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On the second (or, rather, the first) specimen of the recently described *Calliophis salitan* (Squamata: Elapidae), with the first report of the species from Mindanao Island, southern Philippines

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Abstract. We report on the second known specimen of the recently described banded Asian coralsnake, *Calliophis salitan*, identified among the Museo Nacional de Ciencias Naturales collections of Dr. Hipólito Fernández, made in 1886. The specimen was collected on Mindanao Island in the southern Philippines as part of the "Comisión Central de Manila," the Spanish Crown's effort to catalogue and showcase Philippine biodiversity for the Madrid public. We assign this important specimen to *C. salitan* (formerly known from a single specimen collected on Dinagat Island) based on its highly distinctive external phenotypic characteristics (scalation, body size, and inferred colour pattern). The discovery of *C. salitan* on Mindanao significantly extends the known geographic range of this species and partially fills an intermediate distributional hiatus – a large geographic gap in the distribution of large-bodied, long-glanded coralsnakes. This report partially resolves a biogeographic enigma surrounding the question of how a distinctive evolutionary lineage of elapid snakes – more closely related to the *Calliophis bivirgatus* group from Borneo and other landmasses of Sundaland than to any other Philippine elapids – could have colonized only a small island (Dinagat) in the geographic interior of the archipelago. The answer appears, most likely, that this dispersal occurred over land, via the large intervening island of Mindanao. Although the exact site of collection is unknown, consideration of the collector's itinerary suggests that it originated most likely in the vicinity of Davao City, southeastern Mindanao. Its discovery confirms that *C. salitan* occurs on Mindanao (or, at least, did occur on this island as recently as 133 years ago), and that locating additional populations via targeted surveys is an urgent priority for conservation of this remarkable Philippine endemic snake lineage.

Keywords. Coralsnakes, distribution, Elapidae, reptiles, Southeast Asia.

Introduction

Compared with neighbouring Sundaland, the Philippines has a relatively depauperate terrestrial elapid snake fauna. Terrestrial Philippine snakes of the family Elapidae (Leviton, 1964; Leviton et al., 2014, 2018) include *Ophiophagus* (one species)*, Naja* (three species), *Hemibungarus* (three species), and *Calliophis* (four species). Despite the relatively low diversity of land-dwelling elapid species in the archipelago, the Philippine elapid snake fauna possesses interesting attributes in terms of natural history, ecology, and biogeography. Conceptually, these topics invoke a number of evolutionary questions, concerning phenomena not well understood.

The first of these is the unexplained and evolutionarily anachronistic case of sexual size dimorphism in the diameter of the discharge orifice in venom-conducting fangs of *Naja philippinensis*, which is larger in females (Wüster and Thorpe, 1992). This is the only known case of this phenomenon in cobras, and such a disparity may be expected to have functional significance (Bogert, 1943). However, an unambiguous explanation of its adaptive significance in Philippine cobras has yet to be provided (Wüster and Thorpe, 1992).

Second, on a related point, Philippine cobras possess highly-specialized spitter dentition (rifled, mobile fangs for frontal projection of venom; Wüster and Thorpe, 1992), and yet conflicting accounts and ambiguous reports of actual spitting behaviour in Philippine "spitting" cobras *N. philippinensis* and *N. samarensis* (Taylor, 1922, 1975; Leviton, 1964, Leviton et al., 2014) suggest an unresolved disconnect between structure and function (Watt et al., 1988; Wüster and Thorpe, 1991,

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1992). In addition to unclear literature accounts, we have never observed spitting behaviour in these species, despite numerous field encounters over the past three decades (RMB, pers. obs.).

Third, Philippine elapids possess unexpected and surprising phylogenetic relationships. The close, sister-lineage relationship between king cobras of the genus *Ophiophagus* and the Philippine endemic false coralsnakes of the genus *Hemibungarus* was entirely unexpected because of their remarkably dissimilar phenotypes, anatomy, ecology, microhabitats, and behaviour (Castoe et al., 2007; Brown et al., 2018; Plettenberg Laing, 2018).

