

A new record of the Dwarf Sea Krait (*Laticauda frontalis*) from the Loyalty Islands, New Caledonia

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ABSTRACT

Common in Vanuatu, the Dwarf Sea Krait *Laticauda frontalis* also is known from five old records (in the 1880s and 1890s) from the Loyalty Islands, between Vanuatu and the main island of New Caledonia. Those records have been interpreted by some authorities as errors, or as reflecting occasional waifs rather than breeding populations. We now report an additional specimen of *L. frontalis* from the Loyalty Islands island of Maré, and we review distributional data for this species and for the closely allied *L. saintgironsi*. Sympatry on the western coast of Maré confirms that these two taxa warrant separate species status despite their minimal genetic divergence.

Key words: Laticaudinae, Nengone, Nouvelle-Calédonie, seasnake, sea snake, Iles Loyauté

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Introduction

Geographic distributions of most marine species are known in less detail than is available for terrestrial taxa, because of the difficulties of sampling in the oceans (Andrew and Mapstone 1987; Heatwole *et al.* 2017). Our knowledge of snake distributions provides a good example of this habitat-related difference. Distributions of terrestrial snakes are relatively well-known, but information on many of the >60 species of seasnakes is fragmentary (Elfes *et al.* 2013; Moore and Richards 2014; D'Anastasi *et al.* 2016). This is especially true for rare taxa, and those confined to habitat types (such as shallow waters or coral reefs) where commercial trawling operations are not possible (Udyawer *et al.* 2016). As a result, recent work has discovered seasnake taxa in areas far distant from those in which they were previously known (e.g., D'Anastasi *et al.* 2016). Those information gaps are problematic for conservation efforts, a critical issue because widespread declines in seasnake abundance are occurring even in protected areas (Goiran and Shine 2013; Lukoschek *et al.* 2013). If we do not know where a species occurs, we are unlikely to be able to frame effective measures for its conservation.

The seasnakes of the Loyalty Islands, midway between Vanuatu and the large island of Grande Terre, New Caledonia, exemplify these problems. Both of those large and relatively well-sampled island groups contain a diverse array of “true” (hydrophiine) seasnakes and amphibious sea kraits (Laticaudinae) (Ineich and Rasmussen 1997;

Bauer and Sadlier 2000; Ineich and Laboute 2002; Shine *et al.* 2002a,b). However, the species composition of those seasnake faunas differs among areas for both lineages. Here, we focus on the sea kraits: this relatively ancient (>12 million years ago: Sanders *et al.* 2008) radiation comprises species that forage in the ocean but return to land to rest, digest their prey, slough their skins, and court and mate (e.g., Shetty and Shine 2002a,b). One taxon (*Laticauda laticaudata*, the Brown-lipped Sea Krait) is common to both Vanuatu and New Caledonia; this widespread and highly aquatic species shows little genetic divergence across large areas (Lane and Shine 2011). In contrast, another major lineage (the Yellow-lipped Sea Kraits, *L. colubrina* group) is more closely tied to terrestrial habitats and shows greater geographic differentiation of populations (Heatwole *et al.* 2005; Lane and Shine 2011). Within this latter radiation, one species (*L. saintgironsi*) is endemic to New Caledonia (including Grande Terre, Isle des Pines and the Loyalty Islands) whereas Vanuatu contains the widespread *L. colubrina* (also known from much of the Indo-Pacific: Heatwole *et al.* 2005) as well as a dwarf form (*L. frontalis*) that is the main focus of our present report. Morphologically similar to the larger *L. colubrina* (and hence, easily mis-identified), *L. frontalis* is common in Vanuatu and is also known from six records to the southwest – five from the Loyalty Islands and one from “New Caledonia” (perhaps from the Loyalty Islands also, because the species has never been recorded from the more intensively-sampled island of Grande Terre).

