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INTRODUCED SPECIES

First Record of the Island Wolfsnake, *Lycodon capucinus* (H. Boie in F. Boie 1827), from New Guinea, with Comments on Its Widespread Distribution and Confused Taxonomy, and a New Record for the Common Sun Skink, *Eutropis multifasciata* (Kuhl 1820)

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Photographs by Kukuh Indra Kusuma except where stated otherwise.

Abstract.—We report the first records of the Island Wolfsnake, *Lycodon capucinus* (H. Boie in F. Boie 1827) at Timika, Mimika Regency, Papua Province, Indonesian New Guinea. These are of considerable interest since they provide further proof for the ability of this species to disperse via human transport, and the expansion into New Guinea represents a significant milestone, a distance of 675 km (by air) from the closest known population on Seram Island in the Moluccan Archipelago. Of even broader interest is the fact that one of the specimens contained a prey item, a Common Sun Skink, *Eutropis multifasciata* (Kuhl 1820), in itself a significant territorial expansion for that species. We preface our reports with a comprehensive review of the available information on the Island Wolfsnake's taxonomy and distribution. We also discuss the expansion of *E. multifasciata* across Wallacea and into New Guinea.

Lycodon (H. Boie in Fitzinger 1826) is a speciose colubrid genus comprising 50 species (Uetz et al. 2017) following the synonymy of *Dinodon* with *Lycodon* (Guo et al. 2013; Siler et al. 2013). It is distributed widely and commonly encountered throughout southern and southeastern Asia. Colloquially known in English as "wolfsnakes," a number of species appear to be excellent Batesian mimics of the highly venomous kraits, genus *Bungarus* (e.g., Abercromby 1910; Pough 1987; Balakrishnan 2010), with at least one krait-mimic species, *L. subcinctus* (Reinwardt in F. Boie 1827), even mirroring the krait's possession of a single scale between the eye and the nasal scale[1] (Daltry and Wüster 2002; Das 2010; pers. obs.). Hunting house geckos of the genus *Hemidactylus* at night, the more perianthropic members of the genus *Lycodon*, including *L. capucinus* and *L. aulicus* (Linnaeus 1758), are frequently encountered inside buildings or among the goods and chattels of humans, a lifestyle that renders them ideally suited to be transported with trade goods, foodstuffs, or building materials across oceans to islands and other land masses outside their natural ranges. The most successful species in this regard is *L. capucinus* (Fig. 1), which consequently often is called the Island Wolfsnake (Das 2010; Harikrishnan et al. 2012) and sometimes even the House Wolfsnake (Ng et al. 2011).

[1] Daltry and Wüster (2002) distinguished between their new species, *L. cardamomensis,* and *L. subcinctus,* indicating that the former exhibited both loreal and preocular scales between the eye and the nasal scale, whereas the latter possessed only a loreal scale, which, in the absence of a preocular scale, contacts the eye. A distinguishing characteristic of elapid snakes is the lack of a loreal scale (McCarthy 1985), although there are occasional exceptions (Abtin et al. 2014), but elapids do possess preocular scales. Regardless of whether the single scale anterior to and in contact with the eye, and posterior to the nasal scale, in *L. subcinctus*, is a loreal or a preocular scale, its position and singularity do serve to support the concept of *L. subcinctus* as a mimic of *Bungarus candidus* (Linnaeus 1758).

Fig. 1. An Island Wolfsnake (*Lycodon capucinus*) from Timor-Leste, where the species has been naturalized since the 1960s. These snakes often function as human commensals, which renders them vulnerable to human-mediated transport across oceans to islands and other land masses outside their natural ranges. Consequently, *L. capucinus* often is called the Island Wolfsnake. Photograph by M. O'Shea.

In this paper, we present the first records of *L. capucinus* for New Guinea. During the process of assembling the data on the distribution and identification of this species, we had to review the taxonomic history of *L. capucinus* and *L. aulicus*, given that these species frequently have been confused. We produced some of the same information for *Eutropis multifasciata* to ensure that the new record we present is accompanied by a thorough exposé.

The Confusing Taxonomic History of *Lycodon capucinus*

***Erpétologie de Java* and the original description**.—The description of *Lycodon capucinus* attributed to Heinrich Boie was actually published by his elder brother Friedrich (F. Boie 1827) during the year of Heinrich's death in the Dutch East Indies. Friedrich Boie cited as his original source his brother's manuscript *Erpétologie de Java* (prepared between 1823 and 1825), a copy of which exists in the library of the Naturalis Biodiversity Center, Leiden, The Netherlands. However, the manuscript was never actually published, and species names presented therein are unavailable for the purposes of nomenclature according to the *International Code of Zoological Nomenclature* (ICZN 1999, 2012). Therefore, the first acceptable description presenting the name *L. capucinus* appeared in F. Boie (1827), giving the type locality as Java.

Friedrich Boie listed eight species in the genus *Lycodon,* including (presented in Boie's order and with correct author attributions) *L. aulicus* (Linnaeus, 1758); *L. hebe* (Daudin 1803), now a synonym of *L. capucinus*; *L. capucinus* H. Boie in F. Boie 1827; *L. subcinctus* Reinwardt in F. Boie 1827[2]; *L. unicolor* (H. Boie in F. Boie 1827[3]), now a synonym of *L. aulicus*; *L. malignus* (attributed to Merrem 1820, although modern authors cite Daudin 1803), now a synonym of *L. striatus* (Shaw 1802); *L. galathea* (Daudin 1803), now also a synonym of *L. striatus*; and *L. fuliginosus* H. Boie in F. Boie

[2] As he did with all other author attributions, Boie (1827) linked the species name to Caspar Georg Carl Reinwardt (1773–1854) without providing a year, although modern authors usually list the year of Boie's paper as the year of description.

[3] Perhaps curious is the fact that the attribution of *L. capucinus* as a species described by H. Boie is generally reflected in the literature, as "H. Boie in F. Boie 1827." At the same time, the name *L. unicolor*, which was also attributed to Heinrich by his brother, is generally cited incorrectly as F. Boie 1827.