Fourth, the biogeography of Philippine elapids is interesting because it involves a peculiar geographic replacement pattern of coralsnakes (Leviton, 1964; Brown et al., 2018). In this case, the three endemic species of *Hemibungarus* have come to occupy three separate faunal regions of the northern, northeastern, and central portions of the archipelago (the Pleistocene Aggregate Island Complexes, or PAICs – *sensu* Brown and Diesmos, 2009; Brown et al., 2013a), whereas four PAIC-endemic species of *Calliophis* are restricted to three faunal regions of the southern and western reaches of the archipelago (Fig. 1; Leviton et al., 2018).

Finally, snake biogeographers have been puzzled by the absence of kraits and large-bodied, brightly-coloured coralsnakes in the archipelago. These conspicuous faunal elements are well-documented and frequently encountered just outside of the Philippines (on the islands of Borneo, Sumatra, Java, Sulawesi, and the Thai-Malaysian Peninsula of mainland Southeast Asia; Uetz et al., 2020), but have been notably absent within the archipelago (but see below).

The first four topics summarized above represent reasonably well understood or, at least, partially documented Philippine-specific elapid case histories that can be viewed as intriguing challenges for international collaborations involving Philippine scientists, students, and researchers from nearby Southeast Asian countries

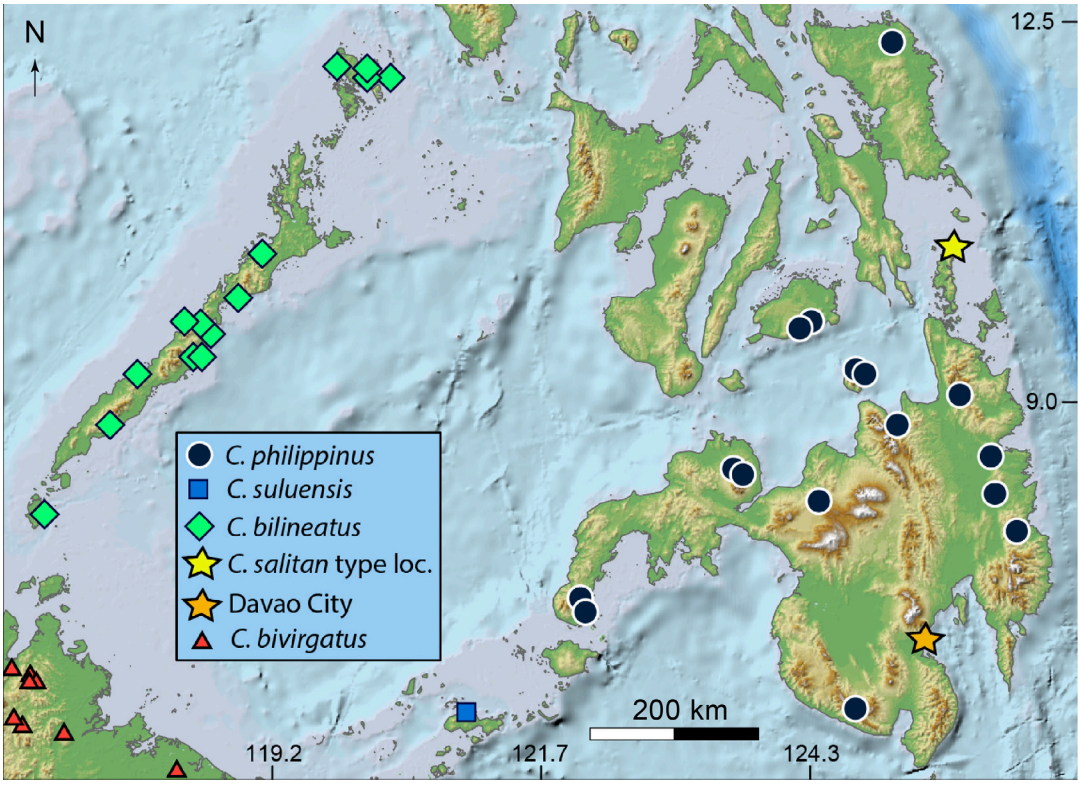

Figure 1. Map of the southern Philippines with the specimen-vouchered distributions of Philippine *Calliophis* species indicated by various symbols as shown in the key. A yellow star marks the *C. salitan* type locality on northern Dinagat Island. According to the itinerary of Hipólito Fernández, collector of the first specimen of *Calliophis salitan* from Mindanao Island (MNCN 22719), he accessed the island through the Port City of Davao (orange star).

