AMPHIBIANS AND REPTILES OF LUZON ISLAND, II: PRELIMINARY REPORT ON THE HERPETOFAUNA OF AURORA MEMORIAL NATIONAL PARK, PHILIPPINES.

Rafe M. Brown1, 2, Jimmy A. McGuire1, 5, John W. Fer ner2, 3, Nicandro Icarangal, Jr.4 and Robert S. Kennedy2

1Section of Integrative Biology and Texas Memorial Museum, University of Texas, Austin TX, 78712, USA.
2Department of Vertebrate Zoology, Geier Collections and Research Center, Cincinnati Museum of Natural History, 1720 Gilbert Avenue, Cincinnati, Ohio 45202-1702, USA.
3Department of Biology, Thomas More College, Crestview Hills, Kentucky 41017, USA.
4Zoology Division, National Museum of the Philippines, Executive House, P. Burgos Street, Manila, Philippines.
5Present Address: Museum of Natural Science, 119 Foster Hall, Louisiana State University, Baton Rouge, Louisiana 70803–3216, USA.

(with 33 text-figures)

ABSTRACT.– We present species accounts for 19 amphibians (frogs) and 30 reptiles (19 lizards, 10 snakes, and one turtle) collected at localities within the central Sierra Madre Mountains in Aurora Province, Luzon, Philippines. Despite its close proximity to Manila, this heavily forested site produced several significant discoveries. Specimens collected during this expedition contributed to the type series of the newly-described *Rana tipanan*, *Platymantis sierramadrensis* and *Sphenomorphus tagapayo*. Notable collections of poorly known species include specimens referable to *Brachymeles bicolor* and *Sphenomorphus leucospilos*, two species previously known only from two specimens each.

Unidentified and possibly undescribed species include two unusual specimens referable to the genus *Platymantis* and a single specimen of the genus *Sphenomorphus*. That so many discoveries could be produced in such a short survey effort (less than two weeks) further emphasizes the degree to which the amphibian and reptile populations in the mountains of Luzon are drastically understudied. We discuss patterns of montane endemism on Luzon and argue for an immediate and exhaustive herpetofaunal survey of the Sierra Madre Mountains.

KEY WORDS.– Amphibians; Aurora Memorial National Park; herpetofauna; Luzon Island; Philippines; reptiles; Sierra Madre Mountains.

INTRODUCTION

It is now known but not widely appreciated that the major Philippine Island of Luzon (Fig. 1) is a composite island, formed from several paleoislands that have only recently accreted into a single land mass (Adams and Pratt, 1911; Feliciano and Pelaez, 1940; Rutland, 1968; Hashimoto, 1981a, 1981b; Auffenberg, 1988; Hall, 1996; 1998). As a result of this unique history, we can make at least two predictions: (1) intra-island biological diversity should be substantial, and (2) the regions corresponding to the former paleoislands (the Zambales massif, the Cordillera Central, the Sierra Madres, and highland volcanic portions of the Bicol Peninsula) are likely to be inhabited by faunas characterized by substantial degrees of endemism - especially among montane species that are unlikely to pass through the lowland habitats that now connect these former islands. Recent herpetological survey work (Ross and Gonzales, 1991; W. C. Brown et al., 1997a; 1997b; 1997c; 1999; Alcala, et al., 1998; R. M. Brown et al. 1995a; 1995b; 1996; 1999a; 2000; Diesmos, 1998; Diesmos, Brown, Crombie and Alcala, unpublished data) suggests that both of the above pre-
dictions are likely to hold true. These studies indicate that local montane endemism is much more extensive (on a much finer scale) than previously considered by investigators utilizing patterns of mammalian (Heaney and Rickart 1990; Heaney et al., 1991; 1998; Rickart et al., 1991; Rickart and Heaney, 1991) and avian (Dickerson et al., 1990; Kennedy et al., 2000) taxonomy and geographical species distributions. Most of Luzon Island remains poorly sampled for herpetofauna. Given the inadequacy of the current data, it is premature to assert strong conclusions regarding biodiversity estimates; additional intensive biotic sampling is absolutely essential if we are to gain a proper understanding of Luzon’s diversity. The data that we present represent a preliminary view of the herpetological diversity of one forested area in the Sierra Madre Mountains and indicate that much work is needed before we can conclude that the herpetofauna of this biogeographical subprovince is well known.

The Sierra Madre is an elongate chain of mountains that extend down the eastern coast of north and central Luzon island (14°–19° N; Fig. 1). Perhaps because earlier evidence suggested that the separate mountain ranges of Luzon support only low levels of herpetological diversity (Inger, 1954; W. Brown and Alcala, 1978; 1980; but see Taylor, 1920, 1922a; 1922b; 1922c; 1922d), virtually no herpetological field work was conducted on Luzon between Edward Taylor’s Philippine field career (1915-1920) and the early 1990’s (see R. Brown et al., 1996). Moreover, many intervening studies, conducted within the framework of a polytypic species concept (Inger, 1954; W. Brown and Alcala, 1978; 1980; 1994; Leviton 1961; 1962; 1963; 1964a; 1964b; 1964c; 1964d; 1965a; 1965b; 1967; 1968; 1979, 1983) recognized Luzon endemics as island “races” of widespread Philippine or SE Asian species and discounted the possibility that these “subspecies” might actually represent independent evolutionary lineages belonging to larger species complexes. Recent work, however, has renewed interest in patterns of montane endemism on Luzon and has bolstered the notion that the zoogeography of this complex island is much more interesting than was thought for most of the past century (Ross and Gonzales, 1992; W. Brown et al., 1997a; 1997b; 1997c; 1999; Diesmos, 1998; Alcala et al., 1998; R. Brown et al., 1995a; 1995b; 1996; 1999a; 2000).