1827, now a species in the genus *Boaedon* and the only one of the eight for which F. Boie listed characteristics. Friedrich Boie attributed three of these species to H. Boie's unpublished *Erpétologie de Java*, even though *L. fuliginosus* is an unrelated African species. This further demonstrates the sometimes chaotic mixing of specimens in H. Boie's Javan collections, in which not only African but also South American specimens were included (O'Shea and Kaiser 2016).

Confusion with *Lycodon aulicus*.—The type species of the genus *Lycodon* is *L. aulicus* (Linnaeus 1758), from which *L. capucinus* is physically almost indistinguishable. Both taxa possess the same head and body scalation and both exhibit highly variable patterning, although paradoxically the patterning is generally used to separate the two taxa. Both species are light to dark brown dorsally and both possess a relatively broad white or yellow band across the neck, a character that may be reduced to a pair of large occipital blotches on either side of the midline and which may extend forwards onto the cream-colored supralabials. In *L. aulicus*, the dorsal body markings then continue as a narrow, white, chain-like pattern with vertebral crossbars 1–2 scales wide, linked at least on the anterior flanks by a faint line or a series of punctuated pale dashes. In *L. capucinus*, this chain-like pattern may be present, but it appears to be less defined, and patterning is often reduced to a mass of white flecks created by light edging to most of the lateral and dorsal scales (Taylor and Elbel 1958; Taylor 1965; Manthey and Grossmann 1997; Das 2010; de Lang 2011; Cox et al. 2012). These two pattern arrangements are extremely similar, and identifying specimens to species within or close to their distributional overlap zone or without knowing their geographical origin would be difficult. This difficulty in unequivocally determining the identity of a specimen outside its natural range makes identifying waifs or introduced specimens all the more difficult. The situation is further complicated by the presence of unicolored, patternless individuals within both species.

Günther (1858) and Boulenger (1893) referred to specimens of *L. capucinus* as "*L. aulicus* Var. D.," and both authors included some southern Asian specimens in this category to confuse this assessment. Boettger (1898) referred to Philippine specimens as "var. *capucina* Boie," also under the name *L. aulicus*.

Subspecies or full species?—By the early to mid-20th Century experts tended to give *L. capucinus* subspecific status, as *L. aulicus capucinus* (e.g., Barbour 1912; Brongersma 1933; Smith 1943; de Haas 1950), although some authors still resisted the trend, treating *L. capucinus* as a synonym of either *L. aulicus* (Boulenger 1890, 1912) or its synonym *Ophites aulicus* (Griffin 1909; Taylor 1922). Yet three decades later, Taylor and Elbel (1958) wrote of *L. capucinus*, "We do not regard this as a subspecies of *Lycodon aulicus* (Linnaeus) since each of these forms occupies a large part of the range of the other," although they incorrectly cited the type locality of *L. capucinus* as Thiruvananthapuram (now Trivandrum), India, in the belief that *L. capucinus* was present on the Indian Subcontinent.

Whereas some authors extended the range of *L. capucinus* into southern Asia, others extended the range of *L. aulicus* into southeastern Asia. Pope (1935) considered all mainland southern and southeastern Asian populations, including those from the Philippines and the Malay Archipelago, to represent *L. a. aulicus*, and he followed Mertens (1930) in attributing only the Javan and the Lesser Sunda Island populations to *L. a. capucinus*.

In the mid- to late 20th Century, authors began to treat *L. capucinus* as a species separate from *L. aulicus*. Although this trend has continued to this day, it has not been without its critics, especially those who do not recognize the validity of *L. capucinus* at the specific or even subspecific level. For example, Lanza (1999) wrote, "Until more convincing evidence becomes available, they are treated here as a single monotypic species (*L. aulicus*), as the two taxa seem to differ only in coloration, which, furthermore, greatly varies within each of them." He then nevertheless went on to produce individual species accounts for both *L. aulicus* and *L. capucinus*.

Little agreement on the true status of this taxon exists even during the late 20th and early 21st Centuries, with authors of cited papers on introduced populations variously referring to these snakes as *L. capucinus* (Cogger 1992; Buden and Taboroši 2016), *L. aulicus capucinus* (Fritts 1993), or *L. aulicus* (Buden 2000; Lever 2003; Kraus 2009). Nevertheless, molecular data have confirmed that only a single taxon ranges from Myanmar throughout southeastern Asia and into the Philippines (Siler et al. 2013), although no specimens from the Indonesian Archipelago were included in that analysis. That population should be identified by the name *L. capucinus*.

The Wide and Expanding Geographic Distribution of *Lycodon capucinus* (Fig. 2)

Relying on the conclusion that two taxa are involved, whether recognized at the subspecific or specific level, several questions emerge. Given that these forms are very similar in morphology and presumably occupy identical ecological niches, where in the extensive combined range of these snakes does only one of them occur, and where, if at all, do both occur in sympatry and perhaps in competition with each other? Alternatively, if the species are fully formed at the extreme ends of their respective distributions, does perhaps a contact zone exist in the center of the distribution where allopatrically formed species could have a clinal distribution, as one taxon gradually becomes the other – a potential *Rassenkreis*?

