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The herpetofauna of Parque Nacional El Cusuco, Honduras (Reptilia, Amphibia)

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ABSTRACT — Thirty species of amphibians and reptiles (four salamanders, nine anurans, six lizards, and 11 snakes) are recorded from Parque Nacional El Cusuco, located in the northwestern portion of the Honduran department of Cortés and adjacent Santa Bárbara. The park has an area of about 234 km² of mountainous terrain located in the Lower Montane Wet Forest formation. Elevations in the park range from 1500 m to 2242 m on the peak of Cerro Jilisco. The visitors' centre lies at 1550 m. The nuclear zone of the park receives a minimum of 3000 mm of rainfall annually. Mean annual temperature in this zone is 18°C at its lower reaches and 16°C at its higher reaches. The vegetation is characteristic of the Lower Montane Wet Forest formation of Holdridge and is organized into three strata. Population declines or disappearances of 30.8% of the amphibian species are documented in the park. Only 8.9% of the entire Honduran mainland and insular herpetofauna and 30.0% of the species found in the Lower Montane Wet Forest formation are afforded protection in the park. Careful and continuing monitoring of the park's remaining herpetofaunal populations will be necessary.

RESUMEN — Trienta especies de anfibios y reptiles (cuatro salamandras, nueve anuros, seis lagartijas y 11 culebras) han sido registrados por el Parque Nacional El Cusuco, ubicado en la parte noroeste del departamento hondureño de Cortés y la parte adyacente de Santa Bárbara. El parque comprende aproximadamente 234 kilómetros cuadrados de terreno montañoso en el cual se representan una formación vegetal, Bosque Muy Húmedo Montano Bajo. Las alturas en el parque se extienden entre 1500 m a 2242 m en el pico de Cerro Jilisco. El Centro de Visitantes está situado a 1550 m. La zona nuclear del parque recibe un mínimo de 3000 mm de lluvia anualmente. Temperatura anual promedio en esta zona es 18°C en los alcances bajos y 16°C en los alcances más altos. La vegetación es típica de la formación Bosque Muy Húmedo Montano Bajo y está organizado en tres niveles. Declinaciones o desaparecimientos de poblaciones de un 30.8 por ciento de las especies de los anfibios son documentados en el parque. Solamente 8.9 por ciento de la herpetofauna hondureña de la tierra firme y las islas y 30.0 por ciento de las especies ubicados en la formación Bosque Muy Húmedo Montano Bajo son proveídos protección en el parque. Se necesita un monitoreo cuidadoso y continuo de las poblaciones remanentes de anfibios y reptiles.

OUR knowledge of the herpetofauna of Honduras has reached a point where it is possible to examine its conservation status, which we have been doing in a series of recent papers. Wilson & McCranie (1998) examined population declines in several amphibian species known from Parque Nacional Pico Bonito. Wilson et al. (2001) discussed in detail the efficacy of the current system of biotic reserves in providing protection to

the country's herpetofauna. McCranie & Wilson (2002) assayed the probable future of the amphibian fauna of the country. Wilson & McCranie (2003) identified a group of so-called herpetofaunal 'indicator species' in order to assess the 'environmental stability' of habitats in Honduras. Wilson & McCranie (2004a) discussed the conservation status of the Honduran herpetofauna.

The assessments discussed above have indicated that the study of the Honduran herpetofauna has entered a new era. Since 1980, when the first new species (*Leptodactylus silvanimbus*; McCranie et al. 1980) was described in what can be labeled the 'modern era' of herpetofaunal research in Honduras (McCranie & Wilson, 2002), many new taxa have been added to the herpetofauna of this country (see McCranie & Wilson, 2002, for a discussion of the amphibian additions up to that time). Wilson & McCranie (1998), however, provided the turning point into a new era, one of significant population declines, especially in amphibians distributed at about 900 m and above in the country. These declines are especially important, inasmuch as it is the most distinctive segment of the Honduran amphibian fauna, the endemic species and those otherwise restricted to Nuclear Middle America, that have been most drastically affected (McCranie & Wilson, 2002). Nonetheless, it is also evident that reptile populations are also becoming adversely affected (Wilson & McCranie, 2003, 2004a), principally as a result of habitat destruction, so that both segments of the herpetofauna are involved.

That these trends are part of the problem of global biodiversity decline is becoming increasingly evident (see E. Wilson, 1988, 1992; E. Wilson & Perlman, 2000 for general assessments). It is also evident that these irreversible trends are occurring in the face of an extensive system of biotic reserves present in Honduras. The reasons for this set of circumstances have been examined at length by Wilson et al. (2001) and Wilson & McCranie (2004a).

We recently began a series of papers concerned with the composition, distribution, and conservation status of the amphibians and reptiles occurring in various biotic reserves in Honduras with an inaugural paper on Refugio de Vida Silvestre La Muralla in northwestern Olancho (Espinal et al, 2001). The present paper is the second in this series and examines these same aspects for Parque Nacional El Cusuco, a park established in the highest reaches of the Sierra de Omoa in the northwestern corner of Honduras.

One or both of us have made eight trips into this park, starting in 1979, at a time before the park was established.

