

TINKLE, D. W. 1961. Population structure and reproduction in the lizard *Uta stansburiana stejnegeri*. Amer. Midland Natur. 66:206-234.

———. 1969. The concept of reproductive effort and its relation to the evolution of life histories of lizards. Amer. Natur. 103:501-516.

———, H. M. WILBUR, AND S. G. TILLEY. 1970. Evolutionary strategies in lizard reproduction. Evolution 24:55-74.

TURNER, F. B., P. A. MEDICA, J. R. LANNOM, AND

G. A. HODDENBACH. 1969. A demographic analysis of fenced populations of the whiptail lizard, *Cnemidophorus tigris*, in southern Nevada. Southwest. Natur. 14:189-201.

Received: 17 January 1972

Accepted: 5 April 1972

Department of Biology, The University of Utah, Salt Lake City, Utah 84112

THE SYSTEMATIC STATUS AND LIFE HISTORY OF *HYLA RHODOPEPLA* GÜNTHER

WILLIAM E. DUELLMAN

ABSTRACT: *Hyla rhodopepla* Günther, 1859, is a member of the *Hyla microcephala* group and ranges from Ecuador to Bolivia along the edge of the Amazon Basin. Mating call, tadpoles, and other aspects of the life history are typical of those of the *Hyla microcephala* group. *Hyla aluminiata* Andersson, 1906, *Hyla rufopunctata* Andersson, 1906, and *Hyla albida* Melin, 1941, are placed in the synonymy of *Hyla rhodopepla*.

MANY Amazonian frogs named during the 19th Century have been known from a few references in the literature, sometimes from only the type description. Such is the case of *Hyla rhodopepla* named in 1859 by Günther on the basis of a single specimen from the "Andes of Ecuador." Except for its inclusion in checklists and other compilations (Boulenger, 1882:389; Nieden, 1923:273; and Gorham, 1963:23), *Hyla rhodopepla* has been mentioned only twice in the literature—a record of a specimen from Zamora, Ecuador, by Parker (1934) and a report on genetic compatibility experiments on individuals from Iparía, Perú, by Bogart and Bogart (1971). Field work in Ecuador and Perú has resulted in the rediscovery of this small species, and examination of type specimens of various nominal taxa has permitted the assignment of certain names to the synonymy of *Hyla rhodopepla*.

Hyla rhodopepla Günther

Hyla rhodopepla Günther, 1859:112 [holotype.—BMNH 58.7.25.30 (1947.2.23.53)]

from "Andes of Ecuador"; Fraser, collector].

Hyla aluminiata Andersson, 1906:16 [syntypes.—NHRM 1953-56 (5 specimens) from San Fermin, Departamento La Paz, Bolivia; NHRM 1357-59 from Chaquimayo, Departamento Puno, Perú; Nils Holmgren, collector]. New synonymy.

Hyla rufopunctata Andersson, 1906:18 [holotype.—NHRM 1960 from Lagunillas, Departamento La Paz, Bolivia; Nils Holmgren, collector]. New synonymy.

Hyla albida Melin, 1941:27 [syntypes.—NHMG 471 (2 specimens) from Roque, Departamento San Martín, Perú; Douglas Melin, collector]. New synonymy.

Type Specimens and Justification of Synonymy.—The holotype of *Hyla rhodopepla* (BMNH 1947.2.23.53) is an adult female with a snout-vent length of 27.0 mm. The specimen is soft, but a pattern consisting of dark lavender flecks on the dorsum and a broad, dark lavender dorsolateral stripe from the snout to the groin is evident; the thighs are unpigmented. Günther (1859:

TABLE 1.—Measurements and proportions (range and mean) of *Hyla rhodopepla* from Santa Cecilia, Ecuador.