Southern Asia.—While the question of species boundaries and contact zones for *L. aulicus* and *L. capucinus* is perhaps

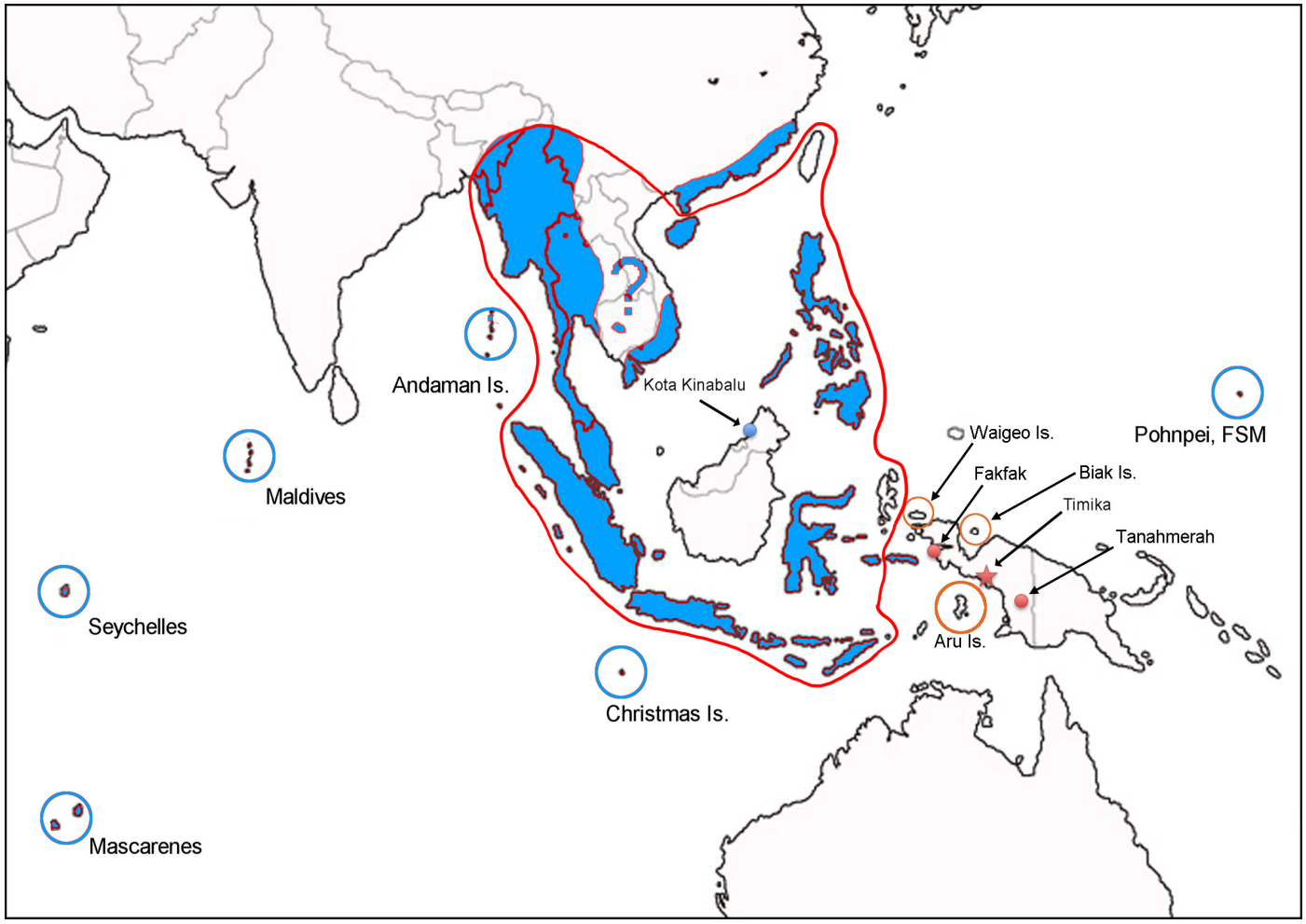

Fig. 2. The natural and naturalized range of *Lycodon capucinus* (blue) and *Eutropis multifasciata* (red), including naturalized island populations in the Indian and Pacific Oceans. Blue spots and blue-ringed islands indicate isolated populations of *L. capucinus*; red spots and red-ringed islands indicate isolated populations of *E. multifasciata*. The red star in southwestern New Guinea indicates the new locality at Timika, Papua, Indonesia. The precise boundaries of both species in the northwest (Assam, India, and northwestern Myanmar) cannot be confirmed with absolute accuracy.

ideally suited to be addressed by molecular data, beginning the process of differentiating ranges by carefully looking at the known distribution and determining where a meeting point could exist is nevertheless possible. Based on the best possible morphological data, the overlap zone would seem to lie in Myanmar. The current taxonomic status quo essentially confines *L. aulicus* to southern Asia (Smith 1943; Wallach et al. 2014), with records including Pakistan (Khan 2002), India, including Sikkim and Assam in the northwest (Whitaker and Captain 2004), Nepal (Schleich and Kästle 2002), Sri Lanka (Wall 1921), and Bangladesh (Khan 1982), with the taxon entering southeastern Asia only in Myanmar (Zug et al. 1998).

Mainland Southeastern Asia.—*Lycodon capucinus* is believed to exhibit a primarily southeastern Asian distribution (Fig. 2), so for the purposes of the present discussion we considered records from southeastern Asia to be *L. capucinus* and those from southern Asia to be *L. aulicus*, with only those from Myanmar and China needing further comment. While still treating the two taxa as subspecies of a single species, Smith (1943) defined distinct distributions for the two forms within Myanmar (then known as Burma), stating that *L. a. aulicus* occurred north of latitude 17°N, whereas *L. a. capucinus* could be found south of latitude 24°N. This allowed for an overlap of 7° latitude and, indeed, Wallach et al. (2014) listed both taxa as occurring in the Yangon (formerly Rangoon) region of southern Myanmar, from where *L. aulicus* occurs northward to Shan and *L. capucinus* ranges southward to Tanintharyi in the Burmese panhandle, the northwesternmost part of the Malay Peninsula. This large apparent area of overlap could have been what Taylor and Elbel (1958) referred to in their statement, but given the high degree of interspecific resemblance, and without the modern techniques available for the molecular comparison of morphologically similar taxa, assigning individuals from this apparent area of overlap to either taxon with any degree of confidence would seem impossible.

