

ISSN 0260-5805

**THE BRITISH
HERPETOLOGICAL SOCIETY
BULLETIN**



**No. 69
Autumn 1999**

AMPHIBIANS AND REPTILES OF MONKEY BAY NATIONAL PARK, BELIZE

SAMUEL T. TURVEY* AND ANNA G. COOPER†

* University Museum, Oxford University, Parks Road, Oxford OX1 3PW

† Department of Zoology, Oxford University, South Parks Road, Oxford OX1 3PS

INTRODUCTION

Monkey Bay National Park (MBNP; sometimes referred to by other sources as 'Monkey Bay Nature Reserve') is an approximately square-shaped, 2,250 acre area of protected land situated between Belize City and Belmopan, at the western edge of Belize District, Belize. A qualitative herpetofaunal survey of MBNP was conducted for 25 days between July and September 1997, by four students from Oxford University and a graduate of University College, Belize. This was carried out in collaboration with the Conservation Division of the Belizean Government, to provide base-line data on a previously little studied area of Belize. A full report of the expedition's findings has already been produced (Turvey *et al.*, 1999); this paper serves to present a brief account of these results to a wider audience.

The northern border of MBNP is defined by the Sibun River, the area's major water feature, which lies at an elevation of approximately 30 metres above sea level. The land climbs slowly towards the south of the Park, where the topography is characterised by numerous limestone karst towers (some exceeding 120 metres in height) associated with large numbers of caves. These features form part of the ecologically sensitive Karst Land Formation, which occurs predominantly in protected areas in southwest Belize (Parker *et al.*, 1993; Iremonger and Sayre, 1994); the Formation remains relatively unprotected in Belize District, where it constitutes the northern extremity of the foothills of the Maya Mountains. Several creeks flow through MBNP into the Sibun. Lentic habitats are represented by variable patches of standing water, termed bajo, which form after rain within pockets of poorly drained, strongly hummocked 'potato' soils found throughout the gently undulating topography north of the Park's karstic region.

Recent investigations by Boston University (unpublished) indicate that MBNP was inhabited by Mayans during the pre-colonial era. Forested areas around the Sibun were logged heavily in the nineteenth and early twentieth centuries. Reduced logging operations continued in the region into the 1960's, at which time the northwestern part of MBNP formed part of the citrus and mango plantations of the Glenwood Estate. Although isolated houses can be found close to the Park's boundaries, the nearest settlement to MBNP today is La Democracia, a village (population approximately 100) situated two miles to the northeast; the village of Churchyard, recorded as being located on the opposite side of the Sibun to MBNP, has effectively ceased to exist.

MBNP was designated as a National Park in 1992. Access can be gained from the adjoining Monkey Bay Wildlife Sanctuary (MBWS), a 1070 acre protected area immediately north of the Sibun consisting of pine savanna and pine-fig forest. MBWS is situated at Mile 31.5 on the Western Highway, and was established in 1990 (see Kather,



Plate 1. Broadleaf forest in MBNP, dominated by Cohune Palm (*Orbigyna cohune*).



Plate 2. Bajo in MBNP.



Plate 3. *Gastrophryne elegans*.

1992, for treatment of land stewardship in MBWS and MBNP). Together MBWS and MBNP form a protected habitat corridor spanning the Sibun River Valley and connecting other protected areas in Belize.

The survey was conducted during Belize's rainy season, which lasts from June to January. During this period, Belize District usually receives between 200 and 300 mm rainfall per month, with humidity remaining in excess of 80%, and temperatures remaining between mid-20's to approximately 30°C (Brosnahan, 1994). However, during the survey period there was considerably less rainfall than is typical for the time of year. MBNP is situated close to the boundary between Belize's northern and southern hardwood forest regions, referred to respectively as Semi-Evergreen Seasonal Forest, and Evergreen Broadleaf Forest or 'rainforest' (Meyer and Farneti Foster, 1996), and contains component species from both vegetation types. This transition zone has been described as the Tropical Moist Transition to Subtropical ecological lifezone (Hartshorn *et al.*, 1984, *sensu* Holdridge, 1967). The geographical region between the Sibun and Mullins Rivers, an area encompassing MBNP, was further described by Meyer and Farneti Foster (1996) as Karst Hills Forest Vegetation; this has much in common with their Semi-Evergreen Seasonal Forest, particularly with respect to tree species and seasonal leaf loss, but does not reach the heights encountered in the other two vegetation types, and has less developed buttress roots and epiphytic growth.