The purpose of this paper is to discuss the composition, geographical and ecological distribution, and the conservation status of the herpetofauna of Parque Nacional El Cusuco. In addition, we also discuss the importance of this park as a herpetofaunal reserve.

MATERIALS AND METHODS

Specimens are deposited in the following museums: California Academy of Sciences, San Francisco (CAS); Field Museum of Natural History, Chicago (FMNH); Museum of Natural History, The University of Kansas, Lawrence (KU); Natural History Museum of Los Angeles County (LACM); Museum of Natural Science, Louisiana State University, Baton Rouge (LSUMZ); Museum of Vertebrate Zoology, University of California, Berkeley (MVZ); Royal Ontario Museum, Toronto, Canada (ROM); Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main, Germany (SMF); National Museum of Natural History, Washington DC (USNM); Universidad Nacional Autónoma de Honduras, Tegucigalpa (UNAH).

Fieldwork for this paper is summarized as follows: Wilson and McCranie have made six trips together for a total of 18 days (12th–14th April 1979; 21st–23rd May 1980; 1st–3rd August 1982; 13th–14th July 1983; 3rd–7th August 1987; 22nd–23rd July 1996); McCranie made two trips by himself for 6 days (18th–21st August 1992; 9th–10th September 2003). In addition, our Honduran colleague Mario R. Espinal collected for 15 days on three trips in 1993 (11th–14th July; 17th–22nd August; 26th–30th September). The fieldwork by McCranie and Wilson was concentrated on the El Cusuco region up to 1850 m on Cerro Cusuco, whereas Espinal visited several nearby peaks and mountain slopes. We have also included specimens collected by Gunther Köhler in the El Cusuco area 24th–27th September 1996.

DESCRIPTION OF THE PARK

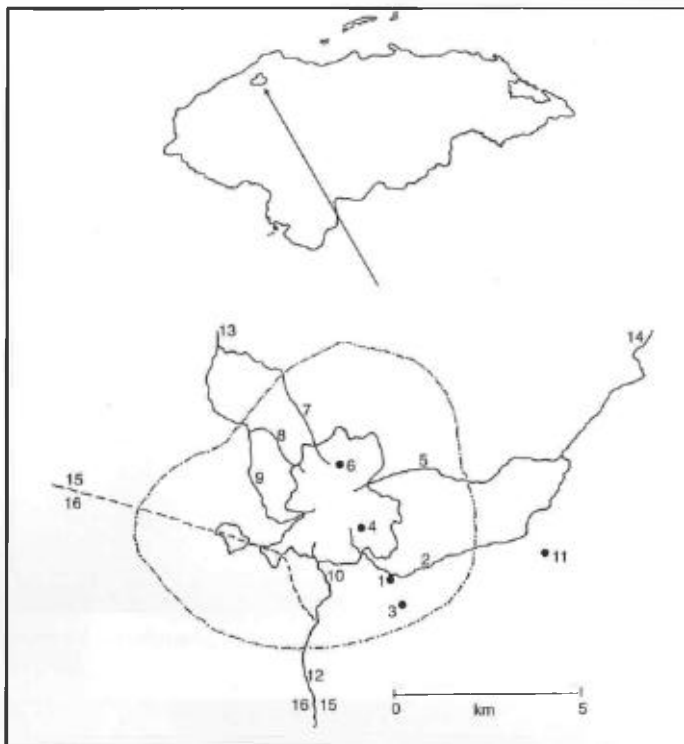
Parque Nacional El Cusuco is located in the northwestern sector of the Honduran department of Cortés and the adjacent portion of the department of Santa Bárbara (Map 1). The park encompasses an area of approximately 234 km², with a nuclear zone of about 7.7 km² (Anonymous, No Date). The park consists of elevations of 1500 m and higher, with those of 1800 m and higher making up the nuclear zone. A visitor's centre is situated near the road leading to the park from Buenos Aires at 1550 m.

Physiography

Parque Nacional El Cusuco is situated within the largest physiographic area in Honduras, the *Serranía* (Wilson et al., 2001). Moreover, it is found within the northern portion of the *Serranía*, called the Northern Cordillera. The park is located within the Sierra de Omoa (also called Cordillera de Merendón on some maps), the northwestern-most mountain range in Honduras. This range is bounded on the north and west by the alluvial plain of the Río Motagua and also on the north by the adjacent narrow coastal plain bounding the Bahía de Omoa. It is bounded on the east by the Sula Valley formed of the alluvial plains of the ríos Chamelecón and Ulúa and on the south by the valley of the Río Chamelecón and tributaries of the Río Motagua.