and beyond (Alcala, 2004a, b). However, the last point enumerated above has recently been addressed with the discovery of a strikingly distinct, spectacularly-coloured, new species of long-glanded coralsnake, *Calliophis salitan* Brown et al., 2018, heretofore known from a single specimen. This species, documented only from Dinagat Island northeast of Mindanao (Fig. 1), remains enigmatic because virtually nothing is known about its biology. *Calliophis salitan* was discovered in 2007 and was described on the basis of a single specimen (Brown et al., 2018). Related species are referred to as "long-glanded tropical coralsnakes" because they possess remarkably enlarged venom glands, which extend from the head to the thoracic-cardiac cavity (Brown et al., 2018: Fig. 6).

In the years since the initial discovery of *C. salitan* (by J.B. Fernandez in 2007) and its description (Brown et al., 2018; Leviton et al., 2018; Weinell et al., 2019), numerous biodiversity surveys and faunal inventories of Dinagat Island (as well as nearby Siargao Island), southern Leyte and Samar islands, to the north, and northeastern Mindanao and Camiguin Sur islands to the south (Fig. 1) have been conducted by qualified herpetologists (see Sanguila et al., 2016 for a review). However, the search for additional specimens of *C. salitan*, or clues to the extent of its geographical range, its biogeography, and natural history (diet, ecology, microhabitat preference, venom toxicity, etc.) have all been fruitless. Eventually, after considerable but unsuccessful efforts to secure additional specimens, the species was described (Brown et al., 2018) and a molecular phylogenetic analysis demonstrated its close relationships to the large-bodied (≥ 1 m total body length), active "racer ecomorph," long-glanded and spectacularly-coloured (blue-black iridescent bodies, bright orange-red heads and tails) coralsnakes of Sundaland: the *Calliophis bivirgatus* complex, which includes the taxa *C. b. bivirgatus*, *C. b. flaviceps*, and *C. b. tetrataenius*. In terms of their size, morphology, colouration, ecology, behaviour, and temperament, the Sundaland large-bodied, coralsnakes of the *C. bivirgatus* complex are much more reminiscent of kraits (e.g., *Bungarus flaviceps*; see Stuebing et al., 2014) than they are of the contrastingly secretive, small-bodied, rarely observed, inconspicuously coloured, and semi-fossorial Philippine species of the *C. intestinalis* complex, which includes *C. bilineatus* from the Palawan PAIC, *C. philippinus* from the Mindanao PAIC, and *C. suluensis* from the Sulu Archipelago PAIC.

The surprising discovery of a species of the *C. bivirgatus* complex on Dinagat Island left several unanswered questions (Brown et al., 2018). One of these we address here, with the first report of a historically-significant, unrecognized specimen, which the available evidence suggests likely originated on the intervening island of Mindanao. The discovery of the second specimen of *C. salitan*, reidentified 133 years after the first record of its existence, and housed within the historic herpetological collections of Spain's National Museum, the Museo Nacional de Ciencias Naturales (MNCN), constitutes a significant biogeographical "piece of the puzzle" in the sense that it fills a distributional gap between the central Philippine island of Dinagat, where *C. salitan* was discovered, and the Sunda Shelf landmasses of Borneo, Java, Sumatra, and the Thai-Malaysian Peninsula, where its closest relatives are found (Stuebing et al., 2014; Charlton, 2020).

