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THE REPTILES OF PAPUA NEW GUINEA

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A member of the Commonwealth since 1975, Papua New Guinea comprises the eastern half of the island of New Guinea, the second largest island in the World. The western half of the island, formerly Dutch New Guinea and now known as Irian Jaya, Indonesian New Guinea or West Papua, is much less accessible and subsequently far less well known ecologically. That is not to say that Papua New Guinea's flora and fauna have been fully explored and that no surprises remain.

P.N.G., as it is frequently abbreviated, was originally two separate colonies: German New Guinea in the north and British Papua in the south, separated by the high mountainous backbone of the island. Other European nations also had vested interests in these tropical colonies, not least the French, the Italians and the Russians. British Papua was handed over to the Australian administration in the early years of this century and when the German north also fell under the Australian authority, after the First World War, Papua New Guinea was created. However the German influence is still evident to this day through some of the town names: Finschafen, Alexishafen, Helmholtz etc. The Second World War brought the Japanese to New Guinea and they quickly invaded much of the island and marched down the Kokoda Trail to within a few miles of the capital Port Moresby and the southern coast, on their way to invade Australia, before being finally repulsed. After the war P.N.G. returned to Australian control, and received independence in 1975.

Politically, therefore, as a united and independent country P.N.G. is quite young yet geographically it is very old. Of Gondwanaland origin, a land of dense jungles, hot savannas and treacherous swamps, precipitous mountain ranges with torrential rivers rushing down deep craggy gorges and reef-fringed tropical islands off the magrove-edged coast. A tropical paradise, and in many regions one hardly touched by the 20th century, apart from the occasional resort and the numerous crashed aircraft scattered through the forests and shallow coastal waters. Mainland P.N.G., which comprises 15 provinces, is only slightly larger than the United Kingdom yet its population is probably less than 5 million. The numerous archipelagos, including the large islands of New Britain, New Ireland and Bougainville, which make up the five off-shore provinces to the east and north, add to the total land surface of the country.

Communications have always been a problem in P.N.G. The great distances involved, the extensive seasonal floodings in the lowlands, the huge rivers and the difficult, mountainous terrain have all added to the isolation of the indigenous communities. There are a small number of good to excellent highways in the coastal regions and the Highlands Highway allows access to the mountain provinces but many areas are accessible only by air or on foot. Flying in P.N.G. is a real experience as many of the airstrips are short grassy areas hacked out of the bush or narrow mountain plateaus overhanging deep valleys, and many Australian bush pilots come to New Guinea to earn their wings. P.N.G. is also the land of many languages – some 750 different tongues known as *tok ples* (talk place) often confined to one village. English is spoken and taught in the schools but many people fall back on the favourite *pisin inglis* (pidgin English) and newspapers such as *Wantok* (One talk = the extended family) are published in this 'national' language. In Papua there are also two other fairly widely used languages: Hiri motu and the adapted Police motu.

Although politically and economically a modern 20th century country there is still much that is tribal about P.N.G. and society and the people are extremely proud of their heritage, celebrating their warrior past with huge elaborate festivals called *sing sings*. That is not to say that the past is dead since tribal fights between feudal villages frequently take place even today, especially in the highland provinces, and all the men are skilled in the use of spears and bows and arrows. PNG is a mixture of the modern with the traditional. Port Moresby's skyscrapers look out over the Koki stilt village whilst the modern Parliament building combines both

the old style with the new ways. This seat of modern govenment is built in the style of the *haus tambaran,* the feudal village men's house of the Sepik. It is into this environment that I have ventured twice in search of reptiles and amphibians.

In 1986 I spent three and a half months as the herpetologist on the staff of the Operation Raleigh's P.N.G. expedition to Central and Western Provinces, and in 1990 I returned to P.N.G. for a further five months, primarily to capture and 'milk' highly venomous elapids for snakebite research at the Department of Clinical Medicine at Oxford University and Liverpool School of Tropical Medicine. This second visit also provided the opportunity for further herpetological field work in Madang and Central Provinces under the auspices of a Christensen Research Institute Fellowship.

WESTERN PROVINCE

Western Province is the largest and one of the most remote. With West Sepik or Sundaun Province in the north it forms the frontier with Irian Jaya. The huge Fly and Stickland Rivers rise in the distant Star Mountains to the far north where Western Province borders West Sepik and from there they meander their way south, first through rainforests and then across a vast, almost featureless, low-lying region of *Eucalyptus* savanna, termite mounds, and flood plains. The two rivers converge south of Lake Murray to form the greatest river in New Guinea which finally empties into the ocean in the Gulf of Papua just north of the provincial administrative centre on off-shore Daru Island, one of the few localities in the southern half of the province which is not flooded for a large part of the year. There are few roads in Western Province, only faint representations of trails and settlements which are better marked on the maps than on the ground. Villages here have a habit of disappearing and reappearing many kilometres away, leaving no signs left that the original settlements ever existed.

Daru is a shambles of a town but one is immediately reminded of how important reptiles are to the people of the region. Live Green Turtles *Chelonia mydas* lie upturned on the jetty, awaiting buyers with prices chalked on their plastrons, and numerous stores such as Fly River Trading, Daru Enterprises or Western District Trading offer 'buying and selling finest grade *pukpuk* (crocodile) skins'. The other herptile encountered as soon as one steps ashore is the ubiquitous Cane Toad *Bufo marinus,* the introduction of which as a sugar cane crop pest control measure in the 1930's, has proved to be an ecological and environmental disaster for Australia, New Guinea and several Pacific islands.

Moving to the mainland it is not difficult to understand why the administrative centre was built on an off-shore island. When southern Western Province floods whole areas vanish underwater. Consequently most of the houses are built on stilts. The downstairs quarters are often only used for storage during the dry season and they are good localities for looking for huge White-Lipped Treefrogs *Litoria infrafrenata,* and the numerous species of geckoes which move into human dwellings: *Hemidactylus frenatus, Gehyra mutilata* and *G. oceanica.* At night the Brown Catsnake *Boiga irregularis* may also be encountered underneath the houses, seeking these frogs and lizards. There is a local belief that if you go out during the day and this snake sees you but you don't see it, the snake will follow you home and sleep with you that night. When someone comes down from upstairs during the night and encounters a Catsnake they usually jump to conclusions and hysteria ensues. I captured a large number of these extremely common snakes by sitting up late at night in villages, waiting for the screams. During the day the commonest arboreal snake is the graceful Coconut Snake or Green Treesnake, *Dendrelaphis calligastra,* which may be seen climbing the coconut palms in search of treefrogs which sleep in the huge fronds, or pursuing Rocket Frogs, *L. nasuta,* across the ground. The coconut palms also provide microhabitats for many species of geckoes and skinks and I investigated the crowns of any palms felled in or around the villages. Apart from fruit bats and sugar gliders the most interesting specimen collected was the skinks, *Prasinohaema semoni.* This is one of the five species of green blooded, prehensile-tailed skinks, four species of which are endemic to New Guinea whilst one species also occurs in the Solomon Islands.