Due to former logging practices, MBNP contains secondary forest, composed of subclimax successional vegetation in which the canopy is lower and more open than in primary Karst Hills Forest Vegetation. The well-drained floodplain adjacent to the Sibun consists of riparian forest, characterised by riparian figs (*Ficus* spp.) and patches of dense, impenetrable thicket made up largely of the exotic bamboo *Guadua spinosa*. The transitional and broadleaf secondary forest occurring further away from the Sibun is dominated by Cohune Palm (*Orbigyna cohune*), and the forest floor is littered with large decomposing palm fronds. Other tree species in this region include the Give and Take Tree (*Cryosophila argentea*), the Prickly Yellow (*Xanthoxylum kellermannii*), the Cockspur or Bullshorn Acacia (*Acacia cookii*), the Stinking Toe (*Cassia grandis*), and a few large buttress-rooted trees such as Mahogany (*Swietenia macrophylla*) which were missed during logging operations. At the western edge of MBNP, on the site of the former Glenwood Estate plantation, Lemon (*Citrus limonia*) and Mango (*Mangifera indica*) trees are found growing alongside these other species. Understorey vegetation is rather sparse except in areas of bajo, where dense woody vegetation forms a tangled, multistemmed thicket containing few taller emergent hardwoods.

The Belizean herpetofauna has been treated by Hoevers and Henderson (1974), Henderson and Hoevers (1975), more recently by Garel and Matola (1996) and Meyer and Farneti Foster (1996), and extensively by Lee (1996). A further review will also soon be available (Stafford and Meyer, 1999). 34 species of amphibian and 111 species of reptile are recognised by Lee (1996) to occur in Belize, and Stafford and Meyer (1999) list a further 11 reptile species. Almost half of these inhabit forested areas (Stafford, 1991). Belize's modern faunal affinities lie in the zoogeographical area of nuclear Central America (Iremonger and Sayre, 1994), belonging to the 'Caribbean lowland' assemblage (Kather, 1992). The Belizean biota is particularly rich, because it supports both North and South American species in addition to species shared with the Greater Antilles (Iremonger and Sayre, 1994). Duellman (1966) recognised six distinct herpetological biociations in Central America, principally based upon physiognomic characters of vegetation, with moisture and temperature as the principal environmental factors affecting species distribution in the region. However, MBNP contains herpetological components of both his Humid Tropical Assemblage and his Arid

Tropical Assemblage, and a more useful approach is to describe the fauna of Belize's drier north as similar in character to that of Yucatecan Mexico, whereas that of the wetter south is more similar to that of eastern Guatemala. As with vegetation, MBNP is geographically situated in a transitional area between these two faunal regions (Kather, 1992). Campbell and Vannini (1989) considered all of Belize, along with the northern portion of Guatemala and the lower Polochic and Motagua valleys, to fall within the 'Petén faunal area', one of eight such areas used by these authors to describe herpetofaunal distributions in Guatemala and Belize.

In comparison with other tropical areas, herpetological diversity is rather low in the Yucatán Peninsula (comprising southeast Mexico, northeast Guatemala and all of Belize), due to its relatively homogeneous topography (Lee, 1996). However, the Peninsula is rich in endemic plant and animal species, and the uniqueness of the Yucatecan biota has long been appreciated by naturalists, who have often treated the area as a distinct biotic province. 14% of the Yucatecan herpetofauna is endemic (Lee, 1996). Surprisingly little is known about the distribution or natural history of many of the Peninsula's herpetofaunal species, with researchers often having to rely on information obtained from populations found elsewhere in Latin America (Lee, 1996). When the recognised global decline in amphibian populations (eg. Wake, 1991) is also taken into consideration, with further declines probably occurring on a local scale in Central America due to factors such as fungal pathogens (Lips, 1999) and increasing air temperatures following the warming of tropical oceans (Pounds *et al.*, 1999), then obtaining base-line distributional and ecological data on Yucatecan herpetofaunal species becomes a priority.

Surveying was carried out with diurnal and nocturnal visual encounter surveys, and with a 30 metre 'L'-shaped drift fence with pitfall and funnel traps (O'Shea, 1992). The drift fence proved to be surprisingly effective, catching even relatively large herpetofaunal species such as *Kinosternon acutum* and *Corytophanes hernandezii*. Only one specimen (belonging to *Rhinophrynus dorsalis*) was found in a funnel trap.