In a previous study on the herpetological diversity and endemism of Luzon Island (R. Brown et al., 1996), we reported on herpetofaunal communities of the Zambales Mountains, (Zambales and Bataan Provinces; Fig. 1). In this paper, we report on a significant collection of amphibians and reptiles taken near Baler Bay in forested regions in and around Aurora Memorial National Park (Aurora Province). Although a comprehensive analysis of the herpetofaunal communities of the entire Sierra Madre range is not possible at this time due to inadequate surveying, we take this opportunity to present a preliminary report on this important site. We do so because our collection contained many new and notable species and because of the importance of having adequate knowledge of the herpetofauna of Aurora Memorial National Park for the enactment of future conservation initiatives in the Sierra Madres.

MATERIALS AND METHODS

The National Museum of the Philippines/Cincinnati Museum of Natural History Philippine Biodiversity Inventory (PNM/CMNH PBI) team conducted field studies at four sites in Aurora Province (Fig. 1) from 14 May to 1 June, 1997. We established altitudinal transects (Ruedas et al., 1994, as modified by R. Brown et al., 1995a, 1996) and utilized standard collection and specimen preservation techniques (Simmons 1987; Heyer et al., 1994). Specimens were photographed, fixed in 10% buffered formalin, and transferred to 70% ethanol (1 mo later).

Detailed examination of all material was conducted by RMB, JWF and JAM and measurements are based on preserved material. We follow the taxonomy of Taylor (1922b), W. Brown and Alcala (1978, 1980) and R. Brown et al. (1995; 1995b) for gekkonid and scincid lizards. The taxonomy of Inger (1954), Frost (1985), Duellman (1993), W. Brown and Alcala
FIGURE 1: Luzon Island, northern Philippines. The four major montane components that form Luzon (the Zambales, the Sierra Madres, the Cordilleras, and the volcanoes of the Bicol Peninsula) are dark stippled. The position of Aurora Memorial National Park within the Sierra Madres is indicated; star = Manila.
FIGURE 2: Habitat on the Dipiningan branch of the Cobatangan River (Location 1a), Aurora Memorial National Park.

FIGURE 3: Small tributary of the Dipiningan branch of the Cobatangan River; habitat of *Rana tipanan*, *Rana luzonensis*, and *Limnonectes macrocephalus*. Note large boulders, where *Rana tipanan* were perched.

FIGURE 4: Characteristics of high elevation forest above 1000 m at Location 1b.

FIGURE 5: Typical stream side habitat of *Rana luzonensis*, *R. woodworthi*, *R. similis* and *Limnonectes macrocephalus* at Location 3.
FIGURE 6: Species accumulation curves for amphibian and reptilian taxa surveyed at Aurora Memorial National Park (exclusive of turtles). The extensive systematic sampling effort (of approximately 25 man hr per day) lasted nine days. The dashed line added to the end of each curve leads to the final totals for Aurora Memorial National Park. The specimens (two additional species of frogs and one additional lizard) represents incidental collections during the last few days after the systematic collecting effort had been discontinued.

FIGURE 7: Kaloula kalingensis from Location 1b.

FIGURE 8: Kaloula picta from Location 2.

FIGURE 9: Platymantis corrugatus from Location 1a.

FIGURE 10: Platymantis dorsalis from Location 1b.

FIGURE 11: Platymantis sp. from Location 1b.
FIGURE 12: *Platymantis* cf. *sierramadrensis* from Location 1a.

FIGURE 13: *Rana luzonensis* from Location 1a.

FIGURE 14A: *Rana tipanan* (male) from Location 1b.

FIGURE 14B: *Rana tipanan* (female) from Location 1b.

FIGURE 15: *Rana similis* from Location 1a.

FIGURE 16: *Polypedates leucomystax* from Location 1a.

FIGURE 17A: *Rhacophorus pardalis* from Location 1a (male).

FIGURE 17B: *Rhacophorus pardalis* from Location 1a (female in amplexus with recently-deposited foam nest).
FIGURE 18: Philautus surdus from Location 1b.

FIGURE 19: Gonyocephalus sp. from Location 1b.

FIGURE 20: Cyrtodactylus philippinicus at Location 1a.

FIGURE 21: Brachymeles bicolor from Location 1b.

FIGURE 22: Brachymeles bonitae from Location 1a.

FIGURE 23: Dasia grisea from Location 1a.

FIGURE 24: Mabuya multicarinata borealis from Location 1a.

FIGURE 25: Sphenomorphus abdictus aquilonius from Location 1a.
FIGURE 26: Sphenomorphus cumingi from Location 1a.

FIGURE 27: Sphenomorphus tagapayo from Location 1b.

FIGURE 28: Calamaria bitorques from Location 1b.

FIGURE 29: Dendrelaphis pictus pictus from Location 1a.

FIGURE 30: Oxyrhabdium leporinum leporinum from Location 1a.

FIGURE 31: Psammodynastes pulverulentus from Location 1a.