The many creeks which dissect the villages are full of small fish, frogs and tadpoles which make up the diet of watersnakes such as the Common Keelback, *Tropidonophis mairii*.* These harmless snakes, and any other dark coloured snakes, are fequently killed as suspected 'Pap

blacks', a snake which holds an almost mythological fear over the inhabitants of the southern Papuan half of P.N.G.

Areas cleared and planted for the cultivation of root crops, yams, sweet potatoes etc. provide ideal habitats for reptiles such as skinks: *Emoia spp., Sphenomorphus spp.,* the Blue-Tongued skinks *Tiliqua gigas,* and the Major Skinks, *Egernia frerei;* and snakes: the diminutive parthenogenic Brahminy 'flowerpot' Blindsnake, *Typhlina bramina,* and the larger *Typhlina polygrammica,* the common Black Treesnake, *Dendrelaphis punctulatus,* and the slatey-grey snake, *Stegonotus cucullatus.*

Many of the coastal villages are surrounded by mangrove swamps, monsoon forest and numerous interlocking creeks. The pock-marked mud flats with their populations of crabs and mudskippers provide accommodation and food for the mildy venomous, rear-fanged homalopsine mudsnakes: the Smooth Watersnake, *Enhydris polylepis,* Richardson's Grey Mangrove Snake, *Myron richardsoni,* the Banded Watersnake, *Cantoria annulata,* Bockadam *Cerberus rhynchops,* and the White-Bellied Mangrove Snake, *Fordonia leucobalia,* which dorsally may be any colour from dark grey to yellow. The mangrove swamps are also home to lizards ranging in size from the tiny geckoes of genus *Lepidodactylus* to the Spotted Mangrove Monitor Lizard, *Varanus indicus.* In the saltwater around the mangroves in-shore seasnakes of the genera *Hydrophis* or *Enhydrina* may occasionally be found lurking.

Further inland the saline swamps give way to freshwater treeswamps, home to the New Guinea Side-Necked Turtle, *Emydura novaeguineae,* and the Red-Bellied Side-Necked Turtle, *E. subsglobosa.* Natricine watersnakes such as the Common Keelback, *Tropidonophis mairii,* the slender Painted Keelback, *T. picturata,* and the stout Barred Keelback, *T. doriae,* hunt fish and frogs in the denticulate channels. In the larger watercourses and rivers the large 2m Arafura File Snake or Elephant's-Trunk Snake, *Acrochordus arafurae,* may occasionally be seen surfacing for air. The local women collect these 'flabby-bodied' snakes, their meat being considered a delicacy whilst the skins are used on the tribal *kundu*-drums. Traditionally, only lactating women are supposed to capture these snakes and this they do by entering the water, exuding milk on the surface to 'attract' the snakes and then moving their feet through the mud until the snake is located. The snake is picked up and dispatched with a bite to the neck to break the spinal cord.

Large rivers such as the Fly possess large populations of crocodiles, both Saltwater, *Crocodylus porosus,* and Freshwater, *C. novaeguineae,* and a flourishing crocodile farming industry has been established from this wild stock. The rare pit-shelled, pig-snouted Fly River Turtle, *Carettochelys insculpta,* which features on the 5 toea coin, also inhabits these large saline/ freshwater courses and a particularly large species of turtle is also reputed to occur in the lower Fly River. I also obtained a specimen of *Hydrophis sp.* some 60km inland on the Oriomo River. Parker (1982) reported the rapid deaths, in the 1970's, of three young girls following bites from a small unidentified snake whilst bathing in the Ouwe Creek at Wipim. The Ouwe Creek feeds into the Oriomo River just north of Old Zim where I collected the *Hydrophis.* Seasnakes are known to enter tidal rivers and swim some considerable distance into freshwater. In the Ramu River system in northern New Guinea the common Beaked Seasnake, *Enhydrina schistosa,* represents a serious snakebite threat to river fishermen and several fatalities have occurred a considerable distance from the open sea.

The majority of Western Province comprises vast expanses of *Eucalyptus* savanna, dotted with termite mounds. These savannas appear to be either flooded or scorched depending on the time of year. Fire is a regular controller of vegetation and many tree species may be actively triggered into life by the passing of a rapid bush fire.

* The recently applied generic name for the Australasian natricine Keelbacks, *Tropidonophis* (Malnate & Underwood 1988), has been used here in place of the previously accepted *Amphiesma* and *Styporhynchus.*

The commonest lizards on the ground are the skinks and the most obvious, occurring in most habitats, are the four fingered skinks of genus *Carlia.* On the savannas the two main species are the brown *Carlia fusca* and the striped *C. bicarinata.* Males may be seen waving their tails slowly in display from fallen log vantage points. Small striped Snake-Eyed Skinks,

Plate 1. Salvador's Monitor, *Varanus salvadori*, Moitaka, National Capital District, Papua New Guinea.

Plate 2. Cat Snake, *Boiga irregularis*, Karkar Island, Madang, Papua New Guinea.

Cryptoblepharus pallidus, are also commonly seen scuttling up the white bark of the gum trees. These small skinks provide food for many other vertebrates but one of their most unusual predators is Burton's Snake Lizard, *Lialis burtonis.* Australasian snake lizards belong to a family known as the Pygopodidae. They are believed to be related to the geckoes but their limbs are greatly reduced, in *Lialis* the hindlimbs being represented by a pair of small scaly 'flaps'. *L. burtonis,* which also occurs in Australia, possesses extremely long and kinetic skull and 'forceps-like' jaws which are perfectly designed for prey handling since snake lizards prey upon, and swallow whole, small scincids such as *Carlia* or *Emoia.* The articulation of the snake lizard's jaws is such that it can swallow prey of greater body size, in relative to its own size, than many snakes (Patchell & Shine 1986). Local names for these inoffensive lizards include pencil snake or friendly snake since they refuse to bite man, often going stiff as pencils when handled.

Larger lizards also inhabit the savannas of Western Province. The Frilled Lizard, *Chlamydosaurus kingi,* may occasionally be seen displaying from fallen gum trees. This dramatic Australian agamid is only known in P.N.G. from Western Province. More frequently the Two-Striped Dragons, *Diporiphora bilineata,* and *Lophognathus temporalis,* may be seen rushing across the path, the latter species running on its hind legs in the manner of the neotropical basilisks. Monitor lizards or goannas are also in evidence. The commonest is Gould's Savanna Monitor, *Varanus gouldii,* but the most impressive species must be the Salvador's Crocodile Monitor or Artrellia, *Varanus salvadori.* This giant of a lizard is reputed to grow to a length of in excess of '6m', rivalling the Komodo Dragon for the title of the 'World's longest lizard'. Villagers report that Artrellis will bring down deer, pig and hunting dogs and have even been known to attack man. Attempts to instigate a hunt to capture a large specimen alive were unsuccessful when the local hunters vanished. Their lack of enthusiasm for the project was illustrated quite well by one hunter who insisted that he had to go and stay with his mother-in-law! However, a juvenile *V. salvadori* was sighted and I encountered captive half-grown adults at Moitaka Crocodile Farm near Port Moresby.