Historical background and Philippine herpetological collections at MNCN: The "Comisión Central de Manila" of 1885. In his MNCN catalogue of Philippine vertebrate specimens collected prior to 1886 and assembled in 1887 as part of the Comisión's activities, Gogorza (1888) sought to summarize all that was known of specimen-based vertebrate biodiversity of the Philippines, for later presentation to the scientific and lay public of Spain. This catalogue summarized each specimen's identity, the locality from which it had been secured, the collector, and the date. The Comisión was atypical in the sense that no standard expeditions were carried out during or leading up to 1887. Instead, an agreement was made to first hold an exhibition covering aspects of history (including natural history) of the Philippines in-country, and then subsequently transport this exhibition to Madrid, in a manner similar to public exhibitions that were the trend, hosted by other European countries and colonies at the time. To do this, a "Comisaría Regia" was constituted in Madrid, and given the responsibility of organizing both the exhibition site in Madrid and also the Comisión (located in the Philippine capital city of Manila on the island of Luzon). The latter was charged with gathering all possible zoological specimens, collected throughout the archipelago by various collectors spanning different traditions and trades (physicians, engineers, naturalists, monks, priests, etc.) that would subsequently be brought to Madrid (Catálogo, 1887), thereby assembling a collection of hundreds of specimens.

The main contributors to the Comisión's collecting activities were Hipólito Fernández and Domingo Sánchez y Sánchez. Other contributors included José Pérez Maeso, Carlos Mazarredo, Ramón Jordana, Agustín Domec,

Regino García, and Claudio Montero. A summary of the numbers and locations of their contributions follows.

The prominent physician and collector Hipólito Fernández collected on Luzon near Manila, and also near the port at Lagonoy City (Camarines Sur Province), Lobo (Batangas Province), Mindoro Island, and on some of the West Visayan islands. He also visited Mindanao Island by way of the port city of Davao. Fernández collected a total of 130 reptiles (91 specimens of 33 snake species, all in collections at MNCN), including MNCN 22719, a large elapid snake reportedly from "Isla de Mindanao, Filipinas," (date of specimen cataloguing 30 June 1887; presumably collected sometime before this date) but with no more specific locality information, which is the subject of this report.

Domingo Sánchez y Sánchez, for whom an 1886 itinerary is available in the MNCN archives, embarked aboard a paddle steamer, the *Queen Isabel II*, from the port of Manila on 10 January 1886 and travelled to Bulacán, returning on 10 February. Localities visited included Quiñgua, Montes Angat (vicinity of today's Angat Dam), Pinubayan Forest (vicinity of the Constancia Mine) and Tayabas. Between February and March 1886, he conducted an expedition to Samar Island, directed by D. Sebastián Vidal, together with ichthyologist Regino García. This excursion collected in Paranas, Villareal, Zumarraga, Daram, Bioso, and Catbalogan. In total 77 specimens of reptiles were collected (38 snakes of 15 species) from Samar localities and the following sites on Luzon: Manila, Lobo and Nasugbu, Tuy, and Lian (Batangas Province), Dolores (Tayabas), Angat and Quiñgua (Bulacan), Morong and Bosoboso (Rizal), and Calauan and Los Baños (Laguna).

José Pérez Maeso collected Philippine specimens before the Comisión was established. In 1885 he made a donation to the MNCN (Barreiro, 1992) of 31 specimens of reptiles, including 14 snakes (10 species). He collected on Mindanao (in Surigao Province and on the Zambonaga Peninsula) and other islands, including southern Basilan Island, Samar, "Isla de Paragua" (= Palawan Island, vicinity of Puerto Princesa City), and on Luzon (in Bulacan Province).

Carlos Mazarredo, forest engineer, donated a collection of a total of 76 specimens of reptiles, including 34 snake specimens representing 15 species from various islands (all collected by him during 1884–1885; Barreiro, 1992: 347). These included specimens from Luzon: Dolores (Tayabas Province); vicinity of Bulacan, Cuevas de Puning (Bulacan Province); vicinity of Bula and Bato Cities, and from Nueva Cáceres (Camarines Sur Province); Antipolo (Morong); Daraga, Irosin, and Tabaco cities (vicinity of Mayon Volcano, Albay Province); Negros Island, vicinity of Dumaguete City (West Visayas); Leyte Island (East Visayas); Mindoro Island, vicinity of Boac City; Marinduque Island. Ramón Jordana y Morera, also a forest engineer, only collected on Balabac Island (south of Palawan). MNCN specimens include three specimens of *Lycodon muelleri* and two *Dendrelaphis marenae*.