N	Snout-vent length (SVL)	Tibia length/SVL	Foot length/SVL	Head length/SVL	Head width/SVL	Tympanum/eye
Males						
24	19.7–22.9 (21.4)	0.489–0.584 (0.530)	0.406–0.459 (0.431)	0.292–0.332 (0.306)	0.323–0.381 (0.343)	0.346–0.538 (0.426)
Females						
6	26.8–27.7 (27.3)	0.526–0.540 (0.531)	0.426–0.436 (0.432)	0.302–0.321 (0.309)	0.332–0.346 (0.340)	0.464–0.500 (0.482)

112) described the color: "Back and upper side of lower leg rose-coloured, the former scarcely dotted with violet; a purplish-brown, lighter-edged (in spirits) band around the muzzle through the eye, along the sides to the loin; upper arm and leg not coloured; under parts whitish."

The type series of *Hyla aluminiata* consists of eight young, some with tail stubs; RMNH 1353 is the largest individual (snout-vent length, 15.3 mm) and is here designated as the lectotype. The specimens are discolored, but a pattern of dark flecks and dorsolateral stripes is evident on the lectotype; pigment is absent on the upper arms and thighs. Andersson (1906:16) described the color: "The ground-color above is bluish-white with small oval black spots, sharply defined. The front part of the head is either uniform silvery white, or there are, as on the figure, a few scattered spots. In one specimen the whole upper surface (except that of the limbs) is uniformly spotted. A black dorso-lateral streak runs from the tip of the snout through the eye nearly to the loin. In the largest specimen the sides below this streak are yellowish white but in the smaller one more or less dark. The extremities and the lower surfaces are in all examples uniformly light."

The holotype of *Hyla rufopunctata* (NHRM 1360) is a male with a snout-vent length of 19.3 mm. The specimen is somewhat desiccated and faded to a dull tan. Andersson's illustrations of *Hyla aluminiata* (Pl. 1, Fig. 3) and *Hyla rufopunctata* (Pl. 1, Fig. 4) show frogs having color patterns

nearly identical with each other and with that of *Hyla rhodopepla* (Günther, 1859, Pl. VII, Fig. E).

The two syntypes of *Hyla albida* (NHMG 471) are females having snout-vent lengths of 21.8 and 25.1 mm. The largest specimen has a white dorsum with brown flecks and brown dorsolateral stripe; the lips are white, and the limbs are creamy gray with a few indistinct scattered brown flecks on the limbs. My notes on the coloration of the types agree with the description given by Melin (1941:27).

Neither Andersson nor Melin compared their new species with *Hyla rhodopepla*, but Melin (1941:27) stated in his description of *H. albida*: "This species may be closely related to *H. aluminiata* And. from Bolivia. Irrespective of the sparse and small spots on the upper surface, it is, however, distinguished from the latter species by its reddish dotting on the forearms and tibiae and its larger size." Examination of the type specimens of the four nominal taxa leaves little doubt that all are representatives of a single species, the earliest name for which is *Hyla rhodopepla* Günther, 1859.

Diagnosis.—*Hyla rhodopepla* is characterized by: (1) head flat, noticeably broader than long; (2) tympanum present; (3) axillary membrane abbreviated; (4) fingers webbed to bases of antepenultimate phalanges; (5) toes, except fourth, webbed to bases of discs; (6) tarsal fold absent; (7) lip white; (8) reddish brown stripe from snout to groin; (9) dorsum creamy

white with reddish brown flecks; (10) tadpoles having long, xiphicercal tails and small, terminal mouths lacking denticles; and (11) mating call consisting of a long, monophasic primary note followed by a series of short, monophasic secondary notes.

Description.—The following description is based on specimens from Santa Cecilia, Ecuador (see Table 1 for morphometric data). Head flat, wider than long, wider than body; snout rounded in dorsal and lateral aspects; canthus rostralis rounded; loreal region barely concave; lips rounded, not flared; nostrils directed dorsolaterally, not protuberant; internarial region slightly depressed; eye large; width of eyelid about one-half interorbital distance; tympanum distinct, separated from eye by distance equal to diameter of tympanum; supratympanic fold weak, covering upper edge of tympanum, curving downward to point about insertion of arm.