The lowland rainforests of Western Province are reputedly inhabited by up to six species of Angleheads, genus *Gonocephalus,* and the Water Dragon, *Physignathus lesueurii.* This latter species evaded discovery but two species of Angleheads were recorded, the White-Cheeked Anglehead, *G. papuensis,* and the Keeled Anglehead, *C. dilophus.*

Pythons are very common in Western Province, all seven mainland species being recorded within its boundaries, and some communities in the southern Trans-Fly exist almost entirely on a diet of python meat. The forest-dwelling Green Tree Python *Chondropython viridis*** is particularly common and both green adult and yellow juvenile specimens may be encountered hunting on the ground after dark or sleeping in low vegetation during the day. Larger, related species such as the Amethystine and Carpet Pythons, *Morelia amethistina* and *M. spilota,* were also found around or in villages at night. Whilst the Amethystine Python appears quite common the Carpet Python was found to be fairly rare in the province. All Western Province Amethystine Pythons encountered were dark brown dorsally overlaid with black reticulate patterning, complying with Parker's (1982) description of rainforest Amethystine Pythons.

Other pythons met with included the D'Albertis White-Lipped Python *Bothrochilus albertisi* and the Papuan Olive Python *B. papuanus* which were captured along the tidal creeks and rivers. Large pythons of these species were occasionally trapped in gill nets set by local fishermen. The D'Albertis Pythons of Western Province reach lengths in excess of 2.5m and exhibit a deep blue-black dorsum and cream venter. The head of this snake is glossy black, strongly contrasting with the white bars of the labial scales. The Papuan Olive Python grows to a vast size both in length and bulk and it may exceed the Amethystine Python in total length. Apart from a regular diet of mammals such as Wallabies this species has proven itself as a 'snake eater', a 2m Amethystine Python being retrieved from the stomach of a drowned 2m Olive Python (O'Shea 1987, 1988). P.N.G.'s most restricted python species, Macklot's Water Python, *B. mackloti,* is confined to a small area in southern Western Province centred around Masingara where it reputedly preys upon waterbirds. This species ws not recorded by me.

** The generic names *Chondropython, Bothrochilus* and *Morelia,* as applied to New Guinea pythons, have been retained here although the author is aware of the recent revision by Underwood and Stimson (1990) which places all New Guinea species in the genus *Morelia.*

Plate 3. Green Tree Python, *Chondropython viridis,* Riwo, Madang, Papua New Guinea.

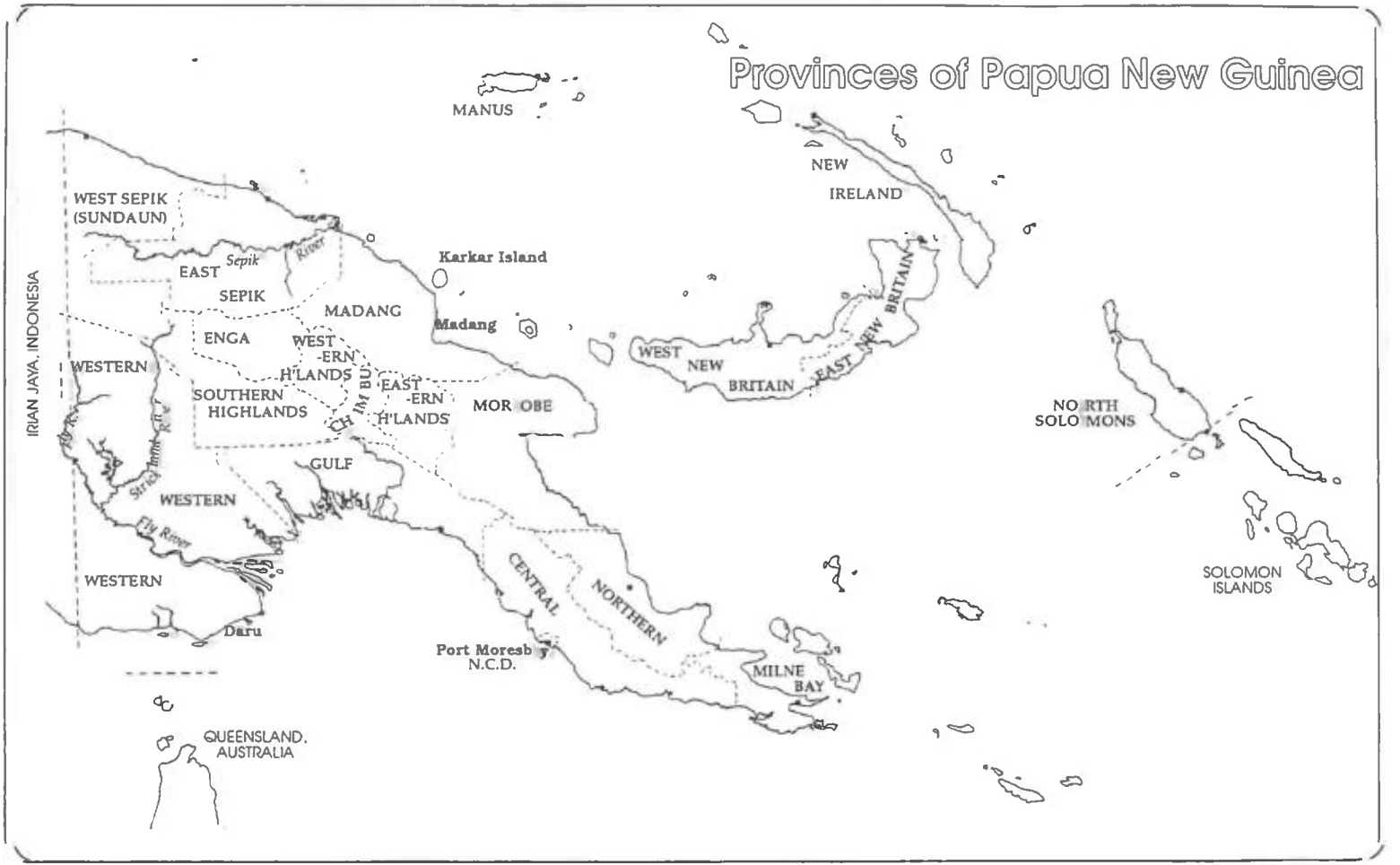
Plate 4. Boelen's Python, *Morelia boeleni,* Varirata, Central Province, Papua New Guinea.