Agustín Domec, Navy officer and physician, resident in the Philippines, appointed by MNCN's "Facultative Board" as collaborator, collected six specimens of snakes on Mindanao, presumably in the vicinity of Davao City (1881), representing five species (notably including a specimen of *Naja samarensis*; reported as *N. tripudians* by Gogorza, 1888: 279), all of which are Mindanao faunal region endemics or widespread species found throughout the archipelago (Leviton et al., 2018). Claudio Montero, Navy Rear Admiral, collected in the Philippines (but without detailed locality information), and contributed 58 reptiles, including 34 snake specimens, representing 16 species.

In summary, a total of 336 snakes, comprising 49 species, were deposited in the MNCN Philippine collection by 1885 (González-Fernández, 2002). Subsequently, in 1887, this collection was first celebrated as part of the "Exposición General de las Islas Filipinas", exhibited in the Parque El Retiro. On the occasion of this exhibition, a new palace, the "Palacio de Cristal" (formerly known as "pabellón estufa") was constructed, and served as a greenhouse public exhibition, featuring live Philippine collected flora (no MNCN zoological specimens were exhibited). Once the exhibition was finalized in 1887, the nearby Museo de Ultramar (located in the current Palacio de Velázquez), housed the Philippine MNCN zoological collections (Gogorza, 1888), until it was decommissioned in 1908, and Philippine specimens were transferred back to MNCN. A total of 39 elapid snakes, representing 12 species from Philippines, are conserved at MNCN; these include the marine elapid, seasnake species *Hydrophis schistosa*, *H. inornatus*, *H. fasciatus*, *H. hardwickii*, and *Pelamis platurus*, the freshwater *H. semperi*, specimens of the terrestrial elapid cobra species *Naja samarensis*, and exemplars of the terrestrial coralsnake species *Hemibungarus calligaster*, *H. mcclungi*, *H. gemianulis*, and *Calliophis philippinus*. Additionally, a single noteworthy specimen of *Calliophis* was housed in the collection. We examine the morphology of this specimen and discuss its taxonomic identity and relevant historic implications below.

Materials and Methods

We examined all preserved specimens of the genus *Calliophis* from the Philippines found in the MNCN. We obtained measurements of external morphology directly from the specimens and follow the standard terminology and methods for quantifying and describing of elapid snake scalation of Brown et al. (2018). We followed Weinell et al. (2019) to identify key characteristics distinguishing species of the genera *Calliophis*, *Naja*, and *Hemibungarus*, and once we unambiguously ruled out the possibility that MNCN 22719 could be a member of any other elapid genus, we used the diagnosis of Brown et al. (2018) and the illustrated key provided by Weinell et al. (2019) to confirm species identity. Measurements were taken with a flexible fabric measuring tape (by RMB, to the nearest mm), and scale characters were scored with the naked eye. A complete list of all other Philippine elapid specimens examined was provided by Brown et al. (2018) and we consulted that work, as well as that of Leviton et al. (2018), for recent summaries of diversity and documented distributions of all other Philippine snakes of the family Elapidae.

Results

Among the Museo Nacional de Ciencias Naturales collections of Hipólito Fernández is a single specimen of *Calliophis salitan*, accompanied by data indicating "30 June 1887 from Isla de Mindanao, Filipinas, by H. Fernández (No. Col: 7424[P])." The specimen, an adult male, is intact, in reasonably good condition, with four 20–30 mm incisions on the ventrum (through ventrals but not subcaudals). MNCN 22719 (Figs. 2, 3) was presumably collected some time before the date of its accessioning, and it was initially identified by Gogorza (1888) as *Naja* sp., then later reidentified and reported as *N. naja samarensis* (González-Fernández, 2002). At some point over the last two decades, its identification was changed in the MNCN database to *Calliophis intestinalis*. However, even without pigmentation characters, the high number of subcaudals, and the relatively long tail (relative to total body length), rules out any possibility that MNCN 22719 could be conspecific with any of the *C. intestinalis* group species (Leviton, 1964; Brown et al., 2018). Additionally, MNCN 22719 possesses two postoculars (whereas three are present in *Naja* and *Ophiophagus*; Weinell et al., 2019: Figs. 17A, B), has a distinctly triangular postnasal (Fig. 3A) vs. the vertically elongate postnasal typical in *Naja* (Weinell et al., 2019: Fig 17A), possesses 13 rows of dorsals that remain unreduced along the entire body (vs. 17–25 in *Naja*, 15 in *Ophiophagus* and *Hemibungarus*), and has a single primary temporal scale (vs. two in species of *Hemibungarus*; Weinell et al., 2019: Fig. 17C). Thus, MNCN 22719 cannot be confused with any other species of elapid snake from the Philippines and is unambiguously identified here as *C. salitan.*