Axillary membrane extending to mid-length of upper arm; ulnar fold and tubercles and fold on wrist absent; forearm slightly more robust than upper arm; hand small; fingers short, bearing large round discs; length of fingers from shortest to longest 1-2-4-3; diameter of disc on third finger equal to diameter of tympanum; subarticular tubercles small, conical; distal subarticular tubercle on fourth finger bifid; supernumerary tubercles small, conical, present in single row on proximal segment of each digit; palmar tubercle bifid; prepollical tubercle elongate; nuptial excrescences absent; webbing extending to bases of antepenultimate phalanges of all fingers.

Hind limbs moderately short; dermal fold on heel; calcars, tarsal tubercles, and tarsal folds absent; inner metatarsal tubercle small, ovoid, not visible from above; outer metatarsal tubercle absent; toes moderately short, bearing discs slightly smaller than those on fingers; length of toes from shortest to longest 1-2-3-5-4; subarticular tubercles small, round; supernumerary tubercles minute, irregularly present on proximal segments; web extending to bases of discs of toes, except only to base of antepenultimate phalanx of fourth toe.

Skin weakly granular on belly and proximal posteroventral surfaces of thighs; skin on other surfaces smooth; anal opening directed posteriorly at upper level of thighs; anal sheath short, lacking folds or tubercles; dentigerous processes of prevomers small, directed posteromedially between posterior margins of ovoid choanae; prevomerine teeth 4-7 ($\bar{x} = 4.8$, $N = 24$) in males, 7-9 ($\bar{x} = 8.3$, $N = 6$) in females; tongue cordiform, shallowly notched posteriorly, barely free posteriorly; vocal slit extending from mid-lateral base of tongue to angle of jaw; vocal sac single, median, subgular, greatly distensible.



FIG. 1.—Adult male *Hyla rhodopepla* (KU 123003) from Santa Cecilia, Ecuador. $\times 3$.

Color in alcohol: Dorsum creamy tan to silvery white, usually marked with small reddish brown flecks, especially on head and nape; broad, dark reddish brown band across tip of snout, through eye, encompassing tympanum, and diminishing between midflank and groin; white labial stripe, expanded below eye to reach orbit, and extending posteriorly immediately below brown band to midflank; dorsal surfaces of shanks color of body, usually with 3 or 4 narrow, diagonal reddish brown bars; forearms usually, and upper arms and thighs always, lacking pigment; ventral surfaces pale cream.

Color notes on 72 alcoholic specimens from Santa Cecilia reveal that dorsal flecks were absent in 3 specimens and diagonal bars were absent on the shanks of 23 specimens, whereas only 3 individuals had dark flecks on the forearms. All seven specimens from Zamora-Chinchi Province, Ecuador, and seven from Pilcopata, Perú, have flecks on the dorsum and bars on the shanks, but lack flecks on the forearms.

In life the dorsum is pale tan with red flecks and a red lateral band: the labial-lateral stripe is creamy white, and the venter is pale yellow. By day the dorsum changes to silvery white, and the flecks and band become reddish brown; the labial-lateral stripe becomes enamel white, and the venter pale cream (Fig. 1). The hands, feet, upper arms, and thighs lack pigment. The iris is pale pinkish gray with gray pre-