Climate

The park is subject to the Highland Wet climatic regime (Wilson & Meyer, 1985). Espinal et al. (2001:101) noted, for Refugio de Vida Silvestre La Muralla, 'The Highland Wet climate occurs primarily above 1500 m elevation and is characterized by 1500 mm or more of annual precipitation and a mean annual temperature of less than 18°C....'. Maps of isohyets and isotherms for Parque Nacional El Cusuco are presented in Anonymous (1994). The isohyet map illustrates that the nuclear zone of the park is surrounded by an isohyet of 3000 mm. The isotherm map



Map. 1. Boundary map of Parque Nacional El Cusuco and an outline map of Honduras showing the park's location. The dot-dash line shows the park's outline; the solid lines show the outline of the park's nuclear zone; the dash-dash line shows the departmental boundaries for Cortés and Santa Bárbara. The other solid lines are rivers and streams. Localities are: (1) El Cusuco; (2) Río Cusuco; (3) Cerro Las Minas; (4) peak of Cerro Cusuco; (5) Quebrada de Jimerito; (6) peak of Cerro Jilincó; (7) Quebrada El Jilincó; (8) Quebrada El Pizote; (9) Quebrada de Cantiles; (10) Quebrada Cabeceras de Naco; (11) Buenos Aires; (12) Río Naco; (13) Río Cuyamelito; (14) Río Cuyamel; (15) department of Cortés; and (16) department of Santa Bárbara.

indicates that the nuclear zone is surrounded by an isotherm of 18°C and that one of 16°C lies within the park.

Vegetation

The vegetation of Parque Nacional El Cusuco is referable to the Lower Montane Wet Forest formation, as slightly modified from Holdridge (1967), commonly referred to as 'cloud forest'.



Above: *Duellmanohyla soralia*. Below: *Norops johnmeyeri*. All photographs © J. R. McCranie.



This formation is found at elevations above about 1500 m and is characterized by a mean annual precipitation range of 2000–4000 mm and a mean annual

temperature range of 12° to 18°C (Wilson & Meyer, 1985).

Anonymous (1994) indicated that this forest formation, called by them 'Zona de Vida Bosque Muy Húmedo Montano Bajo', is characterized by the presence of three strata. The uppermost stratum consists of a closed canopy of trees attaining heights of 35 to 40 m of the following species: *Quercus* spp.; *Podocarpus oleifolius*; *Clusia massoniana*; and *Liquidambar styraciflua*. The middle stratum is composed of the foregoing species lying in the shade of the taller conspecifics mixed with *Persea vesticula* and *Myrica cerifera*. The lowermost stratum is comprised of seedlings of the species in the middle and uppermost strata intermixed with palms such as *Chamaedorea costaricana* and *C. oblongata*, as well as *Geonoma congesta* and a great variety of ferns. Many epiphytic orchids, bromeliads, and mosses are present, as well as lianas and vines.

Microhabitats

Many microhabitats exist for the members of the herpetofauna in the park. There are numerous streams that provide habitat for streamside anurans, such as the species of *Plectrohyla* and *Ptychohyla* and their larvae. The undergrowth of the surrounding forests is a setting for the

anoles of the genus *Norops*. Logs lying on the ground provide habitat for various semifossorial snakes, such as *Ninia espinali* and *Tantilla*



Bolitoglossa conanti.



Plectrohyla dasypus.



Hyla bromeliacia.



Dryadophis dorsalis.



Cerrophidion godmani.



Cerrophidion godmani.

schistosa, and the lizard *Mesaspis moreletii*. Numerous epiphytic bromeliads house salamanders of the genera *Bolitoglossa* and *Cryptotriton*, as well as the bromeliad frog *Hyla bromeliacia* and the stream-breeding frog *Plectrohyla dasypus*.

RESULTS

Composition

The known herpetofauna of Parque Nacional El Cusuco (Table 1) consists of 30 species, including four salamanders (13.3%), nine anurans (30.0%), six lizards (20.0%), and 11 snakes (36.7%). The colubrid snake *Coniophanes bipunctatus* was apparently erroneously reported from the park in a list in Anonymous (1994). That list was compiled by data from McCranie and collections made by

M. R. Espinal. We have been unable to locate this specimen among the collections made by M. R. Espinal (see Materials and Methods).

Broad patterns of geographical distribution

As did Wilson & Meyer (1985), Wilson et al. (2001), and McCranie & Wilson (2002), we placed the species occurring in the park into a set of distributional categories based on the entire extent of their geographic range (Table 1). Five of the categories used by Wilson et al. (2001) do not apply to this paper (species with the northern terminus of the range in the United States and the southern terminus in Central America south of the Nicaraguan Depression [category B], species with the northern terminus of the range in the United States and the southern terminus in Nuclear Middle America [category C], species with the northern terminus of the range in Nuclear Middle America and the southern terminus in South America [category G], marine species [category K], and insular and/or coastal species [category L]). The applicable categories are as follows:

A. Northern terminus of the range in the United States (or Canada) and southern terminus in South America;

D. Northern terminus of the range in Mexico north of the Isthmus of Tehuantepec and southern terminus in South America;

E. Northern terminus of the range in Mexico north of the Isthmus of Tehuantepec and southern terminus in Central America south of the Nicaraguan Depression;

F. Northern terminus of the range in Mexico north of the Isthmus of Tehuantepec and southern terminus in Nuclear Middle America;

H. Northern terminus of the range in Nuclear Middle America and southern terminus in Central America south of the Nicaraguan Depression;

I. Restricted to Nuclear Middle America (exclusive of Honduran endemics);

J. Endemic to Honduras.

The data on broad distributional patterns in Table 1 indicate that the largest number of species

(10 or 33.3% of a combined total of 30 species) fall into the I category, i.e., that containing the Nuclear Middle American-restricted species (exclusive of the Honduran endemics). The next largest category is J, with nine species (30.0%), containing the Honduran endemics. Together, these two categories comprise 63.3% of the tally for the park. The other five categories contain from one to three species each and harbour, as a group, 36.7% of the total number.