FIGURE 32: Pseudorabdion oxycephalum from Location 1a.

FIGURE 33: Rhabdophis spilogaster from Location 1a.

Finally, we attempted to assess the adequacy of field sampling by constructing species accumulation curves for frogs, lizards, and snakes. In this procedure, we plotted total collecting effort against cumulative number of species collected, treating days (of approximately 25 combined man hr per day) as an indicator of sampling effort.

**STUDY SITES/COLLECTION LOCALITIES**

Location 1a. Philippines, Luzon, Aurora Prov., Municipality of San Luis; Dipiningan branch of the Cobatangan (= “Kabatangan” of R. Brown et al., 1999b) River drainage; 1.2 km S, 1.3 km E of Barangay Villa Aurora; 15° 40.2' N, 121° 20.8' E; ca. 410–650 m above sea level (Figs. 2-3).

Location 1b. Philippines, Luzon, Aurora Prov., Municipality of Dinalungan, Talaytay River watershed; 6.5 km N, 6.0 km W Municipality of Dinalungan; 16° 12.3' N, 121° 54.0' E; ca. 110–440 m above sea level (Fig. 5).

Location 3. Philippines, Luzon, Aurora Prov., Municipality Maria Aurora; 0.5 km S, 2.6 km W of Barangay Villa Aurora; 15° 40.6' N, 121° 18.6' E; ca. 600–900 m above sea level.

**RESULTS**

We collected 19 amphibians (frogs) and 30 reptiles (19 lizards, 10 snakes, and one turtle; see species accounts, below). Species accumulation curves (Fig. 6) for the nine days of intensive collecting apparently did not level off in an asymptotic fashion, indicating that not all (or even a knowable percentage of) the species in Aurora Memorial National Park were recorded within the survey period.

**SPECIES ACCOUNTS**

**AMPHIBIA**

**ANURANS (frogs)**

*Microhylidae*

*Kaloula kalingensis* Taylor, 1922 (Fig. 7)

*Kaloula kalingensis* calls from tree holes, hollow bamboo trunks, and wild banana axils in forested and slightly disturbed areas (Diesmos, 1998). Although most calling individuals can be heard from tree holes 2–5 m above the ground, several specimens have been observed calling from holes in logs laying horizontally in contact with the forest floor (Diesmos and R. Brown, pers. obs.). A full series of larvae of this species were collected in water that had collected in the pulp and sheathes surrounding the trunk of wild bamboo plants.

Specimens: (Location 1a) CMNH 5956–65; PNM 5859–66; (Location 2) PNM 5867.

*Kaloula picta* (Duméril and Bibron, 1841) (Fig. 8)

These specimens were collected in flooded rice fields and adjacent pools in disturbed, non-forested areas. Choruses vary from a few to hundreds of individuals (RMB, pers. obs.). A full series of larvae of this species were collected in water that had collected in the pulp and sheathes surrounding the trunk of wild bamboo plants.

Specimens: (Location 1a) CMNH 5956–65; PNM 5859–66; (Location 2) PNM 5867.

*Ranidae*

*Occidozyga laevis* (Günther, 1859)

We collected this species in small forest streams, in stagnant pools beside a large river,
and in drainage ditches in disturbed habitat near rice plantations.

Specimens: (Location 2) CMNH 5986–93; PNM 5881–87.

**Platymantis corrugatus** (A. Duméril, 1853) (Fig. 9)

This species was collected along the forested banks of the Dipiningan branch of the Cobatangan River and specimens were located 10–30 m from the water’s edge. No specimens were collected at locations deeper in the forest and no calls of this species were heard away from the proximity of the river.

Specimens: (Location 1a) CMNH 5928–5935; PNM 5832–36; (Location 2) CMNH 5937–38; PNM 5837–39, 5841; (Location 3) PNM 5840.

**Platymantis dorsalis** (A. Duméril, 1853) (Fig. 10)

Specimens of *Platymantis dorsalis* were collected in a variety of microhabitats ranging from the banks of the Dipiningan branch of the Cobatangan River to mid-montane, higher elevation forests at Locations 1 and 3. *Platymantis dorsalis* calls from the forest floor but has also recently been observed calling from low vegetation (< 1 m) or from on the tops of stumps and fallen logs (Diesmos, R. Brown and McGuire, pers. obs.). The recent discovery of numerous cryptic species in the *P. dorsalis* complex (W. Brown et al., 1997a, 1997b) suggests that morphological data alone may not be sufficient to confidently diagnose these species. In our case, at Location 1a, we recorded the distinctive brief whistling vocalizations that precisely match the known advertisement call for *P. dorsalis* and so we confidently refer these specimens to that species (see W. Brown et al., 1997c for sonogram). In the case of specimens collected at Location 2, advertisement calls were not heard or recorded, so the possibility that some of these specimens represent additional species (with the larger specimens possibly representing *P. taylori*) can not be discounted.

Specimens: (Location 1a) CMNH 5912, 5914–17, 5919–24; PNM 5816–17, 5819–20, 5822–24, 5827–28; (Location 1b) CMNH 5918; PNM 5821, PNM 5825–26; (Location 2) CMNH 5911, 5913; PNM 5814–15, 5818.

**Platymantis cf. mimulus** Brown, Alcala, and Diesmos, 1997

Recently described from Mt. Makiling (W. Brown et al., 1997c), populations related to this species may require further taxonomic partitioning once advertisement recordings become available for several S. Luzon populations currently under study (A. Diesmos, pers. comm.).