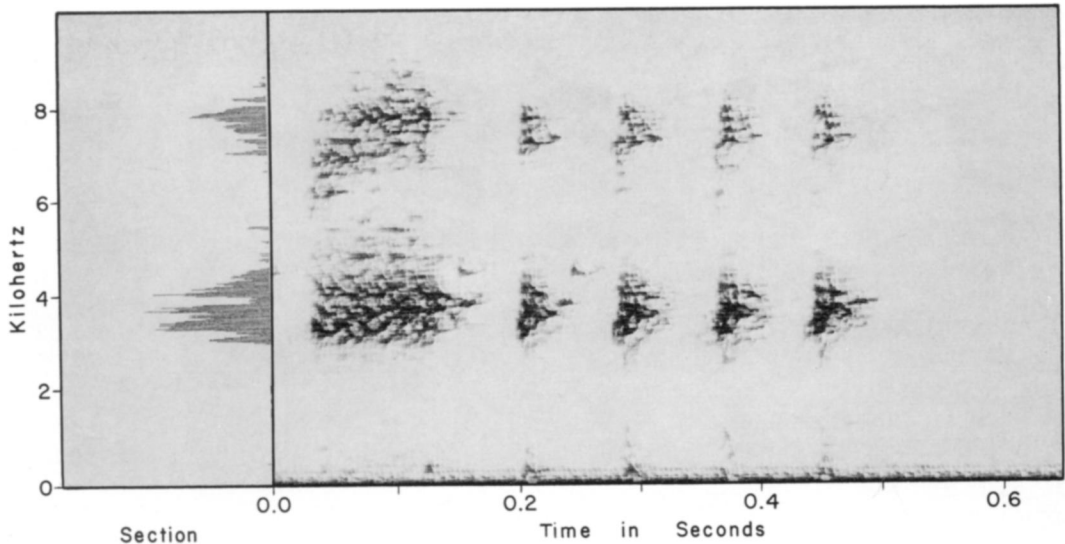


FIG. 2.—Audiospectrogram of mating call of *Hyla rhodopepla*. KU Tape 716, recorded at Santa Cecilia, Ecuador, 25 C. Wide band analysis.

dominant peripherally. The vocal sacs in calling males are yellow.

LIFE HISTORY

Hyla rhodopepla inhabits lowland tropical rainforest in the upper Amazon Basin, where it breeds in temporary ponds in the rainy seasons. At Santa Cecilia the species was not found during the latter part of a dry period which began in late June and lasted until September. Calling males were found 25 April through 27 June. Although some calling males were found in low grasses in and around shallow pools in clearings, the largest breeding congregations were always in a swamp in the forest. In this particular swamp the emergent vegetation consisted almost entirely of *Heliconia* (Musaceae). Other small hylids breeding in this swamp at the same time as *Hyla rhodopepla* included *Hyla cruentomma* Duellman, *H. garbei* (Miranda-Ribeiro), *H. parviceps* Boulenger, *H. rondoniae* Bokermann, and *H. sarayacuensis* Shreve. All of these species call from the leaves or stems of *Heliconia*, usually at a height of more than 1 m above the water, whereas

H. rhodopepla calls from heights usually less than 0.5 m.

The mating call consists of a monophasic primary note followed by 3–5 short, monophasic secondary notes (Fig. 2). The following data are based on analyses of 11 call groups produced by 5 individuals, all recorded at 25 C. The call repetition rate is 4–10 ($\bar{x} = 7.9$) calls per min, and the duration of the primary note is 0.10–0.22 ($\bar{x} = 0.15$) sec; there are 200–220 ($\bar{x} = 206$) pulses per second in the primary notes. The dominant frequency is about 3925 hertz, and a second emphasized harmonic is at about 7850 hertz.

Tadpoles were hatched from eggs laid by captive individuals and others were collected from ponds at Santa Cecilia. The following description is based on a specimen (KU 125917) in stage 30 (Gosner, 1960). Body length 4.9 mm; total length 16.2 mm; greatest depth of caudal fin 3.2 mm at about midlength of tail. Snout in dorsal view broadly rounded, in lateral view inclined anteriorly; body broadest at anterior border of orbit; venter nearly flat; mouth small, half again as wide as deep,



FIG. 3.—Tadpole of *Hyla rhodopepla* (KU 125917) from Santa Cecilia, Ecuador. $\times 4$.

lacking labial papillae and denticles; beaks robust, weakly serrate; eyes large, widely separated, directed laterally; nostrils much closer to tip of snout than to eyes, directed anterolaterally; spiracle small, sinistral; spiracular opening directed posteriorly at point about one-third distance from eye to posterior edge of body, just below midline; cloacal tube short, dextral. Caudal musculature slender, comprising about one-third depth of tail at midlength, extending far beyond caudal fins; dorsal fin extending onto body, about twice as deep as ventral fin (Fig. 3).