Lycodon capucinus is present in other mainland southeastern Asian countries but possibly not as widely or evenly distributed as regional guides, that simply list countries, might

imply. It is widely distributed and commonly encountered throughout Thailand, including Phuket Island (Taylor and Elbel 1958; Taylor 1965; Cox 1991; Lanza 1999; Cox et al. 2012), but its distribution appears to be more intermittent farther to the east (Fig. 2). In Vietnam, it is reported only from the south, with Da Nang the northernmost locality (Campden-Main 1970; Nguyen et al. 2009), whereas in Cambodia it is only known from a single specimen collected at Trapeang Chan on the shores of Tonlé Sap (Saint Girons 1972). Deuve (1970) listed *L. capucinus* (as *L. aulicus*) in his *Serpents du Laos*, but he wrote: "Il ne semble pas que ce serpent ait été jusqu' à présent rencontré avec certitude au Laos. L'auteur l'a jamais rencontré" [It does not appear that this snake has been encountered with certainty in Laos until now. The author has never seen it]. Teynié and David (2010) did include *L. capucinus* in their checklist of Laotian reptiles, but without further comment. Conversely, Tweedie (1957) reported that *L. a. capucinus* was very commonly encountered in Peninsular Malaysia (Flower 1896, 1899), whereas Boulenger (1912) reported the presence of *L. capucinus* (as *L. aulicus*) from the Malay Peninsula and the surrounding islands, as well as on "Penang, Singapore and Kui" (the latter a locality with which we are unfamiliar). It is a common species in Singapore (Lim and Lim 1992; Ng et al. 2011).

Southern China.—Given the apparent absence of records from northern Vietnam, the fact that *L. capucinus* is reported from China is somewhat curious. Several authors listed *L. a. capucinus* from Hong Kong (Romer 1979; Karsen et al. 1986). Pope (1935) also reported *L. a. aulicus* from Hong Kong and mentioned a specimen from western Yunnan Province, which borders the northern Burmese region of Shan where *L. aulicus* is known to occur — but he remarked that the species was very rare in western Yunnan. Zhao and Adler (1993) listed *L. aulicus* (as *Ophites aulicus*) and added the southern Chinese provinces of Fujian and Guangdong. Wallach et al. (2014) listed these four localities and added Hunan Province, which is located to the north of Guangdong, and Gansu Province. This last province is very far to the north on the border with Mongolia. That record is likely a clerical error, a misidentification, or the result of a specimen being accidentally transported from one of the southern Chinese provinces. The issue of individuals of southern Chinese snakes being recorded from more northerly provinces was discussed by Barker and Barker (2010). The sparse Yunnan population is likely an extension of the northern Myanmar population of *L. aulicus*, whereas the populations in Fujian, Guangdong, and Hunan are more closely allied to whichever taxon inhabits Hong Kong.

Andaman and Nicobar Islands.—In the archipelagos of southeastern Asia, *L. capucinus* has been reported from the Andaman but not the Nicobar Islands. Reports were mainly from population centers on South Andaman Island (Biswas and Sanyal 1980; Das 1999; Harikrishnan et al. 2010), which would suggest a human-mediated introduction. Whitaker and Captain (2004) illustrated a juvenile specimen from Middle Andaman Island but its pattern differed from that of typical *L. capucinus*. Another similarly patterned Andaman specimen was illustrated by Buden and Taboroši (2016: Fig. 244). This morphologically distinct Andaman population is now considered to represent a different species, the Andaman endemic *L. hypirhinoides* (Theobald 1868), which was recently resurrected from the synonymy of *L. capucinus* (Vogel and Harikrishnan 2013). That species differs from *L. capucinus* in size, body proportions, and patterning. It is known to occur on North Andaman Island, Middle Andaman Island, South Andaman Island, Little Andaman Island, and the Havelock Islands in the Ritchie's Archipelago (Vogel and Harikrishnan 2013; Rangasamy et al. 2014). Vogel and Harikrishnan (2013) also listed *L. tiwari* Biswas and Sanyal 1965, from Middle Andaman Island, noting that this type locality could be in error, and Car Nicobar, and *L. subcinctus* from Great Nicobar, but they offered no evidence that *L. capucinus* is present in the archipelago.

Sumatra, Java, Bali, and the Lesser Sunda Archipelago (Indonesia and Timor-Leste).—In Indonesia *L. capucinus* (under that name or as *L. a. capucinus*) has been reported from Sumatra (David and Vogel 1996), Java (van Hoesel 1959; Rusli 2016), and Bali (McKay 2006). It is distributed widely throughout the Lesser Sunda Islands, in both the Inner Banda Arc, including on Lombok, Sumbawa, Moyo, Komodo, Padar, Rinca, Flores, Ende, Adonara, Lomblen, Pantar, and Alor, in a west-to-east listing of islands, and the Outer Banda Arc, including Sumba, Sawu, Roti, Semau, Timor, and Wetar (Mertens 1930; Leviton 1965; Auffenberg 1980; Fritts 1993; Kraus 2009; de Lang 2011). *Lycodon capucinus* also is widely distributed and frequently encountered in Timor-Leste, where it has been recorded in seven of the country's 13 districts (Kaiser et al. 2011; O'Shea et al. 2012, 2015), and also from Ataúro Island, politically part of the main island's Dili District but geographically situated in the Inner Banda Arc (Kaiser et al. 2013).

Sulawesi and the Moluccas (Indonesia).—Farther north in Indonesia, *L. capucinus* is known to occur on Sulawesi, Buton, Tanahjampea, and Selayer (Barbour 1912; Leviton 1965; in den Bosch 1985; Fritts 1993; de Lang and Vogel 2005; Kraus 2009; Koch 2012), and farther east on the Moluccan islands of Kisar, Babar, Serua, Banda, Buru, Ambon, and Seram (de Lang 2013).

Borneo (Indonesia and Malaysia).—The major reptilian checklists covering the Indo-Australian Archipelago (Barbour 1912; de Rooij 1917; de Haas 1950; Iskandar and Colijn 2002) all omitted the island of Borneo (comprising Kalimantan, Indonesia; Sarawak and Sabah, Malaysia; and Brunei) as a locality for *L. capucinus* (or *L. aulicus*), and Haile

(1958) omitted both *L. aulicus* and *L. capucinus* from his checklist of the snakes of Borneo. The first confirmed record of a Bornean specimen of *L. capucinus* was presented by Stuebing and Inger (1999) following the discovery of a dead specimen in the senior author's backyard at Kota Kinabalu, Sabah.