A total of 35 species of amphibians and reptiles were discovered in MBNP. These consisted of 202 individuals, belonging to 7 amphibian and 11 reptile families. Further discussion with local people increased the number of herpetofaunal species known to inhabit MBNP to 39. Specimens collected for verification are now held by the University Museum, Oxford; these are denoted by the letters 'OUM' followed by a specific catalogue number. All specimens represent adult individuals except for OUM 21620, 21624 and 21630 (newly metamorphosed individuals) and OUM 21638 and 21639 (tadpoles).

SPECIES ACCOUNTS

CLASS AMPHIBIA

Order Caudata

Family Plethodontidae

1. *Bolitoglossa mexicana* Duméril, Bibron and Duméril OUM 21612

Remarks: Three individuals only, all caught on the same night within half an hour of each other on vegetation above bajo. Possibly congregating to breed, or emerging from more typical cryptic habitats following unusually hot weather.

Order Anura

Family Rhinophrynidae

2. *Rhinophrynus dorsalis* Duméril and Bibron OUM 21637

Remarks: Caught only after heavy rain. No vocalising males heard during survey;

individuals therefore remain active at night throughout the wetter months, after breeding stops.

Family Leptodactylidae

3. *Leptodactylus labialis* (Cope)

OUM 21624, 21630

Remarks: 32 newly metamorphosed juveniles were found between late August and early September; because tadpoles of this species usually metamorphose in less than two weeks (Meyer and Farneti Foster, 1996), adults probably breed in early August in this region of Belize.

Family Bufonidae

4. *Bufo marinus* (Linnaeus)

5. *Bufo valliceps* Wiegmann

OUM 21620, 21621, 21639

Remarks: The most abundant herpetofaunal species encountered in MBNP. The majority of individuals were newly metamorphosed adults, found from mid-August onwards; tadpoles belonging to this species were also observed in bajo pools. Individuals varied in colour from orange to dark olive, but despite this it is unlikely that any represented the poorly known *B. campbelli* Mendelson, which is believed only to inhabit moderate to high elevation primary rainforest.

Family Hylidae

6. *Agalychnis callidryas* (Cope)

7. *Hyla picta* (Günther)

8. *Scinax staufferi* (Cope)

OUM 21638

9. *Smilisca baudinii* (Duméril and Bibron)

Remarks: The most abundant treefrog encountered in MBNP. Duellman (1966) maintained that this species does not breed in ponds surrounded by dense vegetation, instead requiring open, shallow pools; however, the bajo habitat where all specimens were captured, and presumably also bred, was surrounded by relatively dense thicket. Following capture, individuals changed colour from green to brown, whilst retaining the same background mottled pattern.

Family Microhylidae

10. *Gastrophryne elegans* (Boulenger)

OUM 21631

Remarks: 20 individuals were captured in MBNP in August and early September, mainly overnight in the drift fence, making *G. elegans* the fourth most commonly encountered herpetofaunal species encountered in the Park. The abundance of this species was surprising, as *G. elegans* has only been recorded four times previously from Belize; it was described as 'enigmatic' and not commonly encountered anywhere in Central America by Meyer and Farneti Foster (1996), and 'uncommon' by Lee (1996). Capture was probably aided by greasing the inner rims of the drift fence pitfall buckets with petroleum jelly, as individuals demonstrated an ability to climb out of ungreased buckets.

Breeding has never been reported for this species, but the majority of individuals (13) were caught in MBNP in early August, suggesting that they may have been congregating to breed during this period. Two females caught in late August and early September were both much larger than previously examined individuals, and may have been gravid. One of these females was discovered by day under leaf litter beside a small ant nest on the forest floor relatively far from any water body, supporting Nelson's (1972) suggestion that the species is myrmecophagous and cryptozoic. Individuals ranged in dorsal ground colour from dark grey to pale brown, and varied in snout-vent length from 22 to 27 mm.

It is possible that *G. elegans* has been overlooked in other herpetofaunal surveys in Belize, as it is a small, well-camouflaged anuran, but it is more likely that the species has a patchy distribution in northern Central America, with more specific habitat preferences than 'humid lowland forests' (Henderson and Hoeyers, 1975) or 'humid evergreen tropical forests' (Nelson, 1972), and may only be found in secondary regrowth forest.