Venomous snakes of the family Elapidae are very common in Western Province. Small inoffensive nocturnal species such as the Black-Striped Snake, *Unechis nigrostriata,* or the Brown-Headed Snake, *Glyphodon tristis,* occur around villages but most of the dangerous species are diurnal. The Whipsnakes, *Demansia atra* and *D. papuensis,* may be seen abroad even in the mid-day heat of the savannas and also in the village gardens. Although their venom is not considered to be highly dangerous to man these extremely alert and rapid snakes are capable of pursuing and capturing their lizard prey. A pair of males were observed in combat outside a newly constructed church in the village of Kunini.

The most feared snake in Papua is the Papuan Blacksnake, *Pseudechis papuanus.* Reaching lengths of over 2m and characterised by its deep glossy black, smooth scaled dorsum and relatively small eye the endemic Papuan Blacksnake is the largest and most venomous of the Australian genus *Pseudechis.* The largest member of the genus occurring in Australia, the King or Mulga Brownsnake, *P. australis,* has also been reported from southeastern Irian Jaya around Merauke and it is probable that this species may eventually be collected within P.N.G., most likely in the southern frontier region west of the Fly River (Slater 1968). *Pseudechis* is a genus of amphibiophagous snakes and it is suggested that the introduction of the Cane Toad has greatly reduced the populations of both the King Brownsnake in Queensland (Covacevich & Archer 1975) and the Papuan Blacksnake through much of its original range in P.N.G. Cane Toads have not yet spread widely in Western Province but the Blacksnake is not a common species, only a single speciment being captured by myself in 1986. The most frequently encountered highly venomous species in the region is the Papuan Taipan, *Oxyuranus scutellatus canni.* Western Province specimens, which may achieve lengths of 3.5m, are usually dark to medium brown in colour and easily distinguished from the Blacksnake despite the local belief that they are male and female of the same species. The scales of the Taipan are keeled, the vertebral column is raised so that the body attains a triangular shape and the head is elongated and 'coffin-shaped' with the large eyes shielded by shelf-like supraocular scales giving a scowling impression. Taipans are slender, rapid-moving diurnal hunters, and since their prey consists of fairly large and potentially dangerous mammals such as rats, they exhibit a rapidly repeated stab and release bite similar to that perfected by the Black Mamba. This maximises the amount of venom injected but keeps the snake's head at a relatively safe distance to prevent injury. The venom of the taipan is extremely toxic and the fatal dose for a 70kg human is believed to be only 7mg (Campbell 1969) which is very little when one considered that the average bite from a 2m Taipan may deliver 100-200mg of venom (Campbell 1967). It is clear, therefore, that in remote region such as Western Province the taipan constitutes a considerable danger to human life. Although the Taipan is generally considered to be a diurnal species it is known to become more crepuscular or even nocturnal during the dry season and villagers occasionally report sightings in the graveyards on the out-skirts of the village. This may be the result of the activities and customs of the villagers since a burial is usually followed by a three month period of mourning. During this time food and drink are daily placed beside the grave for the refreshment of the 'departed soul'. Such gifts will entice rats and mice and may subsequently attract their predators to this relatively undisturbed area.

The only highly dangerous elapid regularly active at night is the Death Adder, *Acanthophis sp.* These short, stumpy 'viper-like' snakes are found lying on trails through forest and garden habitats, especially during the beginning and end of the wet season. Since vipers are absent from the Australasian region these elapids seem to have evolved into the vacant 'niche' even to the degree of taking on the external morphology and behavioural traits of the vipers. The body is short and stout, the head is moderately angular and the eye, which possesses a vertically elliptical pupil, is shielded by a raised 'horn-like' supraocular scale. The ecology and taxonomy of the New Guinea Death Adders is in need of study and revision and it seems likely that two or possibly three distinct species may occur on the island.

Western Province is herpetofaunally without doubt the most diverse province containing representatives of most New Guinean reptile genera including 100% of the Acrochordids and Pygopodids; 90% of the Boids; 83% of the varanids, 77% of the Agamids and 76% of the Colubrids.


Provinces of Papua New Guinea
MANUS
NEW IRELAND
WEST SEPIK (SUNDAUN)
EAST SEPIK
Sepik River
Karkar Island
Madang
MADANG
ENGA
WEST-ERN H'LANDS
EAST-ERN H'LANDS
CHIMBU
WESTERN
SOUTHERN HIGHLANDS
MOROBE
GULF
WESTERN
Fly River
WESTERN
Daru
Port Moresby N.C.D.
CENTRAL
NORTHERN
MILNE BAY
WEST NEW BRITAIN
EAST NEW BRITAIN
NORTH SOLOMONS
SOLOMON ISLANDS
IRIAN JAYA, INDONESIA
QUEENSLAND, AUSTRALIA

CENTRAL PROVINCE AND NCD

The National Capital District, comprising Port Moresby and its hinterland, is completely surrounded by the coastal belt of Central Province which separates the sea from the towering mountains of the Owen Stanley Range, the foothills of which begin some 30-50km inland, and the lower Astrolabe Range which rise almost out of the sea to the south of the capital. From a biological standpoint the NCD cannot be separated from the rest of coastal Central Province. I was based in the National Resources Wing of the Department of Biology, University of Papua New Guinea, on the out-skirts of Port Moresby on the edge of the Waigani Swamp.

There are a number of excellent tarmac roads leading out of the capital: the Hiritano Highway, The Hubert Murray Highway and the Rigo Road, leading northwest to Bereina, east to Sogeri and southeast to Kwikila respectively, but even these roads deteriorate to pebble and dirt after 20-30km. There is, however, an active programme of road improvement and many areas around Port Moresby may soon become accessible without the need of 4WD. It is still, however, practically impossible to travel out of the province by road and many of the montane settlements of Central Province are still only accessible by air.

The coastal strip of Central Province appears floristically very similar to the Eucalypt savanna of Western Province and northern Australia. Flying in to Port Moresby's Jackson's Airport one passes over a series of rolling open grassy hills punctuated by numerous White-Barked Gum Trees. For much of the year this is an arid environment with few watercourses. The most obvious, diurnal reptiles are the small skinks: *Carlia, Emoia, Cryptoblepharus* etc. and the fast running agamids, *Lophognathus temporalis.* All these species would be seen around the unversity where searches under rocks, oil drums or paving slabs also reveal skinks of the genus *Sphenomorphus,* geckoes, *Hemidactylus frenatus* and the blind snakes, *Typhlina bramina.*

Driving the roads around Port Moresby on a regular basis one begins to appreciate the massive ophidian death toll. The most frequent casualty is the Carpet Python, *Morelia spilota,* I recorded 26 identifiable specimens during two stays in NCD totalling about ten weeks. The next most common species are the Olive Python *B. papuanus,* and the Amethystine Python, *M. amethistina,* but usually alert and rapid moving elapids such as the Black Whipsnake, *D. atra,* and the Taipan, *O. scutellatus,* were not infrequent DOR finds, presumably killed as they basked on the road in the first sun of the morning.