Color in formalin: Pale cream with brown flecks scattered on caudal musculature; brown flecks forming irregular bar from snout to eye, large spot between eyes, and fine reticulations on dorsal fin.

Color in life: Body and tail pale orange, without distinct markings; iris orange-tan centrally, black peripherally.

DISCUSSION

Hyla rhodopepla evidently belongs to the *Hyla microcephala* group as defined by Duellman (1970). Bogart and Bogart (1971) reported a diploid number of 30 chromosomes in *Hyla rhodopepla*; this number is common to members of the *microcephala*, *leucophyllata*, and *parviceps* groups of *Hyla* in South America. Members of the *Hyla microcephala* group are widespread in the tropical lowlands east of the Andes and in Central America. Those species that occur in northwestern South America (*Hyla microcephala* Cope and *Hyla mathiassoni* Cochran and Goin) principally inhabit non-forest environments. Cochran and Goin (1970) named *Hyla riveroi* from Leticia, Colombia, as a member of the *Hyla*

microcephala group; however, it seems to be more closely related to *Hyla minuta* Peters.

The range of *Hyla rhodopepla* encompasses the western periphery of the Amazon Basin from Ecuador to northern Bolivia at elevations from 300 to 1700 m (Fig. 4). Within this region it occurs sympatrically with several other small hylids, including eight species that are widespread in the Amazon Basin: *Hyla garbei* (Miranda-Ribeiro), *H. granosa* Boulenger, *H. leucophyllata* Bereis, *H. marmorata* (Laurenti), *H. minuta* Peters, *H. parviceps* Boulenger, *H. punctata* (Schneider), and *H. rubra* Laurenti. In addition to these, there are eight species that are known only from the upper Amazon Basin—*Hyla bifurca* Anderson, *H. bokermanni* Goin, *H. cruentomma* Duellman, *H. favosa* Cope, *H. funerea* Cope, *H. rondoniae* Bokermann, *H. sarayacuensis* Shreve, and *H. triangulum* Günther. The species of this latter group, plus *H. rhodopepla*, comprise part of an anuran faunal element that seems to be restricted to the tropical rainforest on the western periphery of the Amazon Basin and lower slopes of the Andes. Too little is known about distributions of most Amazonian species to draw more than tentative conclusions, but it is conceivable that these species differentiated in the Napo and Perú Pleistocene forest refugia hypothesized by Haffer (1969).

Acknowledgments.—For the loan of specimens and the provision of working space in their respective institutions I am indebted to Alice C. C. Grandison, British Museum (Natural History) (BMNH); Birgitta Hansson, Naturhistoriska Museet, Göteborg (NHMG); Dorothy M. Smith, University of Illinois Museum of Natural History (UIMNH); Greta Vestergren, Naturhistoriska Riksmuseet, Stockholm (NHRM); and Charles F. Walker, University of Michigan Museum of Zoology (UMMZ). Field work in Ecuador was supported in part by Watkins Museum of Natural History grants, University of Kansas. At Santa Cecilia, Ecuador, field parties enjoyed the congenial hospitality of Ing. Ildefonso Muñoz B. I am grateful to my field companions, especially Thomas H. Fritts, Linda Trueb, and Charles F. Walker, for aid in collecting material. I thank Linda Trueb for the drawing in Fig. 3.