Park distribution

We established three categories of distribution of the members of the herpetofauna within Parque Nacional El Cusuco (Table 1). Species are considered to be widespread in the park, restricted to the park or its immediate environs (although, in some cases, species may be distributed otherwise outside of Honduras), and peripherally distributed in the park.

Of the 30 species recorded from Parque Nacional El Cusuco, 15 (50.0%) are widespread, four (13.3%) are restricted to the park or its immediate surroundings, and 11 (36.7%) are peripheral.

Ecological distribution

In terms of vertical positioning within the primary microhabitat, 15 species (50.0%) were usually found only in arboreal situations, 14 (46.7%) only in terrestrial ones, and one (3.3%) in both (Table 1). With respect to occurrence in the two major microhabitats in the park (forest proper, streamside), 21 (70.0%) were found only within the forest proper, eight (26.7%) only along streams, and one (3.3%) in the forest and along streams.

If the two sets of categories, vertical position within the primary microhabitat and major microhabitats, are combined, then ten species (33.3%) are arboreal forest inhabitants, five (16.7%) are arboreal streamside inhabitants, 11 (36.7%) are terrestrial forest inhabitants, two (6.7%) are terrestrial streamside inhabitants, one (3.3%) is a terrestrial forest and streamside inhabitant, and one (3.3%) is a terrestrial-arboreal streamside inhabitant.

Table 1. Distribution of the 30 species of amphibians and reptiles known from Parque Nacional El Cusuco. Abbreviations include: Park Distribution-W = widespread in park, R = restricted to park or immediate environs, P = peripherally distributed in park; Primary Microhabitat-A = arboreal, T = terrestrial, F = forest inhabitant, S = streamside inhabitant; Relative Abundance-C = common, I = infrequent, R = rare; Conservation Status-S = stable populations in Parque Nacional El Cusuco, D = Parque Nacional El Cusuco populations declining, E = extirpated from park, N = no data on population status. See text for explanation of Broad Distribution Pattern abbreviations.

Species	Park Distribution	Elevational Range (m)	Broad Distribution Pattern	Primary Microhabitat	Relative Abundance	Conservation Status
<i>Bolitoglossa conanti</i>	P	1550-1560	I	A, F	I	S
<i>Bolitoglossa diaphora</i>	W	1550-2200	J	A, F	C	S
<i>Bolitoglossa dunni</i>	P	1550-1570	I	A, F	R	S
<i>Cryptotriton nasalis</i>	W	1550-2200	J	A, F	R	S
<i>Bufo valliceps</i>	P	1550	E	T, F	R	N
<i>Duellmanohyla soralia</i>	P	1550-1570	I	A, S	R	D
<i>Hyla bromeliacia</i>	W	1550-1790	I	A, F	C	S
<i>Plectrohyla dasypus</i>	R	1500-1990	J	A, S	C	S
<i>Plectrohyla exquisita</i>	R	1500-1680	J	A, S	C	S
<i>Ptychohyla hypomykter</i>	W	1500-1720	I	A, S	C	S
<i>Eleutherodactylus milesi</i>	W	1550-1720	J	T, S	C	E
<i>Eleutherodactylus rostralis</i>	W	1550-1800	I	T, F	R	D
<i>Rana maculata</i>	P	1580-1590	I	T, S	R	D
<i>Mesaspis moreletii</i>	W	1720-1870	I	T, F	I	S
<i>Sceloporus malachiticus</i>	W	1550-1660	H	A, F	C	S
<i>Norops amplisquamosus</i>	R	1530-1720	J	A, F	C	S
<i>Norops cusuco</i>	R	1550-1935	J	A, F	C	S
<i>Norops johnmeyeri</i>	W	1550-1825	J	A, F	C	S
<i>Sphenomorphus cherriei</i>	P	1590	E	T, F	R	N
<i>Dryadophis dorsalis</i>	P	1550-1570	I	T, F	R	N
<i>Drymarchon melanurus</i>	P	1550	A	T, F	R	N
<i>Drymobius chloroticus</i>	W	1550-1810	F	T, F, S	I	D
<i>Imantodes cenchoa</i>	P	1550	D	A, F	R	S
<i>Leptophis ahaetulla</i>	W	1680	D	T, A, S	R	N
<i>Ninia espinali</i>	W	1590-2242	I	T, F	R	S
<i>Stenorrhina degenhardtii</i>	P	1550-1630	D	T, F	I	S
<i>Tantilla schistosa</i>	W	1680	E	T, F	R	N
<i>Micrurus diastema</i>	P	1550	F	T, F	R	S
<i>Bothriechis marchi</i>	W	1550-1840	J	A, S	R	D
<i>Cerrophidion godmani</i>	W	1700-1880	H	T, F	I	S

Relative abundance

The 30 species known from the park are classified as being common (found on a regular basis, many individuals can be found), infrequent (unpredictable, few individuals seen), or rare (rarely seen). These classifications are historical (i.e., based largely on earlier trips to the parks) and do not take into consideration the population declines taking place for some species (see next section). Ten species (33.3%) are classified as being common (one salamander, five anurans, four lizards), five (16.7%) as being infrequent (one salamander, one lizard, three snakes), and 15 (50.0%) as being rare (two salamanders, four anurans, one lizard, eight snakes).