Specimens: (Location 1b) CMNH 5925–27; PNM 5829; (Location 1b) PNM 5830–31.

**Platymantis sp.** (Fig. 11)

Two unidentified male specimens referable to the *guentheri* species group (sensu W. Brown et al., 1997a, 1997b) were collected from separate arboreal ferns (2–3 m above the forest floor) during the day. The specimens most closely resemble *P. banahao* but we hesitate to identify them to species on the basis of so few specimens and the absence of any data on advertisement calls. We can not be certain that the two specimens belong to the same species.

Specimens: (Site 1b) CMNH 8128–29.

**Platymantis pygmaeus** Brown, Alcala, and Diesmos, 1998

While no specimens were collected, the distinctive vocalizations of this newly described species (Alcala et al., 1998) were heard (by RMB and JAM) between the hours of 1830 and 2000 h above 800 m above sea level. The area where these species were heard was the upper limit of midmontane forest at this site.

Specimens: (Location 1b): none.

**Platymantis cf. sierramadrensis** Brown, Alcala, Ong, and Diesmos, 1999 (Fig. 12)

Five specimens (four males and one female) seemingly related to this recently-described species (W. Brown et al., 1999) were collected from leaves of shrub layer vegetation within 20 m of the banks of the Dipiningan branch of the Cobatangan River. This species called from the exposed upper surface of leaves and was only
observed immediately following rain. Three of our specimens (PNM 5780, CMNH 5678–9) were included as paratypes in the description of W. Brown et al. (1999) and were incorrectly reported as having originated in “Sitio Mapidjas, Barangay Umiray, Municipality of Dingalan, Aurora Province” (W. Brown et al., 1999). In fact these specimens were collected 1.2 km S, 1.3 km E of Barangay Villa Aurora, Municipality of San Luis, Aurora Province, on the slopes of Mt. Ma-aling-aling, along the Dipiningan branch of the Cobatangan River drainage (15° 40.2’ N, 121° 20.8’ E). Furthermore, W. Brown et al. (1999) reported that the female for this species currently was unknown but one of our specimens that they did not include as a paratype (CMNH 5904) clearly is a female (SVL = 33.7 mm) with enlarged oviductal eggs. The specimen was collected at midday from a large tree fern where it was concealed in leaf detritus that had collected in the fern axils.

The advertisement call of the Aurora population referred to this species is distinct from that reported at the type locality (Mt. Cetaceo, northern Sierra Madres; W. Brown et al., 1999). At the type locality, *P. sierramadrens* produces a series of brief, pure tonal notes, while the population referred to this species from Aurora Memorial National Park (and Polillo Island; pers. comm. with K. Hampson) produces a series of chirps, each with several subpulses per note. For this reason, we find it likely that future studies will necessitate further taxonomic partitioning within W. Brown et al.’s (1999) concept of *P. sierramadrens* once additional specimens and quality call recordings become available from throughout its range (including Polillo Island).

Specimens: (Location 1a) CMNH 5678–9, PNM 5780, 5808 (Location 1b) CMNH 5904.

*Rana (=“Chalcorana”) luzonensis* Boulenger, 1896 (Fig. 13)

This species was collected within 0.1–0.5 m of running water on the banks of both the Dipiningan and Divinawan branches of the Cobatangan River. Numerous pairs in amplexus were observed and collected, vocalizations were recorded, and side pools in the river contained thousands of tadpoles and metamorphosing froglets. When pursued by collectors, frogs jumped into the water of the Cobatangan River.

Specimens: (Location 1a) CMNH 5605–30; PNM 5742–43, 5745–49, 5751–65; (Location 3) PNM 5744, 5750.

*Rana (=“Chalcorana”) tipanan* Brown, McGuire, and Diesmos, 2000 (Fig. 14)

The discovery of this new species (R. Brown et al., 2000) in a small, rapidly cascading tributary of the Dipiningan branch of the Cobatangan River was not wholly unexpected as it was observed but not collected in 1992 (by A. Diesmos) at Mt. Cetaceo in the northern Sierra Madre range. *Rana tipanan* was only collected along smaller tributaries of the Cobatangan River, never in the river itself, and specimens were collected from the tops of large boulders set back from the steeply sloping banks of these mountain creeks. (Fig. 3) When disturbed the new species jumped away from the water (as opposed to the escape tactic of *R. luzonensis* which invariably jumps in to the water); no breeding, amplexus or vocalizations were recorded.

Specimens: (Location 1a) CMNH 5581–88, 5590–5602; PNM 5719–36, 5738–41; (Location 3) CMNH 8011.

*Rana woodworthi* Taylor, 1923

This species is known from a variety of forested riparian habitats in southern Luzon (Taylor, 1920; Inger, 1954; Diesmos, 1998) and is usually found on midstream boulders and bank rocks.

Specimens: (Location 2) CMNH 5982–83; PNM 5878.

*Rana (=“Fejervarya”) vittigera* Wiegmann, 1834

This species was collected in flooded rice fields near Barangay Villa Aurora where it congregates in very large choruses (estimated in the hundreds of individuals).