The possibility that this species is locally abundant is supported by its locality records elsewhere in Belize; of the four sites at which it has been previously detected in the country, one is in Belize District, 30.5 miles WSW of Belize City, very close to MBNP.

Family Ranidae

11. *Rana vaillanti* Brocchi

Class Reptilia

Order Crocodylia

Family Crocodylidae

12. *Crocodylus moreletii* Duméril and Bibron

Remarks: Not observed in MBNP, but known to inhabit the Sibun and MBWS (see Appendix One); its presence in the northern part of MBNP adjacent to the Sibun can thus reasonably be inferred.

Order Testudines

Family Dermatemydidae

13. *Dermatemys mawii* Gray

Remarks: As for *Crocodylus moreletii*.

Family Kinosternidae

14. *Kinosternon leucostomum* Duméril and Bibron

15. *Kinosternon acutum* (Gray)

Remarks: One of the two recorded individuals was caught in a drift fence bucket.

16. *Kinosternon scorpioides* (Linnaeus)

Family Emydidae

17. *Trachemys scripta* (Schoepf)

Remarks: As for *Crocodylus moreletii*.

Order Squamata

Family Gekkonidae

18. *Sphaerodactylus glaucus* Cope OUM 21618

19. *Sphaerodactylus millepunctatus* Hallowell OUM 21627, 21628, 21629

20. *Thecadactylus rapicauda* Houttuyn OUM 21613

Remarks: Only detected within caves in karst towers. At the edge of its recorded range in MBNP, but presumably found in caves throughout the Sibun Karst Land Formation. Individuals were aggressive when caught, emitting harsh barking calls and trying to bite.

Family Corytophanidae

21. *Basiliscus vittatus* Wiegmann

Remarks: Observed in vegetation near to the Sibun.

22. *Corytophanes cristatus* (Merrem)

23. *Corytophanes hernandezii* (Wiegmann) OUM 21611

Remarks: *Corytophanes* species are only rarely observed in Central America and Mexico; they appear to have very low population densities, and cryptic morphology and behaviour makes them appear much rarer still (Andrews, 1979; Bock, 1987). Two individuals of *C. cristatus* and three of *C. hernandezii* were found in MBNP on vegetation above water, in a similar position to that described by Ream (1964); one of the *C. cristatus* individuals was sleeping on a branch over a bajo pool at night.

Family Iguanidae

24. *Ctenosaura similis* (Gray)

Remarks: Not observed in MBNP, but found in similar secondary regrowth forest continuous with the Park's eastern boundary; its presence in MBNP can thus reasonably be inferred.

25. *Iguana iguana* (Linnaeus)

Remarks: Observed in vegetation near to the Sibun.

Family Polychrotidae

26. *Anolis biporcatus* (Wiegmann)

Remarks: Rare compared to other species of *Anolis* in MBNP; only one individual observed.

27. *Anolis lemurinus* (Cope)

OUM 21615, 21616, 21622, 21623, 21636

Remarks: Although colouration and dorsal patterning of individuals in MBNP was quite variable (as recorded elsewhere for the species; eg. see Lee, 1996), many displayed the 'diamondback' pattern described by Stafford (1994, illustr. p.24) for individuals in the Upper Raspaculo river basin. A similar pattern is apparently restricted to females in Costa Rica (Taylor, 1956); insufficient study was conducted to determine whether this was also true for individuals in MBNP.

28. *Anolis rodriguezii* Bocourt

OUM 21617, 21635

29. *Anolis uniformis* Cope

OUM 21614, 21625, 21626, 21632, 21633, 21634

Remarks: 22 individuals were caught, making this the most abundant reptile found in MBNP, and the third most abundant herpetofaunal species. Stuart (1948) considered it one of the most reliable indicators of virgin tall forest in Alta Verapaz, Guatemala, and elsewhere in Belize it is also typical of primary forest (eg. Stafford, 1991, 1994; classified as *Anolis* or *Norops humilis* in these references). Lee (1996) described the species as generally terrestrial, and only occasionally found low on vegetation. Neither ecological observation is borne out by its presence in the secondary regrowth forest of MBNP, where it is on the edge of its recorded range; it was found mainly on low vegetation or fallen logs and rarely on the forest floor or on rocks at the base of limestone karst towers. However, Duellman (1966) regarded *A. uniformis* as a sciophilic species found in a range of different forest habitats.

