0–1, the postocular very small; temporals 2+2; anal single. All from Wa Shan.

Snakes were caught at 1200 (2), 1300 (2), and 1400 m (2). Three were in coniferous forest, two in broad-leaved evergreen forest, and one in a small clearing. One was 15 cm below the surface at the base of a rotting stump, one 5 cm below soil, one under dead leaves, one under a rock, and one on a stump. The female held two eggs in each oviduct.

These snakes, which represent only the second record for this species, closely fit the original description, which was based on a specimen collected in the 1930s. Two characters are diagnostic: a very small postocular is present, internasals are absent.

### *Achalinus spinalis* Peters

*Achalinus spinalis* Peters, 1869, Monatsber, Akad. Wiss. Berlin, 1869: 146. Type locality: uncertain.

One juvenile, SVL 197 mm; tail length/total .18; weight 3 g; ventrals 154; subcaudals 60; scale rows 24–24–23; supralabials 3–2–1; oculars 0–0; tem-

porals 2+2. From Wa Shan at 1230 m under thick moss in a forest clearing

### *Amphiesma metusia* sp. nov. Figure 10.

**Holotype**—Field No. 36982 (CIB), adult female; Wa Shan, Hongya County, Sichuan Province, China, alt. 1200 m; in forest clearing. 29 May 1987.

**Paratypes**—Four adult females, field no. 36849, 36874–5, 37514; two juveniles, 37271, 37302. Same locality as holotype.

**Diagnosis**—This new form shares the following characters with a number of Chinese species of *Amphiesma*: a black stripe at side of belly formed by a spot in lateral fourth of each ventral, a light streak on temporal area separated from eye, 19 scale rows reducing to 17 near end of body and 8 supralabials. The new species differs from the other Chinese *Amphiesma* by having (1) a bold pattern of alternating rows of black squares (not found in any other Chinese *Amphiesma*); (2) 159–164 ventrals in females (differing from *craspedogaster*, *johannis*, *miyajimae*, *optata*, *parallela*, and *vibakari*); (3) 72–85 subcaudals (differing from *johannis*, *miyajimae*, *optata*, *parallela*, and *vibakari*); and (4) dorsal head plates with a mottled pattern lacking a pair of small, dark-edged, light spots on the parietals (spots present in most species of *Amphiesma*).

**Description** (data on holotype in parentheses)—Head elliptic, its anterior portion somewhat narrower and posterior portion slightly wider than the neck. Snout rounded. Rostral broader than high, only its upper margin visible from above. Internasals squarish, a little narrower in front. Prefrontals larger than internasals. Frontal shield-shaped, longer than the distance from it to tip of snout, but shorter than suture between parietals. Nostril rounded, in the center of nasal. Nasal longer than high, a groove from nostril to its upper and lower margins, but not completely divided into two shields. Loreal squarish, the loreal on both sides of 36849 extending posteriorly into orbit below preocular. Eye moderate, pupil rounded. One preocular and three postoculars. Anterior temporals 2 (2) on both sides in four specimens, 1/2 in two specimens, 1/1 in one; posterior temporals 1 in four specimens and 2 (2) in three. Supralabials 8 or 7 (7/8), 3–2–3 in three specimens, 2–3–3 in two, 2–2–3 in one, and 2/3–2–3 in the holotype. Infralabials 9 in the holotype, 9/10 in one specimen, and 10 in five; first pair in contact



FIG. 10. *Amphiesma metusia* sp. nov.; snout-vent length 530 mm.

behind mental; first 5 in contact with anterior chin shields. Mental triangular. Chin shields in two pairs, the posterior pair a little longer than the anterior; posterior pair separated only at rear by three small shields arranged in a triangle.

Dorsal scales in 19 rows on neck (18 in one paratype), 19 at midbody, and 17 before vent; prominently keeled except row 1 or rows 1–2. Ventrals 159–164 (163), mean 161.7; anal divided; subcaudals 72–85 (83), mean 79.2 (N = 6, one with broken tail). The second to fifth subcaudals in a single row in 37271.

Maxillary teeth 23 or 24 (24) on each side; increasing gradually to the rear; no diastema.

Total lengths of adults 705–885 mm (885); SVL 530–663 mm (663); tail length .24–.27 of total length (.25); weights 49–134 g (134). Total lengths of juveniles 246 (incomplete tail), 387 mm; SVL 221, 281 mm; weights 3, 9 g.

Coloration a dark checkered pattern and a poorly defined, usually interrupted medium brown stripe on scale rows 6–7; ventrally red with narrow

black stripes formed by a mark near both lateral corners of each ventral; an oblique black stripe from rear of eye across last supralabials and continuing on to trunk; neck with a light band 3–4 scales wide separated from eye and forming anterior end of lateral stripe; top of head dark olive, lighter on snout with black mottling but no paired, light parietal spots; upper lip bright light yellowish green with black sutures between the supralabials; no markings on head ventrally.