The Philippines.—In terms of geographic proximity, the Bornean specimen mentioned above might have arrived from one of the nearby Philippine Islands because *L. capucinus* had been documented from Palawan Island, as *Ophites aulicus* (Griffin 1909). The species also is known from Luzon, Mindoro, Romblon, Cuyo, Panay, Masbate, Samar, Negros, Bantayan, Cebu, Leyte, and Mindanao in a north-to-south and west-to-east listing (Taylor 1922; Leviton 1965; Alcala 1986; Gaulke and Altenbach 1994; Gaulke 2011; Wallach et al. 2014).

Leviton (1965) considered a number of hypotheses regarding the presence of *L. capucinus* in the Philippines, Sumatra, and Java, including its apparent absence from Borneo. He argued that if this species had been present on Sumatra and Java during the Pleistocene, before the rise of sea levels, then it should have spread onto Borneo and be present there today; he considered it unlikely to have gone extinct in the interim. He also argued that the most likely scenario was of *L. capucinus* extending its range relatively recently (i.e., late Pleistocene) to Sumatra, Java, and the Lesser Sundas and Moluccas. He further suggested that the absence of *L. capucinus* from Borneo (given that one specimen from a backyard on a reasonably well-sampled island cannot be considered a population without corroborating evidence) ruled out a trans-Bornean route for invasion of the Philippines, and at no time were sea levels low enough in the South China Sea, nor land bridges present, to allow invasion from the Asian mainland. Island-hopping from Taiwan also is not an option, as this species does not occur there. In addition, oceanic currents flow the wrong way, preventing rafting as the vehicle for its arrival. Leviton (1965) therefore concluded that the most likely means for the arrival of *L. capucinus* in the Philippines (and also probably the Indo-Malay Archipelago) was by human-mediated transport.

The Indian Ocean.—The presence of an introduced wolfsnake in the Maldives is well known and long established (Philips 1958; Moutou 1985). This is the only terrestrial snake present in the archipelago apart from the Brahminy Blindsnake (*Indotyphlops braminus*), but whether it is *L. capucinus* or *L. aulicus* from relatively nearby Sri Lanka or India has not yet been determined and may have to await molecular analysis.

Farther to the south, *L. capucinus* also is well documented from the Mascarene Islands (Boulenger 1893; Flower 1899; Boulenger 1915; Henkel and Schmidt 2000; Kraus 2009). *Lycodon capucinus* colonized Mauritius during the 1870s (Daruty de Grandpré 1883; Koenig 1932; Blanc 1972; Cheke 1987; Jones 1993; Henkel and Schmidt 2000; Austin et al. 2009), but might have become established on Réunion even earlier, possibly during the 1840s (Maillard 1862; Mertens 1934; Blanc 1972; Bour and Moutou 1982; Cheke 1987; Austin et al. 2009). Now widely distributed and commonly encountered on both islands (Vinson and Vinson 1969; Bour and Moutou 1982), it also has been reported from tiny Île aux Aigrettes (Rodda et al. 1992), where attempts at its eradication have been unsuccessful. In the Mascarenes, this saurophagous serpent, along with other introduced predators, has been instrumental in the decline and extinction of island populations of the endemic Bojer's Skink, *Gongylomorphus bojerii*. Henkel and Schmidt (2000) also report the presence of *L. capucinus* in the Seychelles, but without supporting citations or specimen data.

Christmas Island is a 135-km^2 Australian External Territory located 350 km south of Java and 1,550 km northwest of Western Australia. Between 1899 and 1988, it was mined for phosphate from the seabird guano deposits, but today is used as a refugee detention and immigration center and maintained as a wildlife reserve. It was home to a number of endemic species of mammals, birds, reptiles, crabs, and butterflies, some of which have already gone extinct. *Lycodon capucinus* is thought to have arrived on Christmas Island in 1987 (Smith 1988; Fritts 1993; Lever 2003; Kraus 2009), as it was not included in relevant publications from the early 1980s (Cogger et al. 1983; Burbridge and Jenkins 1984). It has been listed as part of the Australian herpetofauna since the fifth edition of Harold Cogger's compendium *Reptiles and Amphibians of Australia* (Cogger 1992) and has become sufficiently established on Christmas Island to pose a serious threat to the endemic herpetofauna (Cogger 2006; Smith et al. 2012). *Lycodon capucinus* is especially common in the island's bridgehead area, around the wharf and the main settlement at Flying Fish Cove (Lever 2003), where it preyed primarily on introduced geckos (*Gehyra mutilata* and *Hemidactylus frenatus*). In his seventh edition, Cogger (2014) remarked that the wolfsnake was now found all over the island, and that concerns for the survival of Christmas Island's five endemic reptiles (two skinks, two geckos, one blindsnake) were justified. According to Smith et al. (2012), *L. capucinus* seriously threatens the survival of the lizard fauna on Christmas Island, similar to the havoc wreaked by the introduced Brown Treesnake (*Boiga irregularis*) on the avian fauna of Guam (e.g., Smith 1988). Small island faunas are much more vulnerable to the effects of introducing a voracious predator than larger ones, where prey species often have adapted to living alongside native predators (Fritts 1993).

The Pacific Ocean.—A specimen of *L. capucinus* (USNM 266210) was collected in 1986 on Pohnpei in the Federated States of Micronesia (Fritts 1987; Buden 2000;

Buden et al. 2001; Kraus 2009; Buden and Taboroši 2016), having apparently arrived on the island in a Philippine lumber shipment that had trans-shipped through Guam, the Pacific island with the large established population of invasive *B. irregularis*. A second, much older specimen of uncertain provenance from Pohnpei (Buden and Taboroši 2016) also is catalogued at the Smithsonian Institution, with the year of collection given as 1900 (USNM 28246). Another single individual was found at Napier, New Zealand, in a cargo of ceramic pots from Malaysia (Gill et al. 2001; Kraus 2009).