Population declines

Population declines, especially of amphibians, are underway in this national park (McCranie & Wilson, 2002), as is the case elsewhere in Honduras (McCranie & Wilson, 2002; Wilson & McCranie, 1998, 2003, 2004a). Of the 13 species of amphibians presently known from the park, 4 (30.8%) have either declining populations or are apparently extinct. Those with declining populations are *Duellmanohyla soralia*, *Eleutherodactylus rostralis*, and *Rana maculata*. One species, *Eleutherodactylus milesi*, appears to be extinct (see discussion below). *Eleutherodactylus milesi* is endemic to Honduras and *Duellmanohyla soralia*, *Eleutherodactylus rostralis*, and *Rana maculata* are restricted in distribution to Nuclear Middle America.

As discussed by McCranie & Wilson (2002: 412), 'The population of *Eleutherodactylus milesi* at El Cusuco, Cortés, has apparently disappeared. Concerted efforts to find this frog were unsuccessful on three days and four nights in August 1992 and three days and two nights in July 1996. Additionally, we did not find this frog during four days of general collecting at El Cusuco during August 1987, nor did M. R. Espinal on two collecting trips to the region in July and August 1993 [also in September 1993]. The forests at El Cusuco remain in a pristine condition, as the area has been a national park since 1987. El

Cusuco serves as the visitors' centre for the park and has guards and park personnel on duty 24 hours a day. Permission is needed from park personnel just to use the park trails. The disappearance of *E. milesi* from El Cusuco appears to be part of a general pattern of disappearance of all streamside *Eleutherodactylus* populations in the country occurring at about 900 m elevation and higher' *Eleutherodactylus milesi* also could not be found during 9th–10th September 2003.

Study of tadpole collections made in 1996 at El Cusuco indicated that many specimens of *Plectrohyla dasypus* (Honduran endemic not known outside of the park) and *Ptychohyla hypomykter* (restricted in distribution to Nuclear Middle America) had deformed mouthparts. As noted by McCranie & Wilson (2002: 540), 'It appears initially that this phenomenon may be connected to such occurrences that are beginning to be reported elsewhere (Berger et al., 1998; Lips, 1998, 1999), and may be related to overall amphibian population declines or disappearances from pristine habitats at moderate to intermediate elevations recently realized in Honduras, as has been demonstrated also for several localities in Costa Rica and Panama (Lips, 1998, 1999)'. However, in September 2003, these two species were found to still be common in the park and were heard calling on both nights spent in the park. Also, all tadpoles of *P. hypomykter* collected at that time had normal mouthparts.

Parque Nacional El Cusuco harbours seven other Honduran endemics, including *Bolitoglossa diaphora*, *Cryptotriton nasalis*, *Plectrohyla exquisita*, *Norops amplisquamosus*, *N. cusuco*, *N. johnmeyeri*, and *Bothriechis marchi*. Three of these Honduran endemics (*P. exquisita*, *N. amplisquamosus*, and *N. cusuco*) are not known outside of Parque Nacional El Cusuco. Given the above-indicated documented cases of decline or disappearance, it is obviously critical that the populations of the species mentioned in this section be carefully monitored for changes in their population status.

IMPORTANCE OF THE PARK AS A HERPETOFAUNAL REFUGE

In the same manner as Espinal et al. (2001), we utilize the data in Wilson et al. (2001) in assessing the value of Parque Nacional El Cusuco as a refuge for amphibians and reptiles. Wilson et al. (2001) broadly dealt with the usefulness of the Honduran system of biotic reserves. This paper has the advantage of treating in more detail the herpetofauna of one of the country's better-known biotic reserves.

As currently understood, the herpetofauna of the mainland of Honduras, Bay Islands, Cayos Cochinos, Miskito Keys, Swan Islands, and territorial waters consists of 344 species (McCranie, 2004; McCranie & Castañeda, submitted; McCranie & Wilson, 2002; McCranie et al., 2002, 2003a,b, submitted; Wilson & McCranie, 2002; Wilson et al., 2003), including 120 amphibians and 224 reptiles (six of which are marine in distribution). The known herpetofauna of Parque Nacional El Cusuco (30 species), thus, comprises 8.9% of the 338 species known from the mainland and insular environments in Honduras. The percentage of the various mainland and insular species afforded nominal protection in the park varies widely. Neither of the two species of caecilians, none of the nine species of non-marine turtles, nor neither of the two crocodilians is recorded from the park. The percentages of the other groups are as follows: salamanders (15.4% of 26 species); anurans (9.8% of 92 species); lizards (6.8% of 88 species); and snakes (9.2% of 119 non-marine species).