Specimens: (Location 2) CMNH 5984–85; PNM 5879–80.
**Limnonectes macrocephalus** Inger, 1954

This large species of “fanged” frog was collected on the rocky banks (on gravel and small rocks as well as on large boulders above the water’s surface) of the Dipiningan and Divinawan branches of the Cobatangan River. This species frequently is decimated as a food source by humans. However, populations within the protected confines of the Park included males among the largest (> 100 mm SVL) ever observed by us.

Specimens: (Location 1a) CMNH 5545–57; PNM 5694–704; (Location 2) PNM 5693.

**Rana ("Pulchrana") similis** Günther, 1872 (Fig. 15)

Males of this species were recorded in small choruses of 3–6 individuals congregated within 0.5 m of the banks of the Dipiningan and Divinawan branches of the Cobatangan River and several females were also collected as they approached aggregations of males. This species previously was considered a subspecies of the widespread *Rana signata* (Inger, 1954; 1966) until Dubois (1992) and Duellman (1993) listed it as a full species without comment. Recent biochemical data (R. Brown and Guttman unpublished data R. Brown, 1997) demonstrate unequivocally that *Rana similis* is a full, genetically distinct evolutionary species.

Specimens: (Location 1a) CMNH 5939–53; PNM 5842–56; (Location 2) CMNH 5954–55; PNM 5857–58.

**Rhacophorus pardalis** Günther, 1859 (Fig. 17)

This species was collected in groups of several calling males and a few females in vegetation suspended 2–3 m above water buffalo wallows near Barangay Villa Aurora. This species builds foam nests suspended above the water and larvae drop to the stagnant pools below following normal development (Inger, 1954; 1966; RMB pers. obs.). Tadpoles were collected in the pools below arboreal chorus locations. The colouration of the Luzon populations appears to be distinctive (see Alcala and W. Brown, 1988) suggesting that future studies should reconsider the taxonomic arrangements of Inger (1954, 1966) and the possibility that Philippine populations referred to *R. pardalis* may in fact represent Philippine endemics.

Specimens: (Location 1a) CMNH 5972–75; PNM 5871–5874.

**Philautus surdus** Peters, 1863 (Fig. 18)

Males of this species were collected while calling from lower branches of understory vegetation between 400 and 600 m on Mt. Ma-aling-aling. No females were observed or collected and no eggs were located. We note that this species produces highly unpalatable skin secretions, possibly as a predator defense mechanism.

Specimens: (Location 1a) CMNH 5905–10; PNM 5809–10, 5813; (Location 1b) PNM 5811; (Location 3) CMNH 5970-71; PNM 5868–70.

**REPTILIA**

**TESTUDINES** (turtles)

**Bataguridae**

**Cuora amboinensis** (Daudin, 1801)

Specimens of this species were collected in second growth forest bordering agricultural areas. This species is common in disturbed agricultural as well as forested areas and appears to be nocturnal.

Specimen: (Location 2) CMNH 5756; PNM 5784.
SQUAMATA (Lizards)
Agamidae
*Draco spilopterus* (Wiegmann, 1834)

This species was collected from coconut trees bordering agricultural areas; no specimens were
detected in forested areas despite extensive
searches. This habitat preference is well known
for this species (McGuire and Alcala, 2000).

Specimens: (Location 1a) CMNH 5761; (Lo-
cation 2) PNM 5786.

**Gonyocephalus** sp. (Fig. 19)

The single specimen was collected in a
head-up position on the trunk of a dipterocarp

The absence of a suitable taxonomy for Philippine populations of
*Gonyocephalus* precludes the identification of
this specimen to the species level.

Specimens: (Location 1b) CMNH 5764.

Gekkonidae
*Cyrtodactylus philippinicus* (Steindachner,
1867) (Fig. 20)

Our specimens were collected at night on
fallen logs and tree branches suspended over
tributaries of the Cobatangan River.

Specimens: (location 1a) CMNH 5795–96;
PNM 5800.

*Hemidactylus frenatus* Duméril and Bibron,
1836

A single specimen was taken from a tree trunk
at 1900 h. on the banks of the Cobatangan River. *Hemidactylus frenatus* usually is found on
man-made structures such as houses; this species
is common in non-forested areas of the Philippines while the “house gecko” usually encoun-
tered in the forest is *Gehyra mutilata* (RMB,
pers. obs., not collected in this survey).

Specimens: (location 1a) CMNH 5794.

Scincidae
*Brachymeles bicolor* (Gray, 1845) (Fig. 21)

Until recently (Crombie and Ota, unpublished
data), this species was known from only two spec-
imens in the Natural History Museum, London
accompanied by the locality data “The Philip-
pines” (Brown and Alcala, 1980). This species is
very distinctive and possesses an unusually

The colouration is also distinctive,
with a stratified dark (above) and light (below)
colour pattern (see the reproduction of Gray’s
plate in Taylor, 1922b and Brown and Alcala,
1980). While this species can not possibly be con-
fused with any other Philippine scincid lizard, a
full study of the range of its morphological varia-
tion has not yet been provided. When disturbed by
collectors, *B. bicolor* moved in a rapid serpentine

Specimens: (Location 1a) CMNH 5763;
PNM 5787.

*Brachymeles bonitae* Duméril and Bibron, 1839
(Fig. 22)

One of Brown and Alcala’s (1980)
“non-pentadactyl” species *B. bonitae* is well

Specimens: (Location 1a) CMNH 5793.