Road cruising on the black roads at night, especially after light rain, proved fairly successful and I captured a number of Carpet Pythons and other species on the out-skirts of the capital. These snakes were relocated out towards Sogeri at a later date. The Carpet Pythons, which reach 1.5m, are extremely variable in their saddle-mark patterning but they are all identical in their temperament, every specimen striking aggressively if handled. Diurnal searches in the right areas could also produce snakes and the old Errol Flynn tin mine workings on the road to Sogeri were found to be a favourite haunt of Carpet Pythons, five or six being found there on occasions, sheltering inside the metalwork. Amethystine Pythons around Port Moresby appear to exhibit two 'morphs'. There is a brown morph not unlike that found in Western Province and the specimens I encountered around Port Moresby complied with this patterning. However, the university possess a couple of live specimens which are much more yellow in their ground colour, almost resembling large, long-headed Carpet Pythons. The exact collection locality for these snakes could not be ascertained.

The Green Tree Python is also fairly common around Port Moresby and I was presented with a gravid female by the National Museum. This specimen, which had been captured alive by security guards in the grounds of the Prime Minister's residence and turned over to the museum, a laudable but uncommon reaction to the finding of a python, eventually laid 12 eggs but they proved to be infertile.

Media interest surrounding the venomous snake project also resulted in a number of interesting though non-venomous captures: a 3m Amethystine Python in a tree at Hohola, a common Keelback on the runway at Jackson's Airport, Carpet Pythons in driveways and bathrooms, Treesnakes in diplomatic swimming pools etc. This publicity did lead to the capture of venomous specimens, however, including several Black Whipsnakes in a culvert at the P.N.G. Defence

Force barracks at Goldie River and four Taipans from Brown River and Goldie River. Death Adders are reputedly common in the old forestry areas along the Hiritano Highway, particularly near the Brown River where a single specimen was obtained.

The Taipans of Central Province differ greatly in colour from those of Western Province being a deep red-brown to black dorsally with a broad copper-brown vertebral stripe down the body. This stripe appears to be absent in the lighter brown Western Province Taipan and the all-black juveniles encountered around Port Moresby. Since Port Moresby is a fairly sprawling town, with large areas of untouched savanna surrounding and scattered throughout the built-up areas, the Taipan is very likely to come into close contact with man and DOR specimens were recorded in the capital.

The black Taipans of the Port Moresby area are probably responsible for the continued reports of Papuan Blacksnakes, *Pseudechis papuanus,* although there has not been an authenticated record for many years. A number of trips into Blacksnake-type country, swampy grassland and savanna woodland some distance from the capital, failed to locate any Blacksnakes, the only snake species encountered being Whipsnakes and Common Treesnakes, *D. punctualtus.* The Common Treesnakes of Central Province are quite different in colouration from their relatives in Western Province, being light brown with blue interstitial skin rather than jet black.

Out of Port Moresby the various roads lead into quite different habitats. The Hiritano Highway crosses wide stretches of flood plain and passes through small remnants of lowland rainforest, coconut and rubber plantations. Some of these habitats, particularly along the Laloki River, are reputedly home to populations of the Small-Eyed Snake, *Micropechis ikaheka,* but this species is far more common in Madang Province. The Rigo Road runs along the coast, between the sea and the Astrolabe Range, through areas of low-lying savanna, forest and cultivation, but the Hubert Murray Highway to the east provides access to higher ground. Beyond the Errol Flynn Mine and the Pheonix Inn the road begins to climb. Passing between the twin peaks of Warirata (860m) and Hombrom Bluff (554m) the road 'snakes' up the steep, Laloki River valley, past the Rouna waterfall and the hydroelectric dams to Sogeri. From here one road leads to the Varirata National Park, an area of forested valleys inhabited by Birds of Paradise, whilst another leads towards Owers Corner and the beginning of the Kokoda Trail from where it is possible to cross the mountain ranges on foot into Northern Province. The whole area is remote and the few settlements are extremely isolated. Herpetologically this area is very poorly known and deserves further study, especially since Salvador's Crocodile Monitor, *V. salvadori,* is reported to occur within the Varirata National Park.

Even more remote regions of Central Province lie within the Owen Stanley Range and they can only really be reached by air. The highest peaks in the range are Mt Victoria (4072m) and Mt Albert-Edward (3990m) but many other peaks rise to over 3500m. I visited the settlements of Tapini (approx. 900m) and Woitape (approx. 1500m) in 1986 to make collections of reptiles. The common snakes of the area appear to be Slatey-Grey Snakes, *Stegonotus cucullatus,* and the Catsnake, *B. irregularis,* with the Death Adder, *Acanthophis sp.,* being the only dangerous elapid at these altitudes. Smaller, secretive and fairly inoffensive elapids of the genera *Taxicocalamus* and *Aspidomorphus* eluded discovery as did perhaps the most alluring snake in the whole of New Guinea, Boelen's Python, *Morelia boeleni.* This python is endemic to New Guinea and confined to forested montane regions. An elusive snake which has only been reported from a scattering of localities: Kainantu, Eastern Highlands Prov., Wau and the mountains behind Lae, Morobe Prov., Mt Brown and Woitape, Central Province, the Star Mountains, northern Western Prov., the Wissel Lakes, Irian Jaya (McDowell 1975) and most recently from Bundi, Madang Prov. It seems likely that the species is more widespread than has been appreciated and that its reported 'rarity' is probably more a result of the remoteness and inaccessibility of its distribution. My opportunity to make an acquaintance with the Boelen's Python came when I requested to borrow one of a pair from the National Museum to film a sequence with the BBC Natural World film crew. Boelen's Python is stunningly beautiful, stout bodied, muscular species with a broad, short snouted head and a deep velvety blue-black, highly iridescent dorsum rivalling that of the Amethystine Python or the Brazilian Rainbow Boa. On the anterior third of the body there is a series of white, forward-slanting transverse finger-like bars which reach from the ventral surface to a point mid-laterally. The white and black baring of the supralabials further adds to the startling livery of this impressive python.

From Tapini I walked to the village of Matsialavava (1600m), *en route* collecting several species of skinks: *Carlia fusca, Lobulia elegans, L. stanleyanum, Emoia sp.* and *Sphenomorphus sp.* The most interesting capture was a large specimen of *Prasinohaema flavipes,* a second species of prehensile-tailed, green-blooded skink. Far from being located in an arboreal position this skink was found on the ground in a cultivated garden in Matsialavava, the nearest trees being coffee bushes. The trail from Woitape to Avios also produced an attractive red specimen of the Montane Keelback, *Tropidonophis montana,* and it is quite likely that the Owen Stanley Mountains contain many more interesting and infrequently observed species.