The Distribution of *Eutropis multifasciata*

The relatively heavy-bodied, heliophilic, diurnal skink *Eutropis multifasciata* exhibits an extremely wide distribution across southeastern Asia, although this taxon probably represents a species-complex rather than a single species (e.g., Barley et al. 2015). Currently the only taxonomic division within the taxon is the recognition of an endemic island subspecies, *E. m. tjendikianensis* (Mertens 1956) from Pulau Tjendikian to the north of Java, with all other populations, including *E. m. balinensis* (Mertens 1927) from Bali, *fide* Schmitt et al. (2000) and Mausfeld and Schmitz (2003), currently considered to represent the nominate form.

On the Asian mainland, *E. multifasciata* has been reported from Assam and Nagaland in northeastern India (Smith 1935), Yunnan and Hainan Island, China (Pope 1935; Zhao and Adler 1993), Vietnam (Smith 1935; Manthey and Grossmann 1997), Cambodia and Laos (Manthey and Grossmann 1997), and Myanmar, Thailand, and the Malay Peninsula (Smith 1930). *Eutropis multifasciata* also has been reported from Taiwan (Zhao and Adler 1993) and the Philippine islands of Luzon, Palawan, Negros, Bohol, and Mindanao (Brown and Alcala 1980). In the Indo-Malayan Archipelago, it has been reported from all political units of Borneo (de Rooij 1915; Malkmus et al. 2002; Das 2004, 2007), Sulawesi and neighboring archipelagos (Barbour 1912; Koch 2012), Sumatra (Manthey and Grossmann 1997), Java (Barbour 1912; de Rooij 1915; Manthey and Grossmann 1997), Bali (Mertens 1930, as *Mabuya m. balinensis*; Manthey and Grossmann 1997), and their satellite archipelagos (Das 2010), as well as Lombok (Barbour 1912; de Rooij 1915; Mertens 1930), Flores (Barbour 1912; de Rooij 1915; Mertens 1930), Sumbawa (de Rooij 1915; Mertens 1930), Alor (Barbour 1912; de Rooij 1915), and Wetar (de Rooij 1915) in the Inner Banda Arc, and Semau (as Samao)(de Rooij 1915), and Timor (de Rooij 1915), including Timor-Leste (Kaiser et al. 2011, 2013; O'Shea et al. 2012, 2015; Sanchez et al. 2012), and in the Outer Banda Arc of the Lesser Sunda Islands (Barbour 1912; de Rooij 1915; Mertens 1930). To the west of New Guinea in the Moluccan islands, *E. multifasciata* has been reported from Halmahera (as Gilolo) (Boulenger 1887; Boettger 1895; Barbour 1912), Ternate (Peters and Doria 1878; Boulenger 1887; Boettger 1895; Barbour 1912; de Rooij 1915), Bacan (as Batjan)(Peters and Doria 1878; Boettger 1895; Barbour 1912; de Rooij 1915), Ambon (Peters and Doria 1878; de Rooij 1915), Buru, Saparua, Hakuku, and Nusalaut (Kopstein 1926), north Seram (as Ceram)(Boulenger 1887; Barbour 1912; de Rooij 1915), Tanimbar Islands (as Timor Laut) (Boulenger 1887), and Wokan in the Aru Islands (Peters and Doria 1878; Barbour 1912).

In the satellite archipelagos of western New Guinea, Barbour (1912) reported the presence of *E. multifasciata* for Biak (as Wiak) in the Schouten Archipelago, suggesting that this was "the first Papuan record for the species," but he later also listed "Dutch New Guinea" without further comment. De Rooij (1915) added Waigeo (as Waigeu), in the Raja Ampat Archipelago to the northwest of the Vogelkop Peninsula, as well as the first mainland locality, the Fakfak Peninsula, West Papua Province, though she apparently did not examine any specimens from there.

Much more recently, *E. multifasicata* was recorded in large numbers at Tanahmerah on the Digul River, Papua Province (Horton 1972), based on specimens collected by Leo D. Brongersma (1907–1994) during the 1959 Star Mountains Expedition.

Eutropis multifasciata appears to exhibit a patchy distribution at the eastern end of its naturalized range, with its occurrence concentrated around population centers, especially in western New Guinea where it has only previously been reported from Aru, Biak, Waigeo, Fakfak, and Tanahmerah.

Serendipitous Sightings

Based on two sightings, one documented photographically and another with a voucher specimen, we herein record the presence of *Lycodon capucinus* for the first time on the island of New Guinea. These records are not only of interest when it comes to the ever-expanding naturalized distribution of that species, they also are noteworthy because the second snake had preyed on an individual of another naturalized species, the Common Sun Skink (*Eutropis multifasciata*), allowing us to simultaneously add a new New Guinean locality for that species.

Methods

For the vouchered specimens, we obtained snout–vent length (SVL), tail length (TL), and total length (TTL) post-mortem. For *Lycodon*, scale counts recorded included ventrals (from the first ventral scale in contact with the paraventral dorsal scale row to the last ventral scale anterior to the cloaca), subcaudals (from the first post-cloacal scale to the tip of the tail, excluding the terminal scale itself), and dorsals (three counts including one at one head length posterior to the head, one at midbody, and one at one head length anterior to the cloaca).

Fig. 3. The first Island Wolfsnake (*Lycodon capucinus*) in New Guinea, sighted and photographed alive but not collected on 23 August 2016 from east of the Ajkwa River, Timika Regency, Papua Province (USNM-HI 2858a–c). This individual was seen at the locality illustrated in Fig. 7C. It was first photographed as it moved across the habitat (top), then in a close-up. The inset shows a left-lateral view of the head and neck.

We determined aspects of head pholidosis directly from the specimen and verified them photographically. The partially digested condition of the skink made further scalation data collection impossible.

The voucher specimens of *Lycodon* and *Eutropis* will be deposited in the Museum Zoologicum Bogoriense, Cibinong, Jawa Barat, Indonesia (MZB), while voucher photographs for both specimens and the uncollected *Lycodon* have been deposited in the Herpetological Image Collection, National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA (USNM-HI).