MNCN 22719 has a total length of 998 mm, snout–vent length of 841 mm, and tail length of 157 mm. The specimen's hemipenes were not everted at preservation but sex was confirmed by probing; slight lateral bulges, interpreted as hemipenial swellings, are evident in the ventral aspect at the tail base (Figs. 2C, D). All dorsal body scales are unkeeled, in 13 rows, and unreduced for the entire length of the body. MNCN 22719 has 257 vertebral scales, counted from the parietals to a point on the dorsal tail base at the level corresponding to the posterior edge of the precloacal shield, and then 60 dorsal vertebral caudal scales to the end of the tail (not including the tail tip), and 58 subcaudals. MNCN 22719 has 6/6 (left/right) supralabials, and 7/7 infralabials. Prefrontals are slightly wider than long, in contact laterally with the nasal, preocular, and supraocular scales (Fig. 3B); the specimen has 1+0 temporal and a single post-temporal, a single preocular, two postoculars (the lower is less than half the size of the upper), and no loreal scales (i.e., the nasal and the preocular are in contact; Fig. 3A). The postnasal is triangular and the first pair of infralabials is in contact behind the mental, whereas the second pair is small and separated. The second and third pair of infralabials touch the anterior-most elongate pair of genials (Fig. 3C); the fourth pair are largest and contact the anterior and posterior genials and the first sublabial. The fifth–seventh infralabials contact the first sublabial, which is in contact with the genials. Three scales separate the posterior genials and the first ventral (Fig. 3C). The first of these is a small, non-expanded gular scale. The second and third are increasingly laterally expanded gulars (or "preventrals"). Subcaudals are divided but the precloacal scale is single (Fig. 2D).

Discussion

Comparison of MNCN 22719 to other Mindanao populations of small-bodied, long-glanded coralsnakes reinforced our conclusion that the specimen cannot be confused with any other Philippine species. Mindanao specimens considered conspecific with *Calliophis intestinalis* until the 1850s were originally described as "*Callophis intestinalis* var. Philipp." by Günther (1859: Plate XVI, Fig. A). However, despite the detailed