I also made a trip out to Lion Island off the coast of Port Moresby to collect Sea Kraits, *Laticauda colubrina* and *L. latifasciata.* Unlike truly marine hydrophiid seasnakes the Sea Kraits are amphibious, moving onto land to lay their eggs. They have even been observed climbing the shale and boulder cliffs of Lion Island.

MADANG PROVINCE

I spent three months in Madang Province in 1990 based at the excellent Christensen Research Institute, the facilities of which rival anything available at the university. C.R.I. has a comfortable accommodation block, a fully equiped wet lab. with aquaria and cages, an air-conditioned dry lab., museum, library, dark room and computer room. Situated 14km north of Madang town in a beautiful and secluded locality known as Nagada Harbour next to the coastal village of Riwo. Adjoining C.R.I., and providing restaurant facilities for those scientists who are not self-catering, is the exclusive dive-resort of Jais Aben. Local labour, boats and vehicles are all available to researchers. Outside P.N.G., C.R.I. maintains strong links with Oxford University, the California Academy of Sciences, Stanford University and C.S.I.R.O. (Australia).

Much of the original forest along the coastal region of Madang Province has been cleared and the North Coast Road from Madang runs through a succession of coconut, coffee and cocoa plantations and occasional patches of virgin forest. Many of the plantations are abandoned and they are returning to a semi-wild state with dense vegetation clothing the ground and epiphytic plants cluttering the trunks of the palms. During the war Madang town was a Japanese stronghold and much of the area was the subject of heavy bombardment by the American navy and air force. Numerous water-filled bomb craters pock-mart the area, especially around Madang and Alexishafen 21km north along the coast. Further inland there are areas of substantial virgin forest but much of this has vanished in recent years due to extensive logging for the timber trade.

Initial searches around C.R.I. and Jais Aben revealed numerous skinks: *Carlia fusca, Emoia spp.* (including *Emoia longicauda* on the sea-spray covered rocks at the water's edge) and bright green Tree Skinks, *Dasia smaragdina,* on the coconut palms, and geckoes: House Geckoes, *Hemidactylus frenatus,* and Palm Geckoes, *Gekko vittatus.*

Snakes ranging from treesnakes *Dendrelaphis calligastra* and *D. punctulatus,* both very different in colouration from their southern Papuan relatives, to Green Tree Pythons, were also encountered fairly frequently within the compound but snakes were also found in the shallow water along the beach below the Institute. I captured a Little File Snake, *Acrochordus granulatus,* the smaller relative of the Western Province Arafura File Snake, and two Sea Kraits, *Laticauda colubrina,* the larger specimen of which, measuring almost 1.5m, readily took a Zebra Eel with patterning very similar to its own.

A programme of road widening resulting in the felling of many roadside trees and coconut palms provided myself and other zoologists with the opportunity to collect specimens which would otherwise have been unobtainable. Searches of the epiphytes on felled palms revealed large Palm Geckoes and small colubrids, *Stegonotus modestus* and *S. diehli.* The process of talking to locals and explaining ones interest in snakes provided a useful means of obtaining additional specimens and I was called out on a couple of occasions to capture large pythons which would otherwise have been killed out of hand. Other interesting specimens arrived including an Emerald Tree Monitor Lizard, *Varanus prasinus,* and Jacari's Snake Lizard, *Lialis jacari,* the P.N.G. endemic related to Burton's Snake Lizard from Papula and Australia.

The primary purpose of my three months in Madang Province was the collection of Death Adders and Small-Eyed or Ikaheka Snakes, *Micropechis ikaheka,* for the venom research project. Death Adders are reputedly common in the cultivated gardens which surround the villages and also in the grass growing beneath the coffee trees. Searches of both these habitats failed to reveal any specimens and it was not until the delayed dry season began and people started to work in their gardens that Death Adders were collected. The Small-Eyed Snake is reported to spend the daylight hours inside coconut husk piles. The plantation workers husk coconuts on a sharp spike driven into the ground and discard the old husks into piles which eventually become overgrown with creepers and home to a wide variety of animals. Since large piles can cover quite a considerable area help to search them is essential. Initially I would visit a plantation along the coast and, having obtained permission to dismantle the husk piles, hire a few workers to help in the search. The husk pile searches for *Micropechis* in the mainland plantations proved unproductive although a number of other species were collected, the commonest being the Pelagic Gecko, *Cyrtodactylus pelagicus.* The genus *Sphenomorphus* contains almost half of the 120 or so species of New Guinea skinks and the largest members of this genus, the 300mm+ Muller's Skink, *Sphenomorphus muelleri,* was occasionally captured inside the coconut husk piles as were smaller species such as *S. unilineatus.* However, snakes were not found to be common in the mainland husk piles, the sole specimen found during 30-40 such searches being a D'Albertis Python, *Bothrochilus albertisi,* in pre-slough condition. Many invertebrates were also found inside the husk piles: tarantula spiders, scorpions, vinegaroons and giant centipedes but the most common inhabitants were aggressive ants. Once an ant colony was located in a particular husk pile very little else of interest would be found. It is possible that these creatures deterred colonisation by snakes and other large animals.

The roads around Madang were also the cause of many snake road deaths. Whereas the Carpet Python was the commonest casualty around Port Moresby the D'Albertis Python was the most frequently encountered DOR near Madang with the Amnthystine and Olive Pythons also in evidence. I spent many hours road cruising at night, often with the assistance of the local constabulary who captured a Green Tree Python and delivered it to C.R.I. the following morning. Quite a few live snakes were collected. The Madang D'Albertis Pythons were not only much smaller than those from Western Province, usually less than 1.5m, but they were also much lighter in colouration, being copper-brown dorsally becoming lighter brown laterally and yellow ventrolaterally with an immaculate white ventral surface. This much lighter dorsal colouration contrasted much more vividly with the shiny black head than had the patterning of the Papuan specimens. The several Amethystine Pythons encountered were essentially similar in patterning to those in Western Province except that they lacked any dark patterning over lying the brown dorsal ground colour on the anterior third of the body. Other snakes collected on the roads included the Slatey-Grey colubrids, *Stegonotus parvus* and *S. modestus,* and a single specimen of Pacific Ground Boa, *Candoia aspera* which was found in the middle of the road during torrential rain. It is unusual to find DOR lizards but several specimens of Muller's Skink were collected and the only two Small-Eyed Snakes seen on the mainland were also road casualties.