As is obvious, the above figures are somewhat misleading, inasmuch as Parque Nacional El Cusuco harbours only one of the forest formations located in Honduras. It is more useful, therefore, to assess the park's importance by comparing the herpetofaunal composition in the park with that of the same formation in the country as a whole. McCranie & Wilson (2002) and Wilson & McCranie (2004b) demonstrated the presence of 15 salamander species and 28 anuran species in the Lower Montane Wet Forest formation in

Honduras. With the addition of one salamander species to this formation (McCranie et al., submitted), the park's four salamander species make up 25.0% and its nine anurans 32.1% of the whole. Wilson & McCranie (2004b) recorded 22 lizard and 33 snake species from this same forest formation. With the addition of one species of snake to this forest formation (McCranie & Castañeda, submitted), the park's six lizard and 11 snake species constitute 27.3% and 32.4%, respectively, of the whole.

As is evident in almost every other biotic reserve in Honduras (Wilson et al., 2001; Wilson & McCranie, 2003, 2004a), Parque Nacional El Cusuco is subject to human-caused environmental problems. The threats to the integrity of this park have been elucidated by Anonymous (1994), including deforestation, farming and ranching, forest fires, natural landslides, and hunting.

Deforestation, with subsequent growth of secondary forest is a continuing problem in the park. It is noted in Anonymous (1994) that deforested patches range in size from two to 20 hectares. A three hectare deforested patch near the source of Quebrada de Cantiles at 1900 m was highlighted in that report.

Farming and ranching have been proceeding in the park for about two decades prior to the publication of Anonymous (1994), and were reported to have reached the vicinity of the nuclear zone of the park to the north and northeast of Cerro Jilincó at elevations of about 1700 m.

Forest fires are most frequently caused by spread of fires set to burn cropland residues prior to a new season of planting. They have the effect of killing the young trees as a consequence of the fire and the older trees as they become susceptible to illness and insect damage (Anonymous, 1994).

As noted in Anonymous (1994), landslides do occur naturally in the park, but can also result from deforestation and the resulting opening up of the soil to erosion.

Hunting for large mammals, including monkeys, has been more severe in the past (Anonymous, 1994), and has resulted in a scarcity of such animals

in the nuclear zone of the park. Such animals are now protected by law in the park, and the threat is thought now to be less than in the past. Nonetheless, as discussed above, slightly less than half of the species of amphibians resident in the park have populations that are in decline or that have disappeared altogether. These species, all anurans, are either endemic to Honduras or are otherwise restricted in distribution to Nuclear Middle America. As a consequence of these documented declines and disappearances, it will be necessary to carefully monitor these and the other herpetofaunal populations in the park on a continuing basis.

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REFERENCES

Anonymous (1994). *Evaluación Ecológica Rápida (EER). Parque Nacional "El Cusuco" y Cordillera del Merendón*. San Pedro Sula, Honduras: Fundación Hector R. Pastor

- Fasquelle, The Nature Conservancy, and PACA (Proyecto Ambiental para Centro América).
Anonymous (No Date). *Parque Nacional Cusuco y Áreas Protegidas de la Cordillera del Merendón (map)*. Tegucigalpa, Honduras: Instituto Geográfico Nacional.
Berger, L., Speare, R., Daszak, P., Green, D.E., Cunningham, A.A., Goggin, C.L., Slocumbe, R., Ragan, M.A., Hyatt, A.D., McDonald, K.R., Hines, H.B., Lips, K.L., Marantelli, G. & Parkes, H. (1998). Chytridiomycosis causes amphibian mortality associated with population decline in the rain forests of Australia and Central America. *Proc. Natl. Acad. Sci.* **95**, 9031–9036.
Espinal, M.R., McCranie, J.R. & Wilson, L. D. (2001). The herpetofauna of Parque Nacional La Muralla, Honduras. In *Mesoamerican Herpetology: Systematics, Zoogeography, and Conservation*, pp.100–108. Johnson, J.D., Webb, R.G. & Flores-Villela, O.A. (Eds.). Centennial Mus., Univ. Texas at El Paso, Spec. Publ. 1, i–iv, 1–200. Texas: El Paso.
Holdridge, L.R. (1967). *Life Zone Ecology. Revised ed.* San José, Costa Rica: Trop. Sci. Center.
Lips, K.R. (1998). Decline of a tropical montane amphibian fauna. *Conserv. Biol.* **12**, 106–117.
Lips, K.R. (1999). Mass mortality and population declines of anurans at an upland site in western Panama. *Conserv. Biol.* **13**, 117–125.
McCranie, J.R. (2004). Geographic distribution. *Rhadinaea decorata*. *Herpetol. Rev.* **35**, in press.
McCranie, J.R. & Castañeda, F.E. (Submitted). A new species of snake of the genus *Omoadiphas* (Reptilia: Colubridae) from the Cordillera Nombre de Dios in northern Honduras.
McCranie, J.R., Espinal, M.R. & Wilson, L.D. (Submitted). A new species of montane salamander of the *Bolitoglossa dunni* group from northern Comayagua, Honduras (Urodela: Plethodontidae).
McCranie, J.R., Nicholson, K.E. & Castañeda, F.E. (2002). Geographic distribution.