Family Scincidae

30. *Sphenomorphus cherriei* (Cope)

OUM 21619

Family Teiidae

31. *Ameiva undulata* (Wiegmann)

Family Xantusiidae

32. *Lepidophyma flavimaculatum* A. Duméril

Remarks: One individual found under rotting wood during the day.

Family Colubridae

33. *Leptophis ahaetulla* (Linnaeus)

34. *Masticophis mentovarius* (Duméril, Bibron and Duméril)

Remarks: Described by Duellman (1966) as heliophilous and never entering forest.

35. *Ninia sebae* (Duméril, Bibron and Duméril)

Remarks: One individual found under leaf litter, and two more within rotting wood, a microhabitat in which Greene (1975) reported that the species was relatively infrequently found in Veracruz, Mexico. All of the individuals had a predominantly red dorsum with few small, dark bands, similar to those from populations from the north of the Yucatán Peninsula. When caught, one individual adopted the defensive display described by Greene (1975); it also bit its handler, a behaviour which both Greene (1975) and Lee (1996) have maintained is not generally adopted by this species.

36. *Oxybelis aeneus* (Wagler)

37. *Sibon sanniola* (Cope)

Family Elapidae

38. *Micrurus diastema* (Duméril, Bibron and Duméril)

OUM 21610

Remarks: Two individuals of this species were discovered in MBNP. One of these, a male found under a rotting log and preserved as a museum specimen, had a total length of 876 mm (tail 124 mm), making it the largest specimen apparently ever recorded for the subspecies *M. d. sapperi* Roze; the second largest specimen of *M. d. sapperi*, a female cited by Roze (1996), has a total length of 810 mm (tail 91 mm). This observation is of interest in that males of the closely related and sympatric species, *M. hippocrepis*, appear to be smaller than females (Campbell and Lamar, 1989; Lee, 1996; Roze, 1996).

Both individuals encountered in MBNP were docile in temperament and could be manipulated into collecting containers with relative ease; this contrasts with descriptions of temperament for other *Micrurus* species (eg. *M. fulvius*, described in Neill, 1957).

Family Viperidae

39. *Bothrops asper* (Garman)

DISCUSSION

This preliminary investigation indicates that the herpetofaunal diversity of MBNP is of a similar level to that documented in rapid ecological assessments or more specific surveys conducted in other forested areas in Belize, such as the Bladen Nature Reserve (Iremonger and Sayre, 1994), the Columbia River Forest Reserve (Parker et al., 1993) and the Upper Raspaculo river basin (Stafford, 1991, 1994) over similar lengths of time. Many of the species found in MBNP, notably *Scinax staufferi*, *Smilisca baudinii*, *Ameiva undulata* and *Anolis rodriguezii*, are typical inhabitants of secondary forest (Lee, 1996), although *Anolis uniformis* is characteristic of primary forests elsewhere in its range. Some of the herpetofaunal species found in MBNP, such as the two species of *Corytophanes* and in particular *Gastrophryne elegans*, are quite uncommon in the Yucatán Peninsula, and other species such as *A. biporcatus*, *A. uniformis* and *Thecadactylus rapicauda* are close to the edges of their recorded ranges in the area.

Although the survey's objective was to provide an account of herpetofaunal diversity in MBNP, observations were also made concerning the autecology of several species. In particular, many supposedly strictly nocturnal species, such as the two *Bufo* species and *Leptodactylus labialis*, were found also to be active diurnally. Further quantitative research is required to analyse potential habitat partitioning between the sympatric pairs of *Sphaerodactylus* and *Corytophanes* species detected in MBNP; initial observations suggest that *S. glaucus* may occur among rocks at the base of karst towers, whereas *S. millepunctatus* was only detected in leaf litter on the forest floor. Possible future herpetofaunal research in MBNP should also involve an investigation into ecological relationships between the different *Anolis* species present in MBNP; Stafford (1994) reported that between 1991 and 1993 a sudden appearance of the previously unrecorded *A. lemurinus* apparently displaced the smaller *A. uniformis* from a semi-arboreal niche in the Upper Raspaculo, but both species were recorded in large numbers in MBNP, with *A. uniformis* only rarely observed on the ground. Although protection in MBNP may improve the survival chances of the uncommon herpetofaunal species recorded above, further work also needs to be conducted on the metapopulation requirements of these taxa, to determine the additional amount of similar habitat outside the Park boundaries required to sustain viable populations in the area. Such research is particularly important for *Gastrophryne elegans*, a species abundant in MBNP during the time of the survey but apparently very uncommon everywhere else in its range, and with virtually unknown specific ecological requirements.