Relatively little information is available on those records of Dwarf Sea Kraits in the Loyalty Islands, because most of the records are very old. Five specimens in the National Museum of Natural History in Paris were accessioned in 1886 (MNHN 1886.385 to 1886.388, no specific localities) and 1894 (MNHN 1894.0247, from Maré Island) and presumably collected some years earlier. Another animal (a juvenile, MNHN 1990.5093) was collected in 1990 but its locality is given as “New Caledonia” so it may not have come from the Loyalty Islands (I. Ineich, *pers. comm.*). Notes accompanying a single specimen in the Macleay Museum (University of Sydney; #MM633; see Fig. 1) record that the snake is from “Li Foo” [= Lifou] and was collected by Dr Cox in 1875. Hence, the occurrence of the species on the Loyalty Islands rests on animals that were collected more than 140 years ago. Given that recent sampling has recorded *L. saintgironsi* and *L. laticaudata*, but not *L. frontalis* (see above), it remains possible that the older records are in error (as is common in such cases: Heatwole and Cogger 2013 note several examples,

including a type locality outside the currently known range of *L. frontalis* – but see Kharin *et al.* 2010 for a potential extension of the species range to Tonga and New Britain); or that occasional individuals of the species are carried by currents to this extralimital site; or that the species once occurred in the Loyalty Islands but has since been extirpated (as has occurred for seasnakes in other regions: Lukoschek *et al.* 2013).

As a result of that ambiguity, the status of Dwarf Sea Kraits in the Loyalty Islands has been contentious. In their review of the lineage, Heatwole *et al.* 2005 note that “The range of *L. frontalis* is mainly Vanuatu with either small outlier populations or waifs represented in the Loyalty Islands” (p. 101), and that “specimens of *L. frontalis* ... from the Loyalty Islands .. are perhaps waifs” (p. 110). In contrast, Cogger and Heatwole (2006) interpreted the same data as suggesting that the Loyalty Islands are indeed part of the range of *L. frontalis*. That position was challenged by Ineich (2007), whose review of seasnakes in New Caledonia concluded that “the occurrence of reproductive populations for *Laticauda*



Fig. 1. A preserved specimen of *Laticauda frontalis* (Dwarf Sea Krait) in the collection of the Macleay Museum, University of Sydney. The animal (MM633) was collected by Cox in Lifou in 1875. Photograph by Jude Philp, courtesy of Macleay Museum, University of Sydney.

frontalis has also to be assessed. These three cases could correspond to erratic specimens accidentally transported by oceanic currents during climatic anomalies like hurricanes, a colonization not followed by the installation of a reproductive population” (p. 403). Likewise, Lane and Shine (2011) suggested that “Although Cogger and Heatwole (2006) considered the distribution of *L. frontalis* to include the Loyalty Islands ..., it seems likely that the two individuals were waifs/migrants from Vanuatu (p. 575)”. Even more recently, however, Ghergel *et al.* (2016) accepted that *L. frontalis* occurs in the Loyalty Islands as well as in Vanuatu. Heatwole and Cogger (2013) have explored in detail how limited information and errors in identification, coupled with records of occasional specimens well outside a species’ main range, have greatly compromised the accuracy of estimates of geographic distributions of seasnakes – including, that of *L. frontalis*.

Our recent (January 2019) discovery of an additional specimen of *L. frontalis* on Maré Island, in the Loyalty Islands, suggests that the earlier accounts were accurate, and that the species does indeed occur (albeit at low densities) within this island group. The new record also demonstrates sympatry between two sea krait species with minimal genetic divergence (*L. saintgironsi* and *L. frontalis*), confirming that these two taxa are indeed separate biological species.

A new record

Mebuet Bay (-21.51553°S, 167.84982°E) is a small (100 x 150 m) shallow bay with a sandy beach 4.5 km north of the village of Tadine, on the western shore of Maré Island (the southernmost of the islands of the Loyalty Islands). Much of the bay is shallow (<0.5 m at low tide), supporting seagrass beds on sandy substrate (Fig. 2a). Corals dominate further from shore, with a single narrow (1-m-wide) channel amidst the extensive coral flats funneling water from the shallows into deeper water as the tide falls. At the distal end of the channel, the water depth increases rapidly. The bay is renowned for the juvenile Green Sea Turtles (*Chelonia mydas*) that enter the shallows at high tide to feed on seagrass, and rest in deeper waters close to the seagrass beds at low tide.