- Eleutherodactylus diastema*. *Herpetol. Rev.* **33**, 220.
- McCrane, J.R., Townsend, J.H. & Wilson, L.D. (2003a). *Hyla miliaria* (Anura: Hylidae) in Honduras, with notes on calling site. *Caribbean J. Sci.* **39**, 398–399.
- McCrane, J.R., Townsend, J.H. & Wilson, L.D. (2003b). Three snakes new to the herpetofauna of Honduras. *Herpetol. Rev.* **34**, 391–392.
- McCrane, J.R. & Wilson, L.D. (2002). *The Amphibians of Honduras*. Soc. Study of Amphib. Reptiles, Contrib. Herpetol. **19**, i–x, 1–625.
- McCrane, J.R., Wilson, L.D. & Porras, L. (1980). A new species of *Leptodactylus* from the cloud forests of Honduras. *J. Herpetol.* **14**, 361–367.
- Wilson, E.O. (ed.). (1988). *Biodiversity*. Washington, DC: National Acad. Press.
- Wilson, E.O. (1992). *The Diversity of Life*. Cambridge, Massachusetts: Belknap Press of Harvard Univ. Press.
- Wilson, E.O. & Perlman, D.L. (2000). *Conserving Earth's biodiversity with E. O. Wilson (CD-ROM)*. Covelo, California: Island Press.
- Wilson, L.D. & McCrane, J.R. (1998). Amphibian population decline in a Honduran national park. *Froglog* **25**, 1–2.
- Wilson, L.D. & McCrane, J.R. (2002). Update on the list of reptiles known from Honduras. *Herpetol. Rev.* **33**, 90–94.
- Wilson, L.D. & McCrane, J.R. (2003). Herpetofaunal indicator species as measures of environmental stability in Honduras. *Caribbean J. Sci.* **39**, 50–67.
- Wilson, L.D. & McCrane, J.R. (2004a). The conservation status of the herpetofauna of Honduras. *Amphib. Reptile Conserv.* **3**, 6–33.
- Wilson, L.D. & McCrane, J.R. (2004b). The herpetofauna of the cloud forests of Honduras. *Amphib. Reptile Conserv.* **3**, 34–48.
- Wilson, L.D., McCrane, J.R. & Espinal, M.R. (2001). The ecogeography of the Honduran herpetofauna and the design of biotic reserves In *Mesoamerican Herpetology: Systematics, Zoogeography, and Conservation*, pp. 109–158. Johnson, J.D., Webb, R.G. & Flores-Villela, O.A. (Eds.). Centennial Mus., Univ. Texas at El Paso, Spec. Publ. **1**, i–iv, 1–200. Texas: El Paso.
- Wilson, L.D., McCrane, J.R., Gotte, S. & Townsend, J.H. (2003). Distributional comments on some members of the herpetofauna of the Mosquitia, Honduras. *Herpetol. Bull.* **84**, 15–19.
- Wilson, L.D., & Meyer, J.R. (1985). *The Snakes of Honduras*. 2nd edition. Milwaukee Pub. Mus.
- APPENDIX I - Specimen locality data**
- Bolitoglossa conanti*.— El Cusuco, 1550–1560 m, MVZ 186755, 186757–58, 186760, 225842–43.
- Bolitoglossa diaphora*.— near Quebrada de Cantiles, ca. 1700 m, SMF 77611; El Cusuco, 1550 m, MVZ 186764, 221178, 221180, 225844–48, SMF 77610, 77614–15, USNM 335045–48; Cerro Jilincó, 2200 m, MVZ 221179.
- Bolitoglossa dunni*.— El Cusuco, 1550–1570 m, MVZ 186726, 186756, 186759.
- Cryptotriton nasalis*.— El Cusuco, 1550 m, KU 194183–87; Cerro Jilincó, 2200 m, USNM 339713–14.
- Bufo valliceps*.— El Cusuco, 1550 m, KU 209270.
- Duellmanohyla soralia*.— El Cusuco, 1550–1570 m, KU 195556, USNM 514521.
- Hyla bromeliacia*.— El Cusuco, 1550–1790 m, KU 194179–80 (both tadpoles), 194224, 209702 (tadpole), SMF 48024, USNM 304997 (tadpoles), 523169–70.
- Plectrohyla dasypus*.— Quebrada Cabeceras de Naco, 1990 m, SMF 78816, USNM 514409–13; Quebrada de Cantiles, 1825 m, USNM 514414; El Cusuco, 1550–1690 m, CAS 170006, KU 186025–33, 186035 (tadpoles), 186036–37, 186038 (tadpoles), 192879 (tadpoles), 209653–56, 209698 (cleared and stained adult), 209703, 209704 (tadpoles), 209710 (tadpoles), USNM 513859–62 (all tadpoles), 513863, 514415–16, 523472 (tadpoles); Quebrada El Pizote, 1570 m, USNM 514417.
- Plectrohyla exquisita*.— Quebrada de Cantiles, 1570 m, USNM 513488–89; El Cusuco, 1550–1680 m, KU 192880–84, 194178 (tadpoles), 209695–97, 223919 (tadpoles), UNAH 2510, USNM 513483–87, 513490–93.