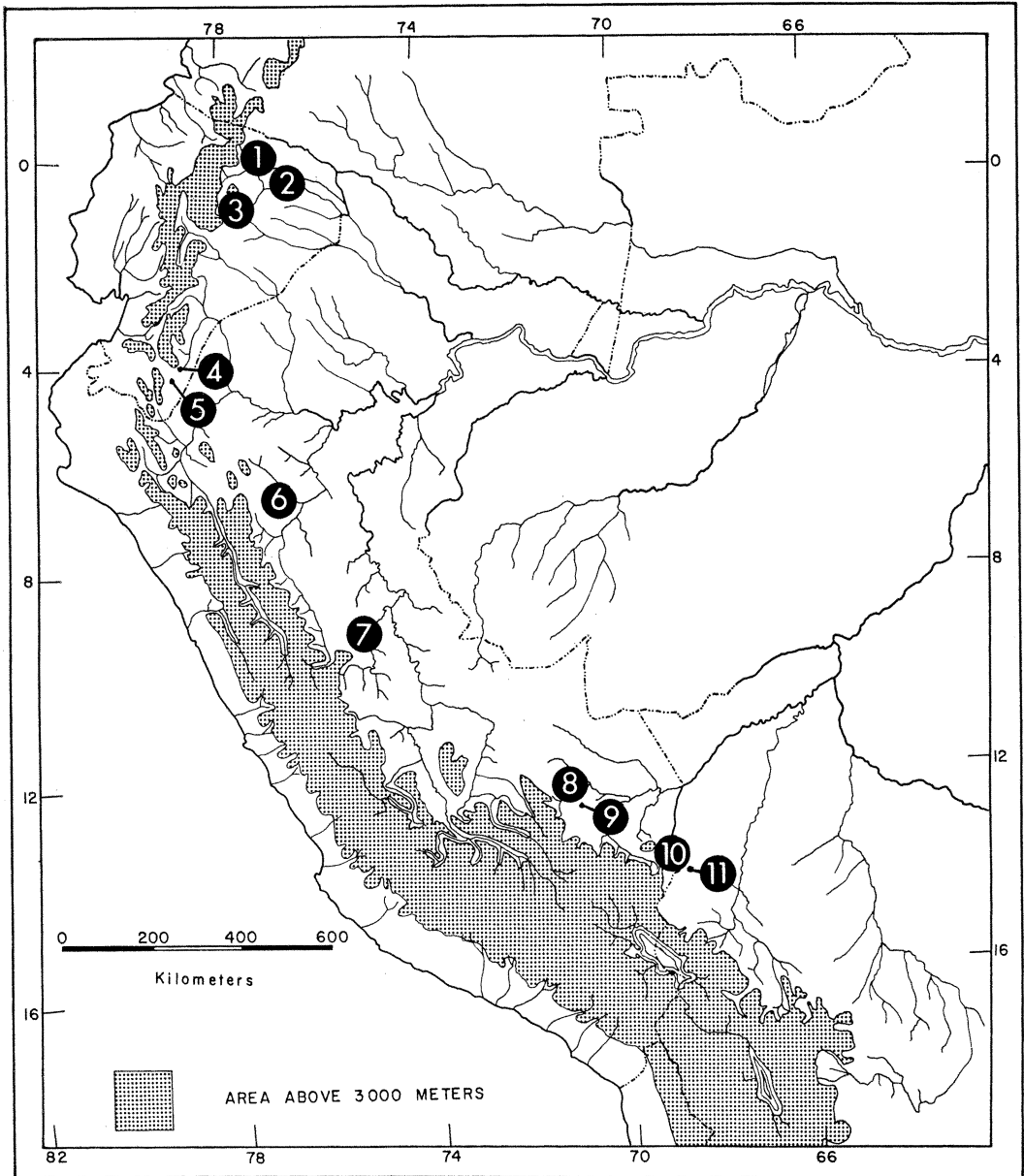


FIG. 4.—Distribution of *Hyla rhodopepla*. Key to numbered localities is given in list of specimens examined.

SPECIMENS EXAMINED

In the following list the number in parentheses following a locality is the key to the locality shown on the map (Fig. 4). Literature sources for specimens not studied by me are given in parentheses; all of the 136 specimens examined are referred to by catalogue number and the abbreviation of the

collection given in the Acknowledgments (KU = University of Kansas Museum of Natural History).