Results

Lycodon capucinus.—While conducting a mammalian survey on 23 August 2016, KIK sighted a *L. capucinus* (USNM-HI 2858a–c; Fig. 3) at 2311 h, alongside a rocky road on a levee about 250 m east of the Ajkwa River, approximately 6.2 km by air south of Timika, Mimika Regency, Papua Province, Indonesian New Guinea (4.6011°S, 136.9129°E, elev. 18 m). This individual was photographed but not collected. A second, slightly larger *L. capucinus* (USNM-HI 2859a–c; Fig. 4) was encountered and collected by KIK on 2 February 2017 at 1037 h in successional forest habitat west of the Ajkwa River, about 1.66 km south-southwest of the first location and approximately 7.5 km by air south of Timika, Mimika Regency, Papua Province, Indonesian New Guinea (4.6155°S, 136.9093°E, elev. 16 m). The habitat in which this snake was captured (Fig. 5) comprises natural succession secondary forest dominated by myrtles (Myrtaceae), palms (Arecaceae), and pandanus (Pandanaceae).

The vouchered specimen is an adult (483 mm SVL + 105 mm TL = 588 mm TTL) and, from its tail shape, appears to be female. Scale characteristics include 196 ventrals, an entire cloacal plate, 66 paired subcaudals, 17-17-15 unkeeled dorsals, nine supralabials with the 3rd–5th supralabials contacting the orbit, nine infralabials, loreal present and slightly elongate, single preocular in contact with the frontal, paired postoculars, and two anterior temporals. The specimen is dorsally chocolate brown with flanks and interstitial skin paler, and with each brown scale edged in white or cream, present-

Fig. 4. The second Island Wolfsnake (*Lycodon capucinus*) in New Guinea, collected and vouchered on 2 February 2017 on the western bank of the Ajkwa River, Timika Regency, Papua Province (USNM-HI 2859a–b). This individual was found and collected at the locality illustrated in Fig. 7C. The inset shows a left-lateral view of the head of the preserved snake.

Fig. 5. Habitat along the western bank of the Mimika River, where the second Island Wolfsnake (*Lycodon capucinus*) from New Guinea was observed, collected, and vouchered, comprises a natural succession of secondary forest dominated by myrtles (Myrtaceae), palms (Arecaceae), and pandanus (Pandanaceae). This type of habitat includes the patches of sun exposure (sun spots) that would be used by Common Sun Skinks (*Eutropis multifasciata*) for basking. An area such as this is likely where the snake encountered its prey.

ing the flecked pattern common in this species; faint indications of pale crossbars on the anterior body and neck also are present. The pale pigment overwhelms the darker pigment on the lower lateral scales, the brown pigment being reduced to spots in the center of each scale. The ventrals, cloacal plate, and subcaudals are immaculate off-white to pale cream. The dorsum of the head is chocolate brown without any pale markings and contrasts with the supralabials, which are pale cream except along their lower edges and sutures, where they are suffused with dark gray-brown. The throat and chin are creamy yellow, but the mental and anterior infralabials are also gray-brown. A cream neck-band is present, fusing with the cream pigment of the posterior supralabials, the band being as many as eight scales wide at the angle of the jaw but middorsally reduced to the width of a single scale, many of the pale scales are heavily suffused with darker pigment and present a mottled appearance. The pattern of this specimen is consistent with other specimens of *L. capucinus* examined by MOS and HK.

The unvouchered first individual also was patterned like a typical *L. capucinus*, dorsally chocolate brown with cream flashes on the body that form faint crossbars over the neck. The yellow supralabials and cream nape bands of this snake were more infused with dark pigment than on the vouchered specimen, but based on its overall morphology this individual too can be clearly identified as *L. capucinus*.

Eutropis multifasciata.—The vouchered *L. capucinus* was found to contain an adult skink (92 mm SVL + 165 mm TL = 257 mm TTL) and, based on its four well-developed pentadactyl limbs, its long tail, and characteristic tricarinate body scales, we can identify it as a representative of the genus *Eutropis* (Fitzinger 1843), specifically of the widely distributed species *E. multifasciata* (Kuhl 1820) (USNM 2860a–b; Fig. 6).

Fig. 6. A Common Sun Skink (*Eutropis multifasciata*; USNM-HI 2860a–b) found in the gut of the second Island Wolfsnake (*Lycodon capucinus*) from New Guinea, with the same collection locality as described in Fig. 3. (A) Right-lateral view of the body, showing the tricarinate body scales and some of the color pattern characteristic of the species. (B) Left-lateral view of the body, showing the partially digested anterior portion of the lizard and the complete tail.

The coloration of this partially digested specimen is olive-brown above, fading to pale green on the lower flanks and venter. The head and left anterior portions of this specimen were partially digested making examination of head scales impossible. The tail was complete but had become detached from the body.

Recent Introductions

Lycodon capucinus.—Located approximately 38 km inland on the Mimika River, Timika is a relatively large town and the administrative center of Mimika Regency, Papua Province (Fig. 7). Its population in 2014 was "around 130,000" (Wikipedia, accessed on 11 February 2018). Timika serves as a major conduit to the outside world for the vast PT Freeport Indonesia Grasberg Mine, the largest gold mine and third-largest copper mine in the world, which is located approximately 60 km north-northeast on the headwaters of the Mimika River.