Further herpetofaunal investigations would also inevitably detect additional amphibian and reptile species present in MBNP. Not only might rare or cryptic taxa have gone undetected, but both treefrog and snake species were encountered surprisingly infrequently during the survey, possibly due to the relatively low levels of precipitation during the survey period, which have been demonstrated to decrease activity in both groups elsewhere in Belize (Henderson and Hoervers, 1977). A more detailed analysis into the actual number of herpetofaunal species present in MBNP, and the possible identity of undetected taxa, can be found in Turvey *et al.* (1999).

ACKNOWLEDGEMENTS

Fieldwork was conducted in Belize by C. Gadd, L. Michalowicz and K. Thompson in addition to the authors. Various funding bodies and institutions made this research possible, notably Oxford University and the Royal Geographical Society. The help of M. Miller, M. Wahls, J. Marlin, S. Platt and R. Manzanero in Belize is gratefully acknowledged, and particular thanks go to P. Stafford (The Natural History Museum, London) for advice at various stages of the research and writing of this paper.

APPENDIX ONE

A herpetofaunal survey was conducted in MBWS in 1994-5 by J. Marlin (BFREE, PO Box 129, Punta Gorda). The following species were recorded. Asterisks indicate that the species is also present in MBNP.

Rhinophrynus dorsalis *
Eleutherodactylus laticeps
Leptodactylus melanonotus
Bufo marinus *
Bufo valliceps *
Agalychnis callidryas *
Hyla ebraccata
Hyla loquax
Hyla microcephala
Hyla picta *
Phrynohyas venulosa
Scinax staufferi *
Smilisca baudinii *
Crocodylus moreletii *
Dermatemys mawii *
Kinosternon scorpioides *
Kinosternon leucostomum *
Rhinoclemmys areolata
Trachemys scripta *
Sphaerodactylus glaucus *
Thecadactylus rapicauda *
Basiliscus vittatus *
Corytophanes cristatus *
Ctenosaura similis *
Iguana iguana *
Sceloporus variabilis
Anolis spp. (many) *
Eumeces schwartzei
Ameiva undulata *
Boa constrictor
Coniophanes imperialis
Drymarchon corais
Drymobius margaritiferus
Imantodes cenchoa
Leptodeira frenata
Leptodeira septentrionalis
Leptophis ahaetulla *
Leptophis mexicana

Masticophis mentovarius *
Ninia sebae *
Oxybelis aeneus *
Oxybelis fulgidus
Sibon nebulata
Spilotes pullatus
Thamnophis marcianus
Thamnophis proximus
Tretanorhinus nigroluteus
Xenodon rabdocephalus
Micrurus diastema *
Bothrops asper *
Crotalus durissus

A further species, *Oxyrhopus petola*, was discovered in MBWS by members of our survey team after leaving MBNP on 5th September 1997.

REFERENCES

- Andrews, R.M. (1979). The lizard *Corytophanes cristatus*: an extreme "sit-and-wait" predator. *Biotropica*, 11(2): 136-139.
- Bock, B.C. (1987). *Corytophanes cristatus*. Nesting. *Herpetological Review*, 18(2): 35.
- Brosnahan, T. (1994). *Guatemala, Belize and Yucatán - La Ruta Maya*. 2nd edition. Lonely Planet.
- Campbell, J.A. and Lamar, W.W. (1989). *The Venomous Reptiles of Latin America*. Cornell University Press, Ithaca, New York.
- Campbell, J.A. and Vannini, J.P. (1989). Distribution of amphibians and reptiles in Guatemala and Belize. *Proceedings of the Western Foundation of Vertebrate Zoology*, 4(1): 1-21.
- Duellman, W.E. (1966). The Central American herpetofauna: an ecological perspective. *Copeia*, 1973: 700-719.
- Garel, T. and Matola, S. (1996). *A Field Guide to the Snakes of Belize*. The Belize Zoo and Tropical Education Center, Belize.
- Greene, H.W. (1975). Ecological observations on the red coffee snake, *Ninia sebae*, in southern Veracruz, Mexico. *American Midland Naturalist*, 93: 478-484.
- Hartshorn, G.S., Nicolait, L., Hartshorn, L., Belvier, G., Brightman, R., Cal, J., Cawich, A., Davidson, W., Dubois, R., Dyer, C., Gibson, J., Hawley, W., Leonard, J., Nicolait, R., Weyer, D., White, H. and White, C. (1984). Belize: *Country Environmental Profile: A Field Study*. Robert Nicolait & Associates Limited, Belize City, Belize.
- Henderson, R.W. and Hoevers, L.G. (1975). A checklist and key to the amphibians and reptiles of Belize, Central America. *Milwaukee Public Museum Contributions in Biology and Geology*, 5: 1-63.
- Henderson, R.W. and Hoevers, L.G. (1977). The seasonal incidence of snakes at a locality in northern Belize. *Copeia*, 2: 349-355.
- Hoevers, L.G. and Henderson, R.W. (1974). Additions to the herpetofauna of Belize (British Honduras). *Milwaukee Public Museum Contributions in Biology and Geology*, 2: 1-6.
- Holdridge, L.R. (1967). *Life Zone Ecology*. Revised edition. Tropical Education Center, San Jose, Costa Rica.
- Iremonger, S. and Sayre, R. (1994). *A Rapid Ecological Assessment of the Bladen Nature Reserve, Belize*. The Nature Conservancy, Virginia, USA.