**Etymology**—*Metusia* from metousia (Gr., partnership), in recognition of the joint Chengdu Institute-Field Museum project.

**Comparisons**—The combination of conspicuous ventral stripes and 19 scale rows in *Amphiesma metusia* resembles 10 species of the genus known from China, including four reported from Sichuan: *craspedogaster*, *octolineata*, *optata*, and *johannis*. The first three have a pair of small light parietal spots (as do the other six species alluded to), setting them off from the new species. None of the four has a checkered pattern, such as typifies

*metusia*. Besides the coloration differences, *metusia* is distinguished from *craspedogaster* in ventral counts (138–157 in *craspedogaster*) and in having the nasal scale undivided.

Apparently, *metusia* is also a larger species. Pope (1935) said that the three largest females of 60 *craspedogaster* measured 478–490 mm SVL, which is smaller than any of our adult females. We have examined the Sichuan *craspedogaster* Pope listed. They all resemble *craspedogaster* in coloration and counts (ventrals <150). *Amphiesma octolineata* has, as its name indicates, a distinctly striped pattern. *Amphiesma optata* has bold transverse light bands and much higher subcaudal counts (95–112). The only species agreeing with *metusia* in lacking parietal spots is *johannis*, which differs from *metusia* in lacking a checkered pattern, in ventral (165–178) and subcaudal (84–89) counts, and in having the internasals strongly narrowed in front.

Five of these snakes were collected at 1200 m, one at 1250 m, and one at 1470 m. Three were in clearings and four in coniferous forest or mixed broad-leaved and coniferous forest. One juvenile was next to a permanent pond swarming with *Polypedates* tadpoles, two adults were on the banks of streams, and the rest away from bodies of water. Both juveniles were off the ground in low vegetation. Four females contained 5–7 large oviducal eggs; the holotype held seven.

#### ***Amphiesma sauteri* (Boulenger)**

*Tropidonotus sauteri* Boulenger, 1909, Ann. Mag. Nat. Hist., (8), 4: 495. Type locality: Kosempo, Formosa. *Amphiesma sauteri* Malnate, 1960, Proc. Acad. Nat. Sci. Philadelphia, 112: 51.

One juvenile and three adult males (juvenile not measured before preservation), SVL 178–295 mm; tail length/total .37–.39 (mean .38); weight of juvenile 1, of adults 4–13 g (mean of adults 7.7); ventrals 132–138 (mean 134.8); subcaudals 74–80 (mean 78.3). One juvenile and three adult females (one adult and the juvenile not measured or weighed before preservation), SVL 340, 360 mm; tail length/total .22 (N = 1); weight 16, 23 g; ventrals 134–139 (mean 135.2); subcaudals 72 (N = 2). Scale rows 17 throughout; supralabials 2-2-3; oculars 1-2 or 1-3, 2-3 in one; temporals 1+2 (6), 2+2 (2). All from Wa Shan.

All were collected at 1200 m, five in coniferous forest and three in large forest clearings. Four were under cover (moss, dead leaves, or rock) and four

on bare soil or dead leaves. Two females had one enlarged egg in each ovary.

#### ***Plagiopholis styani* (Boulenger)**

*Trirhinopholis styani* Boulenger, 1899, Proc. Zool. Soc. London, 1899: 164. Type locality: Kuantun, Fukien (= Fujian).

*Plagiopholis styani* Zhao, 1972, Zhongguo Shenei Jiansuobian, p. 23.

One adult male SVL 273 mm, one juvenile male SVL 109 mm tail length/total .15 (N = 2); weight of juvenile 2 g; ventrals 109, 110; subcaudals 27, 29. Two adult females SVL 298, 313 mm, 2 juvenile females SVL 101, 110 mm; tail length/total .11–.13 (mean .121); weight of adults 22, 30 g, of juvenile 2 g; ventrals 109–118 (mean 115); subcaudals 23–26 (mean 24.8). Scale rows 15; supralabials 2-2-2; oculars 1-2 (5), 1-1/2 (1); temporals 2+2 (5), 1+2 (1). All from Wa Shan.

Four were collected in small clearings and one in coniferous forest, all under moss of floor debris at 1200–1230 m. One female had two eggs in each oviduct, the other female two in the left and four in the right.

#### ***Rhabdophis nuchalis pentasupralabialis***

Jiang and Zhao

*Tropidonotus nuchalis* Boulenger, 1891, Ann. Mag. Nat. Hist., (6) 7: 281. Type locality: Ichang (= Yichang), Hupeh (= Hubei).