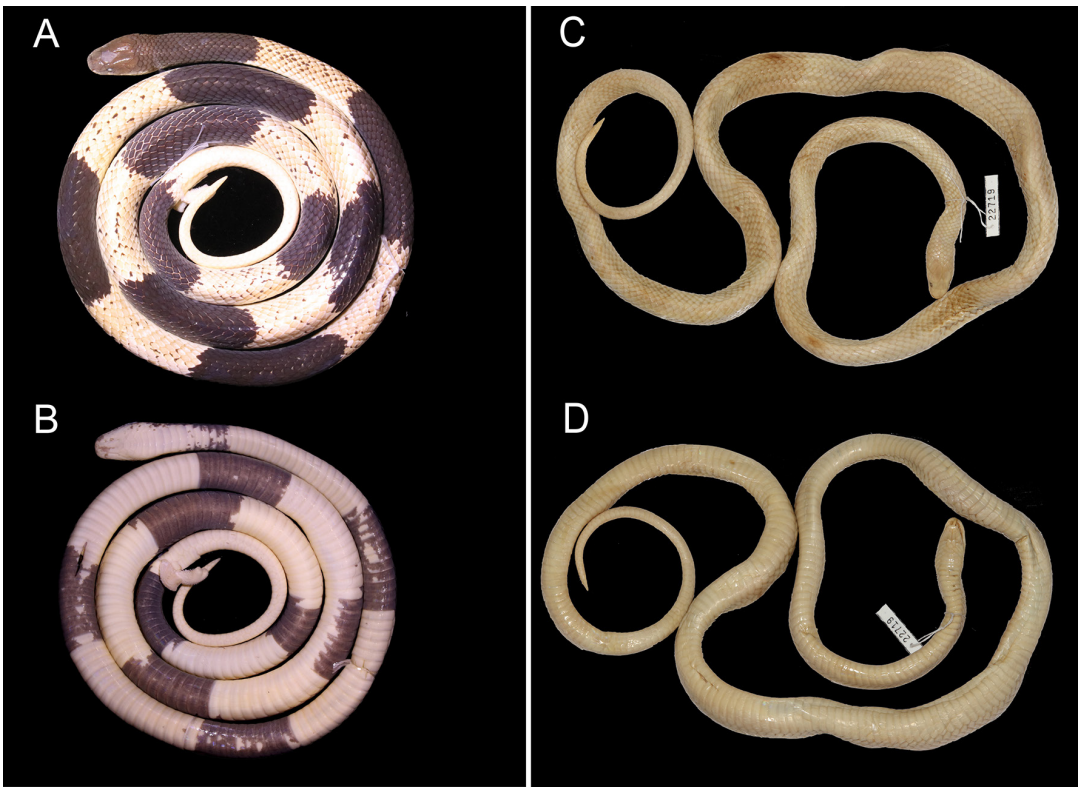

Figure 2. Two specimens of *Calliophis salitan* from the southern Philippines. (A) The holotype from Dinagat Island in dorsal view. (B) The holotype in ventral view. In life, the tail was bright orange but has faded since preservation in 2007. (C) The Mindanao specimen (MNCN 22719) in dorsal view. (D) The same specimen in ventral view. Note the faint pigmentation, suggestive of the species' diagnostic colour pattern: broad, alternating black and white body bands. Photos by Rafe Brown (A, B) and Alberto Sánchez-Vialas (C, D).

description this earliest name for a distinct Philippine population has no nomenclatural validity because of the abbreviated, non-Latinised third part of the name. It was only validated as *Callophis intestinalis* var. *philippina* by Günther (1864: 349). Subsequently, it was treated by Leviton (1964) as the subspecies *Maticora intestinalis philippina* and later transferred back to *Calliophis* following phylogenetic analyses of anatomical characters (Slowinski et al., 2001). They were subsequently elevated to the level of full species, as *C. philippinus* (Leviton et al., 2014, 2018; Sanguila et al., 2016; Brown et al., 2018). *Calliophis philippinus* is a much smaller species (the largest male recorded had a total length of 713 mm, the largest female 575 mm; Brown et al., 2018: Table 3), and the majority of specimens available are typically less than half the body length and diameter of *C. salitan* (RMB, pers. obs.). In contrast, *C. salitan* is a much larger animal, with a total body length ≥ 1 m.

Based on his itinerary, we interpret Fernández's Mindanao specimen (MNCN 22719) as likely having been acquired in the vicinity of Davao City, in the southeastern portions of the island (Fig. 1). Although the hemipenes of MNCN 22719 were not everted at preservation (see Brown et al., 2018: Fig. 7C), we non-invasively confirmed sex, and additionally emphasize that high subcaudal counts in MNCN 22719 (even higher than the demonstrably male holotype – the only other known specimen), support our determination of sex; no females have yet been reported. The body size and proportions of the Mindanao specimen nearly match those of the holotype (Brown et al., 2018). It is nearly 1 m long (total length 998 mm), with a notably long tail that comprises 15.6% of the total length (14.1% in the holotype) and provides an important diagnostic character that distinguishes *C. salitan* from all relevant congeners. As inferred in a recent molecular phylogenetic analysis

Figure 3. Lateral (A), dorsal (B), and ventral (C) views of the head of *Calliophis salitan* from Mindanao (MNCN 22719). Photos by Alberto Sánchez-Vialas.