*Dasia grisea* (Gray, 1845) (Fig. 23)

This species appears confined to lowland for-
est on Luzon and its associated
land-bridge islands. Our specimen was encoun-
tered under a dry coconut log where it attempted
to escape by rapidly swimming into dry coconut

Specimens: (Location 1a) CMNH 5769.

*Lamprolepis smaragdina philippinica* Mertens,
1829

One specimen was taken on a sand bar in the
Cobatangan River while the other was taken on a
trunk of a small tree in regenerated forest.

Specimens: (Location 1a) CMNH 5763;
PNM 5787.
**Lipinia pulchella** Gray, 1845

Using W. Brown and Alcala’s (1980) key, this specimen conforms to their diagnosis of the Negros subspecies (*L. p. taylori*) by virtue of possession of 6 large supraoculars (vs 4–5 in the Luzon subspecies *L. p. pulchella*), 22 midbody scale rows (vs 24–26) and by presence of a vertebral stripe (absent in *L. p. levitoni* from Negros Island). Previously (R. Brown et al., 1996) noted similar difficulties with application of W. Brown and Alcala’s (1980) key to Zambales Mountains specimens of *L. pulchella*, perhaps indicating that a revision of W. Brown and Alcala’s treatment of the Luzon populations of this species is warranted.

Specimens: (location 2) CMNH 5779.

**Mabuya cumingi** Brown and Alcala, 1980

We found this species in patches of open sun at midday on a log at the forest edge. Many other specimens eluded capture by out running collectors on fallen logs or on the ground.

Specimens: (Location 2) CMNH 5765.

**Mabuya multicarinata borealis** Brown and Alcala, 1980 (Fig. 24)

This species is common on the ground, and on rocks and logs within the forest and at the forest’s edge and is active in the morning and afternoon. When disturbed, specimens either ran away at high speed or took refuge under rocks and logs.

Specimens: (location 1a) CMNH 5766–67; PNM 5788–90; (Location 2) CMNH 5768.

**Sphenomorphus abdictus aquilonius** Brown and Alcala. 1980 (Fig. 25)

This species is common on the ground, and associated with fallen logs in patches of sunlight within the forest and is active in the morning and afternoon. When disturbed, specimens took refuge under logs or retreated into leaf litter.

Specimens: (location 4a) CMNH 5773–76, 5778; PNM 5792–95; (location 3) CMNH 5777; PNM 5996.

**Sphenomorphus cumingi** (Gray, 1845) (Fig. 26)

This large species is common in forest gaps and at the forest edge. We collected specimens on tree buttresses and fallen logs and most specimens attempted to climb trees when pursued by collectors, although some attempted to escape by running through leaf litter.

Specimens: (Location 1a) CMNH 5752–4; PNM 57578; (location 3) CMNH 5755; PNM 5782–83.

**Sphenomorphus decipiens** (Boulenger, 1895)

This species was found in leaf litter and under fallen logs where it was active in the morning on the forest floor in patches of sunlight. We have never found this species in warmer forest edge or gap microhabitats.

Specimens: (Location 1a) 5788; PNM 5791 (Location 1b) CMNH 5770, 5789–91; (location 3) CMNH 5771.

**Sphenomorphus leucospilos** (Peters, 1872)

This extremely rare species previously was only known from two specimens in European collections; previous locality data only indicated that specimens were collected on Luzon Island (W. Brown and Alcala, 1980). Our unique specimen was found in mature second growth forest (bordering primary forest) and was active at midday on the surface of fallen leaves.

Specimens: (location 1a) CMNH 5792.

**Sphenomorphus sp.** (Brown and Alcala Group I)

A single specimen of an undescribed scincid species of *Sphenomorphus* was collected in leaf litter on the forest floor at 1050 m. This population is phenotypically most similar to *S. beyeri* (Taylor, 1922a; R. Brown et al., 1995a; 1995b) but midbody and paravertebral scale counts fall well outside the range of variation exhibited by other Group I *Sphenomorphus* (R. Brown et al., 1995a; 1995b; Brown et al., unpublished data) and all other Philippine *Sphenomorphus* (W. Brown and Alcala, 1980).

Specimens: (location 1a) CMNH 5772.

**Sphenomorphus steerei** Stejneger, 1908

We collected this species in leaf litter and from under fallen logs in primary forest and specimens were taken from patches of sunlight as well as shaded areas. When disturbed, *S.
steerei attempted to escape by burrowing into forest floor detritus.
Specimens: (location 1a) PNM 5799; (Location 1b) CMNH 5789–90; PNM 5797–98.

*Sphenomorphus tagapayo* Brown, McGuire, Ferner, and Alcala, 1999 (Fig. 27)
The discovery of this new species (R. Brown et al., 1999b) brought the number of Philippine “Group II” *Sphenomorphus* species (W. Brown and Alcala, 1980) to six (excluding W. Brown and Alcala’s *Sphenomorphus palawanensis* which was transferred to the genus *Parvoscinus* by Ferner et al., 1997). The type series of *Sphenomorphus tagapayo* was collected under small stones, leaf litter, and other forest debris between elevations of 720 and 1175 m above sea level in the transition zone between mixed dipterocarp and mossy upper montane forest. Most specimens were collected on level areas of stepped slopes; only one specimen was taken on an adjacent steeply sloping region of the forest. When attempting to escape, this species runs through leaf litter; the extremely small size of this species (23.1–32.1 mm SVL) renders them extremely difficult to see and capture.
Specimens: (location 1a) CMNH 5631–32; PNM 5766–68; (Location 4) CMNH 5633.