*Rhabdophis nuchalis pentasupralabialis* Jiang and Zhao, 1983, Acta Herpet. Sinica, 2: 60. Type locality: Jiulong County, Sichuan.

Two adult and 3 juvenile males, SVL 327–486, 137–250 mm; tail length/total .19–.24 (mean .211); weight of adults 14–44 g, of juveniles 3–9 (mean 6.3) g; ventrals 148–154 (mean 150.6); subcaudals 55–59 (mean 58.0). Five adult and 3 juvenile females, SVL 342–523 mm, 138–241 mm; tail length/total .17–.18 (mean .172); weight of adults 17–55 g (mean 39.8), of juveniles 2–7 g (mean 5.0); ventrals 148–157 (mean 151.8); subcaudals 43–49 (mean 46.0). Scale rows 15; supralabials 2-2-1 (9), 2/3-2-1 (1), 2-1/2-1 (2), 2-2-1/2 (1); oculars 1-3 (9), 1-2/3 (2), 1/2-3 (1), 2-3 (1); temporals 1+1 (8), 1+2 (5). All from Wa Shan.

These snakes were collected in a very narrow altitudinal band, 1200–1250 m, considerably below the elevation (2750 m) of the type locality of this subspecies. Three were caught within forests,

TABLE 3. Perching sites of frogs at Wa Shan, Sichuan; figures indicate number of individuals.

Species	Along streams						At ponds				Non-aquatic sites			
	in water		on banks		on banks		in water		on banks		on soil		on rocks or logs	
	—	under rocks	under rocks	on soil	on rocks	on vegetation	—	on dead leaves	on vegetation	on dead leaves	below surface	on soil	on rocks or logs	on vegetation
<i>Leptolalax pelodytoides</i>				11	7	13								
<i>Megophrys omeimontis</i>	2	2	10	6	5	3					1	1		
<i>Oreolalax omeimontis</i>	12			2	4						1			
<i>Oreolalax popei</i>														
<i>Oreolalax schmidti</i>		3	8											
<i>Scutiger chiningsensis</i>	1		3	2	2						8	12	1	1
<i>Bufo andrewsi</i>												2		
<i>Hyla annectans</i>														
<i>Amolops chunganensis</i>	1			1	5	3								
<i>Amolops mantzorum</i>	2			1	12	1								
<i>Rana boulengeri</i>	38			1	19								1	
<i>Rana daunchina</i>							1	3						
<i>Rana japonica</i>													2	1
<i>Rana margaritae</i>	5		1	3	60	8								
<i>Polypedates chemfui</i>												1	9	
<i>Polypedates dugrieti</i>											2		8	
<i>Polypedates omeimontis</i>					2	4							4	

TABLE 4. Distribution of stream-breeding frogs along streams of various widths at Wa Shan, Sichuan; figures indicate number of individuals.

Species	Stream width (m)		
	0.5-2	3-5	8
<i>Leptotalax pelodytoides</i>	28	1	0
<i>Megophrys omeimontis</i>	11	1	2
<i>Oreolalax omeimontis</i>	23	5	0
<i>Oreolalax schmidti</i>	11	0	0
<i>Scutigera chintingensis</i>	4	0	0
<i>Bufo andrewsi</i>	2	0	2
<i>Amolops chunganensis</i>	1	0	9
<i>Amolops mantzorum</i>	8	0	8
<i>Rana boulengeri</i>	25	8	29
<i>Rana margaretae</i>	3	4	70

one each in coniferous, broad-leaved, and mixed forest. The rest were in clearings. Five were under mats of moss, one under dead leaves, and one under a rock. Six were on bare soil. Two females had four and seven elongate, oviductal eggs.

## VIPERIDAE

### *Trimeresurus jerdoni* Günther

*Trimeresurus jerdoni* Günther, 1875, Proc. Zool. Soc. London, 1875: 233. Type locality: Khasya (= Khasi Hills, Assam).

One male, SVL 652 mm; tail length/total .17; weight 102 g; ventrals 174; subcaudals 64. One female, SVL (after preservation) 590 mm; tail length/total .14; ventrals 177; subcaudals 57. Scale rows 21-21-17, 23-21-17; supralabials 7; scales between supraoculars 7. From Wa Shan.

Both were caught in clearings, one at 1200 m and one at 1470 m. One was found under debris and one draped over a low plant. The female had three oviductal eggs on one side and four on the other; none of the eggs had developing embryos.

### *Trimeresurus monticola* Günther

*Trimeresurus monticola* Günther, 1864, Rept. Brit. India, p. 388. Type locality: Nepal.