(Brown et al., 2018), *C. salitan* is most closely related to the other large-bodied, non-Philippine long-glanded coralsnakes, *C. bivirgatus*, and *C. intestinalis*. These, and also the small-bodied, related congeners from the Philippines (*C. bilineatus*, *C. philippinus*, *C. suluensis*), all possess markedly shorter relative tail lengths (3.7–11.1% for both sexes of all three species). The Mindanao specimen's snout–vent length is 841 mm, similar to that of the holotype (PNM 9844 SVL = 856 mm) and its tail length is 157 mm (tail length = 141).

Only a few notable differences in standard scalation meristic characters are evident between the two male specimens. The Mindanao specimen (MNCN 22719) has 257 vertebrals, whereas the holotype (PNM 9844) has 235; ventrals number 249 in the Mindanao specimen, and 229 in the holotype. The Mindanao specimen has 60 caudals and 58 subcaudals (the holotype has 55 caudals and 54 subcaudals). In all other standard meristic variables and categorical scalation characters, the two specimens are remarkably consistent.

In the last 133 years, MNCN 22719 has faded considerably, with almost all presumed colour pattern features (bright red tail; neck and remainder of dorsal surfaces of body with alternating, broad, black and white bands; dorsal head black; Brown et al., 2018: Figs. 4A–C, 5A–B) faded, presumably as a result of exposure to ultraviolet light, either while on public exhibit during the years 1887–1889, or beyond. Nevertheless, faintly evident are at least eight faded but discernible, broad, dark transverse body bars (Fig. 2C), matching the documented colour pattern of this distinctive species, which cannot be confused with any other known Philippine elapid snake (Brown et al., 2018; Fig. 2). The holotype, PNM 9844, is also a male, with ten dorsal body bands including the nuchal band (which is continuous with dorsal black cephalic colouration), a creamy off-white throat and chin, but the remaining ventral surfaces of the body have nine broad transverse bands (corresponding to the remainder of those on the dorsum). Ventral surfaces of MNCN 22719 are immaculate (Fig. 2D), and it is unclear whether dorsal bands originally had corresponding ventral colour elements as in the holotype (Fig. 2A, B; Brown et al., 2018: Fig. 5B). Nevertheless, the width of both specimens' transverse bands agrees sufficiently (corresponding to ~14–17 paravertebral scale rows).

In summary, the reidentification of MNCN 22719 as an unmistakable second example of the enigmatic Philippine long-glanded coralsnake, *Calliophis salitan*, provides resolution for a biogeographic quandary (for discussion, see Brown et al., 2018) by filling a puzzling distributional hiatus, with this new record from Mindanao Island. How the species has gone unrecorded for over more than a century of herpetological survey work in the Mindanao faunal region (Taylor, 1922; Rabor and Alcala, 1959; Leviton, 1963; Brown and Alcala, 1970; Ross and Lazell, 1991; Sanguila et al., 2016; Brown et al., 2018) at first appears inexplicable. However, when one considers the brief, unsustained, and for the most part ancillary nature of most herpetological surveys over the last 133 years in the southern Philippines (Smith, 1993a,b; Delima et al., 2006; Nuñeza et al., 2010; Supsup et al., 2017), a likely explanation emerges. Rare, elusive, or secretive snake species, such as arboreal or fossorial taxa, are difficult

to detect and, when discovered during a survey, are typically represented by single or very few specimens. At naturally low abundances, such species may require extensive and continuous surveys to be detected (Ferner et al., 2000; Gaulke, 2011; Sanguila et al., 2016), and even then these species may only be represented by few specimens in collections or even singletons (Brown et al., 2000; Siler et al., 2011; Brown et al., 2013b; Wynn et al., 2016; Weinell et al., 2020). It has become abundantly clear that sustained or repeated, survey-and-resurvey sampling efforts are necessary to comprehensively characterize faunal diversity in the complex forests of the Philippines (Sison et al., 1995; Brown et al., 2000; Ferner et al., 2000; Gaulke, 2011; Siler et al., 2011; Sanguila et al., 2016). By inventorying species diversity across elevational gradients, with attention to sampling across atmospheric and temporal/seasonal variation (e.g., dry season versus wet season), sampling in different major habitat types, and with particular attention to structural microhabitat diversity, future field biologists may come to understand the natural history of the elusive *C. salitan.*

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