Having heard that a Small-Eyed Snake had been killed on the volcanic island of Karkar off the Madang coast arrangements were made for a visit to search for these otherwise elusive snakes. Karkar Island, which measures 25km by 20km, is an active volcanic island which has erupted twice, in 1974 and 1979, the last time killing two vulcanologists. Much of the lower slopes of the island are covered in coconut, coffee and cocoa plantations and I based myself at Kaviak Plantation on the northwest coast where, thanks to the generosity of the owners and managers of the plantation, I was able to work with teams of workers to uncover some of the thousands of husk piles. Small-Eyed Snakes are reputedly very common on the island, several hundred having been reported killed during an anti-crop pest/anti-fire programme of husk pile removal some years earlier.

The most immediately noticeable item about the coconut husk piles on Kakar was the lack of ants. Secondly, the herpetofauna seemed to be much richer than in the mainland husk piles. Several species of emoid skinks could be seen on the tops of the piles, the most attractive being the Blue-Tailed *Emoia caeruleocauda.* Inside the piles species recorded include Muller's Skink, Blue Tongued, *Tiliqua gigas,* and the large brown *Eugogylus rufescens,* a skink which

preys upon other skinks. The juvenile of this skink is barred black and white in contrast to the more sombre adult brown livery. A juvenile Mangrove Monitor Lizard, *V. indicus* was also found within one husk pile but the most interesting lizards collected were the Crocodile or Spiny Skinks, *Tribolonotus gracilis.*

On the mainland these lizards were found to be fairly rare, only occurring in riverine forest and often in pairs. Here, on Karkar, up to a dozen could be found in a single husk pile. *T.gracilis* does not really resemble a skink since its horny, crested head, rough dorsal scales and four rows of raised spines present a much more agamid appearance. The most rugose of a genus of eight species distributed from mainland New Guinea to Manus Province, New Britain and Bougainville and North Solomons, these skinks are even more unusual than even their external spiny morphology and startling orange eye 'make-up' might suggest. They possess an unusual abdominal gland and also glands on their feet which may be connected with territorial olfactory marking (Greer & Parker, 1968) and although the females have two functional ovaries they only have a functional right oviduct so it is necessary for the left ovary to migrate across the body cavity prior to ovulation. When handled or disturbed these lizards also emit a surprised 'squeak' which carries for a considerable distance, an unusual trait for a non-gekkonid lizard.

Snakes were also captured much more frequently in the island husk piles: Catsnakes, Slatey-Grey Snakes and the most numerous species, the Pacific Ground Boa, *Candoia aspera.* These stout, rugose scaled, short-tailed boas were found in almost every pile searched and their lack of aggression or desire to escape has earned them the name of Sleepy Snakes. Only a single specimen, a large and gravid female, showed any aggression, defending herself with a display of loud hissing and open-mouthed strikes. The Small-Eyed Snake was located in the husk piles on Karkar and fifteen specimens ranging from juveniles to adults almost 1.5m in length were captured although specimens up to 2.5m are reputed to occur on the island. These are quite impressive snakes, especially when newly captured since they strike rapidly to either side if not restrained quickly. Even touching a specimen will invoke a convulsion and a rapid sideways strike so it is easy to imagine how people are bitten when they accidentally step on a snake in the dark. The head of the Small-Eyed Snake is dark grey and the eye is extremely small. The anterior section of the body may be white, cream, yellow or light brown, occasionally spotted with darker pigment, but by the second third of the body a few darker cross bands are appearing. These bands increase in depth of colour, width and frequency posteriorly until by the tail the over-riding colouration of the body is that of the dark banding. The Small-Eyed or Ikaheka Snake resembles the Asiatic Kraits and certainly its secretive, nocturnal and unpredictable habits do mirror those of *Bungarus.* Venom collected Karkar specimens produced some extremely high dry weight yields with specimens between 1-1.5m producing 200-240mg on their second milking. However, the toxicity or LD_{50} has yet to be determined for this species.

In the coffee and cocoa trees which grow in the plantations it was possible to find Brown Catsnakes and Pacific Tree Boas, *Candoia carinata.* The *C.carinata* throughout Madang Province are of the slender-bodied, arboreal long-tailed form which occurs in sympatry with the terrestrial, stout-bodied *C.aspera.* There is also a terrestrial, stout-bodied, short-tailed form of *C.carinata* which bares little resemblance to the arboreal form but this species only inhabits areas where *C.aspera* is absent, notably Halmahera in Indonesia to the far west and the North Solomons to the east, since they are unable to occur sympatrically (McDowell, 1979).

MOROBE PROVINCE

I had planned to spend more time in Morobe and Eastern Highlands Provinces searching for the dwarf Death Adders of Henganofi and the giant 1m specimens reported to occur along the Markham River valley but in the event only a short visit to the Wau Ecology Institute in the mountains of Morobe Province was possible. A number of snakes were recorded as DOR enroute: *Boiga irregularis, Bothrochilus albertisi, B. papuanus.* One large 5m *B.papuanus* had been noosed and dragged onto a busy road to be run over by the traffic. This is not an unusual occurrence and I found DOR Carpet Pythons in Port Moresby with string around their necks. Other specimens are simply killed and laid across the road. A Green Tree Python and a Catsnake were found lying next to each other on a road in Madang Province. There is a disturbing trend towards the unnecessary slaughter of harmless, even beneficial, snakes

in tropical countries which needs to be redressed by an education progamme pointing out the benefit to human populations of large, non-venomous, rodent-eating snakes.

ISLAND PROVINCES

Apart from visits to off-shore islands, Daru, Lion Is., Karkar and one or two or three small islands off the Madang coast, I had not had the opportunity to investigate the archipelagos to the north and east. The larger of these islands are home to several very interesting reptiles, notably the Bismarck Ringed Python, *Bothrochilus boa,* on New Ireland, the Monkey-Tailed Skink, *Corucia zebrata,* on Bougainville, the elusive elapids *Parapistocalamus hedigeri* and *Salomonelaps par* also in the North Solomons Province and the various other species of *Tribolonotus sp.* scattered throughout the archipelagos. Perhaps that opportunity may yet arise.

SUMMARISED TABLE OF SPECIES RECORDED

Papua New Guinea possesses an impressive herpetological checklist comprising in excess of 275 reptiles (2 crocodiles; 13 freshwater and marine turtles; 170+ lizards and 90+ marine and land snakes) plus over 80 species of frogs. New species are being discovered and named with considerable regularity whilst other species are being synonymised. The taxonomy of many groups are in a state of flux due to a general paucity of specimens and the lack of collections from many remote regions has created an extremely patchy picture of their georgraphical distribution. It would, therefore, be wholly impractical for me to attempt here to compile a complete distributional checklist so I have confined this table to species which I or my assistants collected or recorded during the periods April 16th–July 31st 1986 and March 10th–August 17th 1990. The absence of a record for a particular species from a province does not necessarily indicate that it is absent from that province, merely that I did not personally record its presence. Species which were only encountered in captivity are not included in this table eg. *Crocodylus porosus, C. novaeguineae* and *Python boeleni.* Figures alongside snake records indicate number of specimens including DOR examples. Although amphibians were not being studied during the 1990 trip those species recorded have been included. 20 species of frogs and 97 species of reptiles are recorded.