Ptychohyla hypomykter.— El Cusuco, 1550–1720 m, KU 192885–87, 204197–202, 204211 (cleared and stained adult), SMF 77606–07 (both tadpoles), USNM 319923, 508456 (tadpoles), 514301–04.

Eleutherodactylus milesi.— El Cusuco, 1550–1720 m, KU 209040–57, 209060–75, 209107, 209141, LACM 137298–305.

Eleutherodactylus rostralis.— El Cusuco, 1550–1800 m, ROM 18093–94, SMF 77592–93, USNM 535858; Montaña San Ildefonso, 1600 m, USNM 535861.

Rana maculata.— El Cusuco, 1580–1590 m, KU 194242, 200549.

Mesaspis moreletii.— El Cusuco, 1720–1870 m, KU 200587–88, USNM 549353–54.

Sceloporus malachiticus.— El Cusuco, 1550–1660 m, KU 194316, 200569, 200620.

Norops amplisquamosus.— El Cusuco, 1530–1720 m, KU 219924–49, USNM 549356–58; Sendero El Danto, 1580 m, SMF 77747–48, 77750.

Norops cusuco.— El Cusuco, 1550–1935 m, KU 194275–85, SMF 78842, 79170–71, 79182, USNM 532567–68.

Norops johnmeyeri.— Quebrada de Cantiles, 1825 m, SMF 78824–26; El Cusuco, 1550–1580 m, KU 192623, LSUMZ 37834, SMF 77755, USNM 322902–08, 549363–66; Sendero de Cantiles, 1740–1770 m, SMF 77760–61; Sendero El Danto, 1580 m, SMF 77756–58.

Sphenomorphus cherriei.— Sendero Las Minas, 1590 m, SMF 78864.

Dryadophis dorsalis.— El Cusuco, 1550–1570 m, based on several specimens seen, but not collected.

Drymarchon melanurus.— El Cusuco, 1550 m, FMNH 23698.

Drymobius chloroticus.— El Cusuco, 1550–1810 m, KU 200598–99, ROM 19974–75, USNM 508411.

Imantodes cenchoa.— El Cusuco, 1550 m, USNM 559720.

Leptophis ahaetulla.— between El Cusuco and Quebrada de Cantiles, 1680 m, USNM 337533.

Ninia espinali.— Quebrada de Cantiles, 1825 m, USNM 333037; El Cusuco, 1590 m, USNM 333036; Cerro Jilincó, 2242 m, USNM 333038.

Stenorrhina degenhardtii.— El Cusuco, 1550–1630 m, KU 194349–50.

Tantilla schistosa.— El Cusuco, 1680 m, USNM 337556.

Micrurus diastema.— El Cusuco, 1550 m, unnumbered specimens in collection of the Fundación Ecológica 'Hector Rodrigo Pastor Fasquelle' at the visitors' centre.

Bothriechis marchi.— El Cusuco, 1550 m, ROM 20016; Sendero de Cantiles, 1840 m, SMF 78867.

Cerrophidion godmani.— El Cusuco, 1700–1880 m, KU 194362, 200624–27.

APPENDIX II - Gazetteer

Buenos Aires — village where road to El Cusuco leaves Cofradía-Buenos Aires road; 1140 m (15°30'N, 88°11'W).

Cabeceras de Naco, Quebrada — stream (upper tributary of Río Naco) draining southern slopes of Cerro Cusuco; collections made at 1990 m (15°29'N, 88°14'W).

Cantiles, Quebrada de — stream (upper tributary of Río Cuyamelito) on west side of Cerro Cusuco; collections made from 1570 to 1825 m (15°31'N, 88°14'W).

Cusuco, Cerro — see Cusuco, El.

Cusuco, El — finca and environs along Río Cusuco on Cerro Cusuco, 5.6 km WSW of Buenos Aires, now serves as visitors' centre for park; collections made in park from 1530 to 1935 m (15°31'N, 88°12'W).

Cusuco, Río — upper tributary of Río Cuyamel, visitors' centre along this river (see Cusuco, El).

Jilincó, Cerro — mountain just NNW of Cerro Cusuco; collections made from 2200 to 2242 m (15°31'N, 88°14'W).

Jilincó, Quebrada El — stream (upper tributary of Río Cuyamelito) draining north slope of Cerro Jilincó.

Jimerito, Quebrada de — upper tributary of Río Cuyamel in east-central portion of park.

Pizote, Quebrada El — stream (upper tributary of Río Cuyamelito) on western slopes of Cerro Jilincó; collections made at 1570 m (15°31'N, 88°15'W).

San Ildefonso, Montaña — mountains just NW of El Cusuco, of which Cerros Cusuco and Jilincó are a part; collections made in park at 1600 m (15°31'N, 88°14'W).

Sendero de Cantiles — trail leading from visitors' centre; collections made from 1740 to 1840 m (15°30'N, 88°14'W).

Sendero El Danto — trail leading from visitors' centre; collections made at 1580 m (15°31'N, 88°12'W).

Sendero Las Minas — trail leading from visitors' centre to Cerro Las Minas; collections made at 1590 m (15°29'N, 88°14'W).