Three males, SVL 425, 445 mm (one badly damaged); tail length/total .18 (N = 2); weight 72 g (N = 1); ventrals 138, 142; subcaudals 49, 53. Three adult and one juvenile females, SVL 610–

620 mm, 210 mm (all measured after preservation); tail length/total .14–.15 (mean .146); weight of adults (before preservation) 220–242 g (mean 228.7); ventrals 141–143 (mean 142.25); subcaudals 41–45 (mean 42.5). Scale rows at neck 23–29, at midbody 21–23, before vent 18–19; supralabials 9 (3) or 10 (4); 7–10 scales between supraoculars. All from Wa Shan.

Snakes were caught in clearings (5) and coniferous forest (2) at 1200 m. Three were under floor debris, two on surface of soil, and one each on and under rocks. Two females were gravid, one with seven and one with nine oviductal eggs.

## Summary of Habitat Distribution of Anurans at Wa Shan

Our data on this topic can be used to give a picture of ecological distribution of this assemblage only within a narrow interval of time. For the majority of frogs that interval fell during or close to the breeding season, so that our data refer largely to breeding sites. Only one anuran for which sample size was at least 10 was collected mainly in nonaquatic areas—*Bufo andrewsi* (table 3).

Most of the Wa Shan frogs are stream breeders (table 3), the five pelobatids, *Bufo andrewsi*, the two *Amolops*, *Rana boulengeri*, and *Rana margaretae*. In the hilly terrain of Wa Shan, streams have rocky beds and banks. Therefore, the heavy use of rocks as perch sites by these stream breeders shown in the table is probably a matter of availability rather than selectivity. Nonetheless, perch site varied among species. For example, *Rana margaretae* and *Amolops mantzorum* used rocks on the banks to a significantly greater extent than other species ( $P < .01$  in both cases; see Materials and Methods). Only one species, *Leptotalax pelodytoides*, commonly perched above ground on vegetation. *Oreolalax omeimontis*, *O. schmidti*, and *Scutigera chintingensis*, unlike the other species, were found mainly under rocks; males commonly called from that position. Although some species, such as *Rana boulengeri*, *R. margaretae*, and the two *Amolops*, appear to remain along stream courses throughout the live cycle, only *R. boulengeri* among them was seen in water more often than not ( $P < .01$ ).

There were also differences among stream-breeding species in terms of the widths of streams exploited (table 4). The pelobatids as a group were rarely seen at the widest stream, whereas the ranids

TABLE 5. Distribution of size classes of *Rana boulengeri* along streams of various widths at Wa Shan, Sichuan.

Snout-vent length (mm)	Stream widths (m)		
	0.5-2	3-5	8
	No. of individuals		
<61	1	0	3
61-75	2	0	8
76-90	3	2	4
91-105	8	4	9
106-136	11	2	5

made heavy use of that habitat. The contrast between the distributions of *Leptolalax pelodytoides* and *Rana margaretae* emphasize this point. Within the Ranidae, the difference between *Rana boulengeri* and *R. margaretae* seen in Table 4 is statistically significant ( $2 \times 3$  contingency table, chi-square 30.53,  $P < .01$ ). This difference is not related to the fact that the sample of *boulengeri* includes a much larger proportion of juveniles and small adults. As Table 5 shows, all size groups of *Rana boulengeri* occurred in both the narrowest and widest streams searched.

The few pond breeders fall into two groups, one comprising the three arboreal species of *Polypedates* and the other two terrestrial ranids, *Rana daunchina* and *R. japonica*. We observed calling males and nest holes of *R. daunchina* at a pond where *P. omeimontis* and *P. chenfu* were breeding. We collected *R. japonica* near a roadside ditch that contained tadpoles of that species. *Polypedates dugrizei* is isolated from its two congeners because of its restriction to high elevations; we found it only on the top of Wa Shan, at 2520 m and the others only below 1300 m.

We conclude from our observations that during the breeding season there is a modest amount of ecological segregation within related groups of species. Among the pelobatids, *Oreolalax schmidtii* and *Scutigera chintingsensis* were restricted to high elevations (2520 m) and the others to below 1450 m. We found the two high altitude species in separate streams, but because our samples are small and because the flattish top of Wa Shan is a network of small streams, we are not certain about their spatial isolation. Three of the pelobatids from lower elevations—*Oreolalax omeimontis*, *Leptolalax pelodytoides*, and *Megophrys omeimontis*—were caught along the same small streams and during the same collecting forays, although they differ slightly in perching sites (table 3). We have

already noted differences between *Rana boulengeri* and *R. margaretae* in perch sites (table 3) and relative abundances along small and large streams (table 4). Nonetheless, both were caught along the same segments of large streams during every collecting foray at those places.

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