**Varanidae**
*Varanus salvator marmoratus* (Wiegmann, 1834)
This common lowland Luzon subspecies was observed in the disturbed and primary forest approximately 300 m from the Dipiningan branch of the Cobatangan River but no specimens were collected.
Specimens: (locations 1a, and 2): none.

**SQUAMATA (Snakes)**
**Colubridae**
*Calamaria bitorques* Peters, 1872 (Fig. 28)
This species was invariably collected under fallen and partially rotten logs on the forest floor.
Specimen: (location 1a) CMNH 5798–99; PNM 5801.

*Calamaria gervaisi* Duméril and Bibron, 1854
This species also was collected under fallen and partially rotten logs on the forest floor.
Specimen: (Location 1a) CMNH 5801.

*Dendrelaphis pictus pictus* (Gmelin 1789) (Fig. 29)
This specimen was collected on a small shrub layer sapling overhanging small stagnant pools in disturbed forest.
Specimen: (Location 1a) CMNH 5758.

This specimen was collected on seedlings overhanging the bank of a the Cobatangan River at midday. When pursued, it retreated into root masses of shrubs on the bank of the Cobatangan River at the river’s edge.
Specimen: (Location 1b) CMNH 5757.

*Elaphe erythrura manillensis* Jan, 1863
This specimen was first observed in primary forest on shrub layer vegetation at midday. When pursued, it jumped from its perch and attempted to escape through leaf litter.
Specimen: (Location 1a) CMNH 5751.

*Oxyrhabdium leporinum leporinum* (Günther, 1858) (Fig. 30)
One specimen was collected from the gravel shingle on the bank of the Cobatangan River at 2100 hr; the other was found in the morning, freshly killed, on a road traversing a well-regenerated secondary forest.
Specimens: (Location 1a) CMNH 5803; (Location 2) PNM 5802.

*Psammodynastes pulverulentus* (H. Boie, 1827) (Fig. 31)
This specimen was collected 10 m from the bank of the Cobatangan River in second growth forest. When captured it was attempting to prey on frogs (held in plastic bags) captured the night before.
Specimen: (Location 1a) CMNH 5762.
**Discussion**

Our collections provide a preliminary view of the amphibian and reptilian fauna from the forested vicinities of Aurora Memorial National Park. The collection of specimens reported herein contains numerous records that are noteworthy for their biogeographical as well as taxonomic significance within the context of our present knowledge of the Luzon herpetofauna. First, several specimens represent records of species that presently are considered Sierra Madres endemics (e.g., *Platymantis pygmaeus, P. sierramadrensis, Rana tipanan, Sphenomorphus tagapayo*, and possibly *S. leucospilos, S. sp.*, and *Brachymeles bicolor*). Other species are also known from other geological components of Luzon but we suspect will eventually be regarded as Sierra Madres endemics (currently unrecognized or undescribed) with further taxonomic work (e.g., specimens we refer to *Platymantis cf. mimulus* and *Platymantis sp.*). The remainders are species that have been reported from two or more of Luzon’s geological components. Some are frequently-encountered species that we expected to find and others (e.g., *Brachymeles bonitae, Typhlops luzonensis, Lipinia pulchella*) are considered moderately common by knowledgeable herpetologists (pers. comm. with A. Diesmos, R. Crombie, and A. Alcala). The species that we did not record but suspect are present in and around Aurora Memorial National Park are too numerous to list and consist of species that fall into each of the categories listed above as well as common low elevation forms found in nearly every habitat throughout the Philippines (i.e., house geckos) and recently introduced species (i.e., *Rana erythraea, Hoplobatrachus rugulosus* and *Bufo marinus*). Not only do we expect numerous forest species to be discovered in Aurora Memorial National Park with future fieldwork, but we also assume numerous common, low elevation species will be discovered as well. We suspect that additional survey efforts will reveal numerous species that were missed by our survey and we point to low elevation disturbed sites and high elevation montane mossy forests as the two general habitats that particularly are in need of further sampling in Aurora Memorial National Park.

Our data are at present too limited to provide an analysis of abundance and species richness; nor can we provide an analysis of spatial, temporal or elevational variation in herpetofaunal communities in Aurora Memorial National Park. It is quite clear from the lack of an asymptote in all three species accumulation curves (frogs, snakes, lizards; Fig. 6) that we did not collect all of the amphibian and reptilian species at this site. Cumulative species totals steadily increased in all faunal groups sampled through the final days of our field work, indicating that we did not exhaustively sample populations within the park. It would be difficult to speculate regarding the true number of species present for each taxonomic group because it appears that the species accumulation curves may not have even been approaching the point of leveling off. The one assertion that we can make is that further intensive sampling efforts will be needed to determine the
true number of amphibian and reptilian species within the confines of Aurora Memorial National Park. We urge future investigators to undertake these studies for their intrinsic value as contributions to Philippine herpetology and because such data are necessary for generating informed conservation and management strategies within protected areas of the Philippines. Nevertheless, we hope that the information provided here will provide baseline information for future studies and will encourage field workers to undertake similar surveys in Aurora Memorial National Park as well as numerous other overlooked yet easily accessible forested sites on Luzon Island. In particular, we hope that our data will contribute to the general effort among Philippine conservation biologists to catalog and document the diversity and endemism of the Sierra Madres before its forests are too drastically fragmented or felled completely.