- Kather, M. (1992). *A Land Stewardship Plan for Monkey Bay Wildlife Sanctuary and Monkey Bay Nature Reserve*. State University for New York College of Environmental Science and Forestry. Unpublished.
- Lee, J.C. (1996). *The Amphibians and Reptiles of the Yucatan Peninsula*. Comstock Publishing Associates, Cornell University Press, Ithaca and London.
- Lips, K.R. (1999). Fungal pathogen involved in decline of anuran populations in Panama and Costa Rica. *Conservation Biology*, 13(1): 117-125.
- Meyer, J.R. and Farneti Foster, C. (1996). *A Guide to the Frogs and Toads of Belize*. Krieger Publishing Company, Malabar, Florida.
- Neill, W.T. (1957). Some misconceptions regarding the Eastern Coral Snake, *Micrurus fulvius*. *Herpetologica*, 13: 111-118.
- Nelson, C.E. (1972). Systematic studies of the North American microhylid genus *Gastrophryne*. *Journal of Herpetology*, 6(2): 111-137.
- O'Shea, M. (1992). *Expedition Field Techniques. Reptiles and Amphibians*. Expedition Advisory Centre, Royal Geographical Society, London.
- Parker, T.A., III, Holst, B., Emmons, L. and Meyer, J. (1993). *A Biological Assessment of the Columbia River Forest Reserve*. RAP Working Papers No. 3. Conservation International, Washington DC, USA.
- Pounds, J.A., Fogden, M.P.L. and Campbell, J.H. (1999). Biological responses to climate change on a tropical mountain. *Nature*, 398: 611-615.
- Ream, C.H. (1965). Notes on the behavior and egg laying of *Corytophanes cristatus*. *Herpetologica*, 20(4): 239-242.
- Roze, J.A. (1996). *Coral Snakes of the Americas; Biology, Identification and Venoms*. Krieger Publishing Company, Malabar, Florida.
- Stafford, P.J. (1991). Amphibians and reptiles of the Joint Services Scientific Expedition to the Upper Raspaculo, Belize, 1991. *British Herpetological Society Bulletin*, 38: 10-17.
- Stafford, P.J. (1994). Amphibians and reptiles of the Upper Raspaculo river basin, Maya Mountains, Belize. *British Herpetological Society Bulletin*, 47: 23-29.
- Stafford, P.J. and Meyer, J.R. (1999). *A Guide to the Reptiles of Belize*. Academic Press, San Diego, USA.
- Stuart, L.C. (1948). The amphibians and reptiles of Alta Verapaz Guatemala. *Miscellaneous Publications of the Museum of Zoology, University of Michigan*, 69.
- Taylor, E.H. (1956). A review of the lizards of Costa Rica. *University of Kansas Science Bulletin*, 38(1): 3-322.
- Turvey, S., Cooper, A., Gadd, C. and Michalowicz, L. (1999). *Oxford University Expedition to Monkey Bay National Park, Belize. Herpetological Survey, July to September 1997*. Unpublished.
- Wake, D.B. (1991). Declining amphibian populations. *Science*, 76: 61-84.