SWP Southern Trans-Fly Western Province (Bensbach to Fly R. and Daru)
CCP Coastal Central Province (Port Moresby, NCD to Rigo)
MCP Montane Central Province (Tapini and Woitape)
CMP Coastal Madang Province (Wasabamal to Usino and Ramu R.)
KMP Karkar Island, Madang Province (Kaviak Plantations)
MMP Montane Morobe Province (Lae and Markham R. to Wau)

	SWP	CCP	MCP	CMP	KMP	MMP
RANIDAE						
Platymantis papuenis				X	X	
Rana arfaki	X					
Rana daemeli	X	X				
Rana sp.				X		
BUFONIDAE						
Bufo marinus	X (Daru only)	X		X		X
LEPTODACTYLIDAE						
Limnodynastes convexiusculus	X					
MICROHYLIDAE						
Asterophrys turpicula	X					
Sphenophryne gracilipes	X					
Sphenophryne sp.	X					
Oreophryne sp.						X
HYLIDAE						
Litoria bicolor	X			X		
Litoria caerulea	X					

	SWP	CCP	MCP	CMP	KMP	MMP
Litoria congenita / rubella	X					
Litoria dorsalis	X					
Litoria gracilenta	X					
Litoria infrafrenata	X	X		X		
Litoria nasuta	X					
Litoria nigrofrenata	X	X				
Litoria sp.A						
Litoria sp.B						
CHELONIIDAE						
Chelonia mydas	X					
CHELIDAE						
Carettochelys insculpta	X					
Emydura subglobosa	X					
GEKKONIDAE						
Cyrtodactylus pelagicus	X			X	X	
Gehyra mutilata	X					
Gehyra oceanica	X					
Gehyra sp.	X					
Gekko vittatus				X		
Hemidactylus frenatus	X	X		X	X	
Lepidodactylus lugubris	X	X				
PYGOPODIDAE						
Lialis burtonis	X					
Lialis jacari	X			X		
SCINCIDAE						
Carlia bicarinata	X	X				
Carlia fusca	X	X		X	X	
Carlia novaeguineae	X					
Cryptoblepharus pallidus	X	X				
Ctenotus spaldingi	X					
Dasia smaragdina			X			
Egernia frerei	X					
Emoia atrocostata	X			X		
Emoia caeruleocauda				X	X	
Emoia kordoana	X					
Emoia jakati				X	X	
Emoia longicauda	X					
Emoia obscura			X		X	
Emoia pallidiceps			X			
Emoia submetallica			X			
Emoia sp.90D*				X		
Emoia sp.90E				X		
Emoia sp.90F					X	
Emoia sp.90G				X		
Emoia sp.90H				X		
Emoia sp.90X						X
Eugongylus rufescens	X			X	X	
Lobulia elegans			X			
Lobulia stanleyanum			X			
Prasinohaema semoni	X					
Prasinohaema flavipes			X			
Sphenomorphus crassicaudus	X					

* Specimens from six species of *Emoia* and six species of *Sphenomorphus* are currently unidentified. These species are recorded in the table as sp.A, sp.B etc. prefixed with their year of collection.

	SWP	CCP	MCP	CMP	KMP	MMP
Sphenomorphus jobiensis	X		X	X	X	
Sphenomorphus melanopogon	X					
Sphenomorphus muelleri				X		
Sphenomorphus nigricaudis	X					
Sphenormorphus undulatus	X					
Sphenormorphus sp.86A			X			
Sphenormorphus sp.86B			X			
Sphenormorphus sp.90A unilineatus				X		
Sphenormorphus sp.90B				X		
Sphenormorphus sp.90C					X	
Sphenormorphus sp.90D				X		
Tiliqua gigas	X	X		X	X	
Tribolonotus gracilis				X	X	
AGAMIDAE						
Chlamydosaurus kingii	X					
Diporiphora bilineata	X					
Gonocephalus dilophus	X					
Gonocephalus papuensis	X					
Lophognathus temporalis	X	X				
VARANIDAE						
Varanus gouldii	X					
Varanus indicus	X				X	
Varanus prasinus				X		
Varanus salvadori	X					
TYPHLOPIDAE						
Typhlina bramina		X[3]				
Typhlina polygrammica	X[3]					
BOIDAE						
Bothrochilus albertisi	X[2]			X[14]		X[3]
Bothrochilus papuanus	X[1]	X[7]		X[2]		X[1]
Candoia aspera				X[7]	X[18]	
Candoia carinata				X[6]	X[2]	
Chondropython viridis	X[4]	X[1]		X[7]		
Morelia amethistina	X[3]	X[5]		X[4]		X[1]
Morelia spilota	X[1]	X[44]				
ACROCHORDIDAE						
Acrochordus arafurae	X[2]					
Acrochordus granulatus	X[1]			X[1]		
COLUBRIDAE						
Boiga irregularis	X[9]	X[13]	X[1]	X[4]	X[6]	X[3]
Dendrelaphis calligastra	X[17]			X[2]		
Dendrelaphis papuensis		X[2]				
Dendrelaphis punctulatus	X[12]	X[1]		X[2]		
Enhydris polylepis	X[4]					
Fordonia leucobalia	X[7]					
Myron richardsoni	X[1]					
Stegonotus cucullatus	X[2]	X[2]	X[4]			
Stegonotus diehli				X[1]		
Stegonotus modestus				X[4]		
Stegonotus parvus				X[6]	X[2]	X[1]
Tropidonophis doriae	X[2]	X[1]				
Tropidonophis mairii	X[15]	X[4]				
Tropidonophis montana			X[1]			

	SWP	CCP	MCP	CMP	KMP	MMP
Tropidonophis picturata	X[1]					
ELAPIDAE						
Acanthophis spp.	X[1]	X[1]	X[1]	X[6]		
Demansia atra	X[3]	X[10]				
Glyphodon tristis	X[3]					
Micropechis ikaheka				X[2]	X[15]	
Oxyuranus scutellatus	X[1]	X[9]				
Pseudechis papuanus	X[1]					
Unechis nigristriata	X[1]					
LATICAUDIDAE						
Laticauda colubrina		X[1]		X[2]		
HYDROPHIIDAE						
Hydrophis spp.	X[1]					

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ERRATUM TO BULLETIN No. 37 (AUTUMN 1991)

Erratum to Bulletin No. 37 (Autumn 1991)
The Reptiles of Papua New Guinea, by Mark O'Shea, p.27: the dried weight venom yield from 1-1.5m specimens of *Micropechis ikaheka* was found to be 100-120 mg rather than the 200-240 mg quoted.