Recently, national and international attention has been piqued by several popularized “faunal inventories”, “biodiversity surveys”, and “conservation initiatives” centering on the Sierra Madres of Luzon Island. While the value of these efforts (towards improving our knowledge of the respective taxa involved) can not be disputed, they have exclusively been oriented towards recording avian and mammal faunal diversity, despite claims to the contrary. Thus, it seems reasonable for us to draw attention to this potentially rich center of herpetological diversity and endemism and to stress the poor status of our knowledge of its amphibian and reptilian communities. We do so because we fear the herpetological diversity of the Sierra Madres will be neglected by disproportionate attention to other more accessible (easily identified and unobtrusively observed) and aesthetically pleasing (attractive to humans) taxa. One potentially disadvantageous outcome of the recent burgeoning attention to the birds and mammals of the Sierra Madres is that government, non-government, and the international conservation community may be lulled into the mistaken impression that the faunal diversity of the Sierra Madres is “reasonably well known”, that no further basic research is necessary, or that priorities elsewhere are more deserving of the provision of scarce research and conservation resources.

In fact, if appreciating and preserving the diversity and unique evolutionary history of the entirety of Philippine biodiversity is one genuine goal of conservation efforts, amphibians and reptiles may be more appropriate model (or “indicator”) taxa than volant mammals or birds because of their lower relative dispersal abilities and their apparent tendency towards finer scale differentiation on local centers of endemcity (i.e., single isolated mountain tops; W. Brown et al., 1997a; 1997b; 1997c; 1999, 2000; Alcala and Brown, 1998; Alcala, et al., 1998; R. Brown et al., 1995a, 1995b, 1996; 1999a, 2000; Diesmos, 1998; Diesmos, Brown and Alcala, unpubl. data). Unfortunately, with regards to the Sierra Madres ecosystem, the degree to which this pattern may be true will remain unknown until large scale herpetofaunal inventories are conducted by qualified herpetologists and results are compared to the well-developed avian and mammalian data sets. As previously mentioned, we are impressed by the numerous discoveries of new and rare species generated by this brief survey and we urge exhaustive herpetological survey efforts throughout the imperiled Sierra Madres of eastern Luzon.

ACKNOWLEDGEMENTS

For permits and logistical support, we are grateful to W. Pollisco and staff of the Protected Areas and Wildlife Bureau (PAWB), Department of the Environment and Natural Resources (DENR). In Manila we thank D. Felicitas and R. Flores (Silliman University) and R. Sison, R. and F. Caberoy, and M. Manuel (National Museum of the Philippines) for logistical assistance and advice. For their hospitality, we owe thanks to Lynn Butler and Jose & Ellie Cabarrus. The untiring efforts of our field colleagues J. Brown, A. Cazon, M. Eduarte, M. Ferner, M. Kebbon, K. Reis and F. Venuz, and of our field assistants O. Puno, R. Gador, L. Gador, R. Mendoza, J. Supsup and R. Supsup are greatly appreciated. In particular we are grateful for the enthusiastic field assistance of V. Yngente and J. Bulalacao.
Our field work in Aurora Province would not have been possible without the help and assistance of many people, particularly Congress-woman B. Angara-Castillo, Mayor A. Angara (Baler), Mayor A. Bitong (Maria Aurora), Mayor A. Tangson (San Luis), Mayor E. Usman (Dinalugan), PENRO T. Ragudo (DENR Baler), the staff of Aurora Memorial National Park (R. Zoleta, L. Llave and P. Dukha), and the Co-Directors of Aurora Integrated Area Development Project, R. Marzan and W. VeraCruz. We owe particular thanks to Aurora Board Member Artemio Dulay and family who helped spearhead and coordinate our field effort.

The Philippine National Museum/Cincinnati Museum of Natural History Philippine Biodiversity Inventory (PNM/CMNH PBI) was supported by donations from Adelaide Farny, Jim & Chris Geier, Buck & Patti Niehoff, Ward & JoAnn Withrow, the Fleischmann Foundation and Bob & Nancy Mason of Outdoor Adventures. Participation by the PNM team members was funded in part by a grant from the John D. and Catherine T. MacArthur Foundation. Rafe Brown’s participation in field work was partially funded by the Society for the Study of Amphibians and Reptiles, The Explorers Club, and the following grants from the Miami University community (Oxford, Ohio): The Zoology Student Enrichment Fund Grant, the Roschman Student Enrichment Fund Grant, the Alumni and Friends of Miami University Undergraduate Research Fund Grant, and the Hefner Museum of Zoology Field Research Grant. John Ferner acknowledges the support of the Faculty Development Fund and Department of Biology of Thomas More College and Jim McGuire’s fieldwork was supported by the Department of Zoology, University of Texas and by a National Geographic Grant (5606-96 to R. Dudley and J. McGuire). This is contribution No. 26 of the PNM/CMNH PBI.

LITERATURE CITED


________, A. E. LEVITON & R. V. SISON. 1999b. Description of a new species of Pseudorabdion (Serpentes: Colubridae) from


________ & E. R. Rickart. 1990. Correlation of clades and clines: geographic, elevational, and phylogenetic distribution patterns among Philip-


Received: 24 August 2000.
Accepted: 7 September 2000.