BOLIVIA: *La Paz*: Lagunillas (11), NHRM 1360; San Fermin (10), NHRM 1353-56. ECUADOR: "Andes," BMNH 1947.2.23.50. *Napo*: Limón Cocha (2), KU 99218-20, UIMNH 63102, 64683, 65462-72; Santa Cecilia (1), KU 105191-204, 111961-8, 123003-10, 125916-9 (tadpoles),

126501-40, 143185-7 UMMZ 129276 (15); Tena (3), UIMNH 90058. *Zamora-Chinchipec*: 4 km SW Cumbaraza (4), KU 120916-20; Zamora (5), BMNH 1933.6.24.68, KU 121032, 121409. PERÚ: *Cuzco*: Pilcopata (8), KU 129233-9. *Huánuco*: Iparia, Río Pachitea (7), (Bogart and Bogart, 1971). *Puno*: Chaquimayo (9), NHRM 1957-9. *San Martín*: Roque (6), NHMG 471 (2).

LITERATURE CITED

- ANDERSSON, L. G. 1906. On batrachians from Bolivia, Argentina, and Peru collected by Erland Nordenskiöld 1901-1902 and Nils Holmgren 1904-1905. *Ark. Zool.* 3:1-19.
- BOGART, J. P., AND JO ELLEN BOGART. 1971. Genetic compatibility experiments between some South American anuran amphibians. *Herpetologica* 27:229-235.
- BOULENGER, G. A. 1882. Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum. Ed. 2, London. xvi + 503 p.
- COCHRAN, DORIS M., AND C. J. GOIN. 1970. Frogs of Colombia. *Bull. U. S. Nat. Mus.* 288:xii + 655 p.
- DUELLMAN, W. E. 1970. The hylid frogs of Middle America. *Monogr. Mus. Natur. Hist. Univ. Kansas* 1:xi + 753 p.
- GORHAM, S. W. 1963. The comparative number of species of amphibians in Canada and other countries III. Summary of species of anurans. *Canadian Field-Nat.* 77:13-48.
- GOSNER, K. L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologica* 16:183-190.
- GÜNTHER, A. C. L. G. 1859. Catalogue of the Batrachia Salientia in the collection of the British Museum. London. xvi + 160 p.
- HAFFER, J. 1969. Speciation in Amazonian forest birds. *Science* 165:131-137.
- MELIN, D. 1941. Contribution to the knowledge of Amphibia of South America. *Göteborgs Kungl. Vetensk.-och Vitterh.-Sam. Handl. (B)* 1(4):1-71.
- NIEDEN, F. 1923. Anura I. Subordo Aglossa und Phaneroglossa, Sectio I, Arcifera. *Das Tierreich*, Lief. 46. Berlin. xxxii + 584 p.
- PARKER, H. W. 1934. Reptiles and amphibians from southern Ecuador. *Ann. Mag. Natur. Hist.* (10)14:264-273.

Received: 26 January 1972

Accepted: 3 April 1972

Museum of Natural History, University of Kansas, Lawrence, Kansas 66044

LINKED CITATIONS

- Page 1 of 1 -



You have printed the following article:

The Systematic Status and Life History of *Hyla rhodopepla* Günther

William E. Duellman

Herpetologica, Vol. 28, No. 4. (Dec., 1972), pp. 369-375.

Stable URL:

<http://links.jstor.org/sici?sici=0018-0831%28197212%2928%3A4%3C369%3ATSSALH%3E2.0.CO%3B2-H>

This article references the following linked citations. If you are trying to access articles from an off-campus location, you may be required to first logon via your library web site to access JSTOR. Please visit your library's website or contact a librarian to learn about options for remote access to JSTOR.

Literature Cited

Speciation in Amazonian Forest Birds

Jürgen Haffer

Science, New Series, Vol. 165, No. 3889. (Jul. 11, 1969), pp. 131-137.

Stable URL:

<http://links.jstor.org/sici?sici=0036-8075%2819690711%293%3A165%3A3889%3C131%3ASIAFB%3E2.0.CO%3B2-R>