Access to Timika from other parts of Indonesia may be by boat or by air, as the newly opened Mozes Kilangin International Airport is served by airlines from as far afield as Jakarta (Java), Denpasar (Bali), and Makassar and Manado (Sulawesi), all well within the established naturalized range of *L. capucinus*. This perianthropic species is quite capable of stowing away in supplies of foodstuffs, building materials, or equipment intended for Timika or the Grasberg Mine. This is an area that has been greatly affected ecologically, as a result of the presence of the Grasberg Mine upstream and the burgeoning town of Timika. Much of the vegetation is secondary and a vast area of mine tailings has been deposited less than 1.0 km east of Timika and 1.5 km east of the specimen locality. However, *L. capucinus* is ideally adapted to exploit such human-modified environments. Prey availability is unlikely to be a problem in the area, since geckos of the genera *Hemidactylus* and *Gehyra*, and skinks of the genera *Carlia, Cryptoblepharus, Emoia, Glaphyromorphus*, and *Sphenomorphus*, in addition to naturalized *Eutropis multifasciata* (see below), are abundant in such lowland, human-impacted habitats in New Guinea. Although *L. capucinus* may be in direct competition for prey with some species, such as the colubrid Slatey-grey, *Stegonotus cucullatus* (Duméril et al. 1854), other groundsnakes of the genus *Stegonotus*, and possibly the saurophagous Smooth-Scaled Death Adder, *Acanthophis laevis* Macleay 1878 or Müller's Crowned Snake,

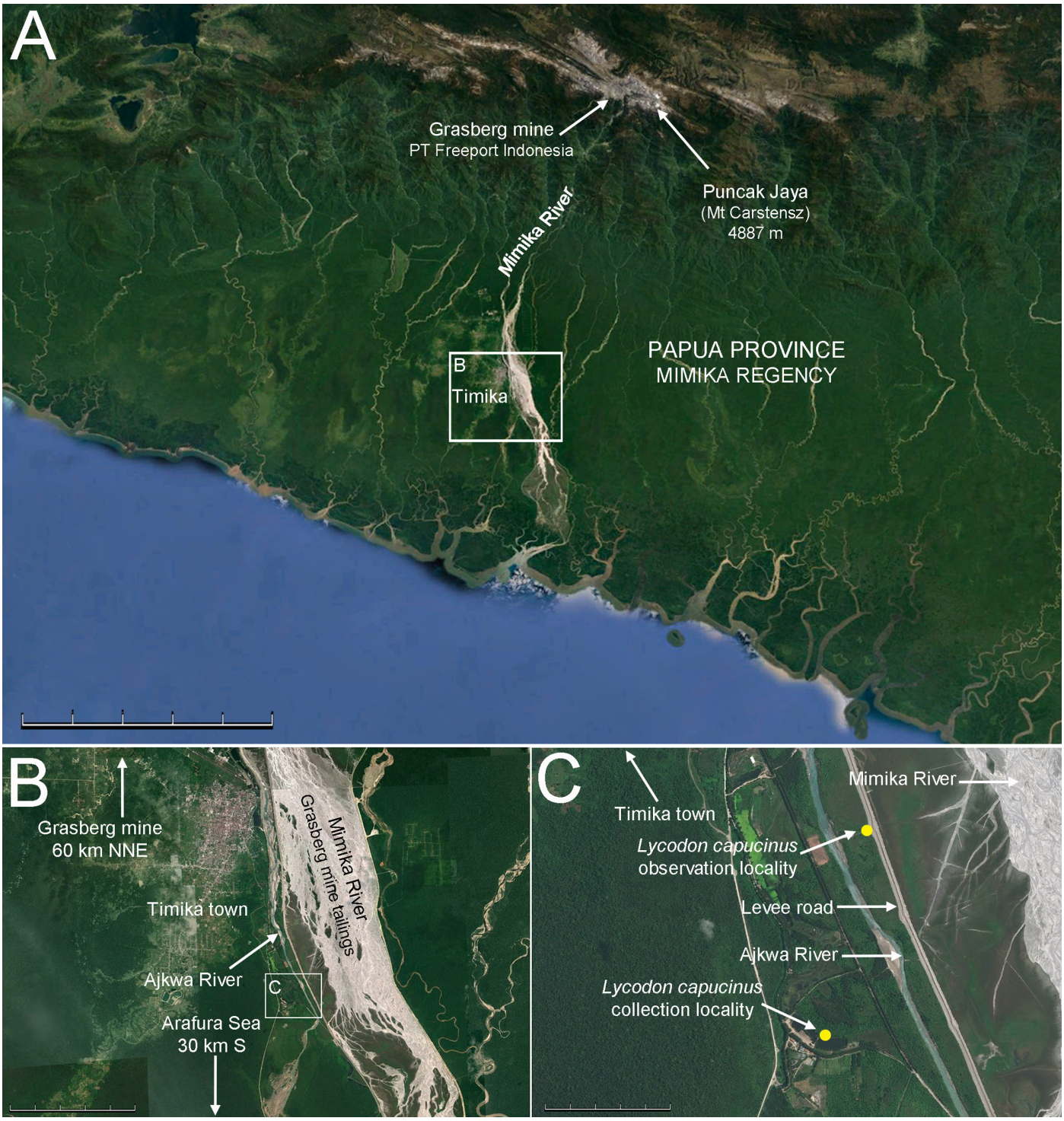

Fig. 7. Satellite maps (derived from Google Earth) of the area in southwestern New Guinea where *Lycodon capucinus* was recently found. (A) The southwestern part of Papua Province, Mimika Regency, Indonesian New Guinea (scale = 50 km). (B) A closer view of the Timika Region, showing location of the town of Timika, the position of the Ajkwa River parallel to the Mimika River, and the wide area of the Mimika River basin occupied by mine tailings (scale = 5 km). (C) Collection and observation localities for the Island Wolfsnake (*Lycodon capucinus*) south of Timika (scale = 1 km).

Aspidomorphus muelleri (Schlegel 1837), competition is unlikely to be a limiting factor given the abundance of prey species. We suspect that other New Guinean population centers with long-established links to the rest of Indonesia (e.g., Jayapura, Sorong, Manokwari, or Merauke) might also contain discrete but established populations of the highly adaptable and globetrotting *Lycodon capucinus*.

Eutropis multifasciata.—This skink is another perianthropic species with a history of human-mediated naturalization events. In the area around Timika, this species was

only recently sighted for the first time (in ca. mid-2016; KIK, pers. obs.) but was locally observed with greater frequency by year's end (KIK, pers. obs.). This specimen is only the third mainland New Guinean report for the species, from a location almost midway between the other two (Fakfak Peninsula and Tanahmerah). As with *Lycodon capucinus*, we predict that surveys in other human population centers in western New Guinea would reveal the presence of this species.

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