While snorkeling at Mebuet Bay on a falling tide at 1000 h on 18 January 2019, we were returning from deeper water through the narrow channel towards the beach when we encountered a male *L. frontalis* swimming actively close to the landward end of that channel in 0.5 m-deep water (Fig. 2b). We captured the snake and retained it for photography, measurements and scale counts before releasing it at the site of capture a few hours later.

The snake was determined to be a male based on subcaudal scale counts and tail shape (more robust in males than females within this lineage: Cogger and

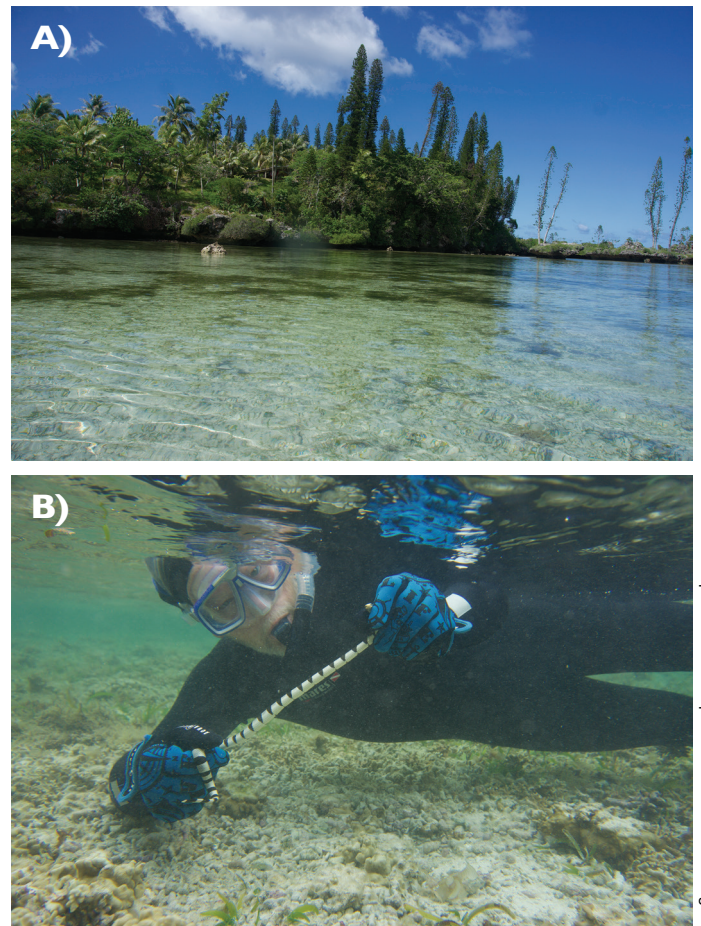


Fig. 2. (a) Mebuet Bay, Maré; (b) Photograph taken at site of capture, immediately after the snake was seized. Note shallow water. Photographer Terri Shine.

Heatwole 2006). Given its body size and colour pattern (dark bands meeting ventrally), the animal is very likely to be adult (Cogger and Heatwole 2006). The snake measured 47.5 cm snout-vent length, with a tail of 6.3 cm. It had 21 midbody scale rows, 28 dark bands on the body and 4 dark bands on the tail. It had 214 ventral scales and 40 subcaudal scales. The anteriormost dark band on the neck was not connected to the black band on the head, and the dark bands around the body were notably thinner on the ventral surface than on the posterior surface of the body (Fig. 3). In all of these traits, the snake falls within the range recorded for *L. frontalis* by Cogger and Heatwole (2006), and outside the range of traits recorded for other laticaudine species including *L. saintgironsi* (the species with which it could most readily be confused; Cogger and Heatwole 2006).

Discussion

Our discovery of a male *L. frontalis* on Maré clarifies the distribution and status of this species. Although the record is of a single specimen, it shows that earlier reports of *L. frontalis* in the Loyalty Islands were unlikely to be due to error; and makes it more difficult to dismiss the presence of individuals of this species on the Loyalty Islands as having been swept

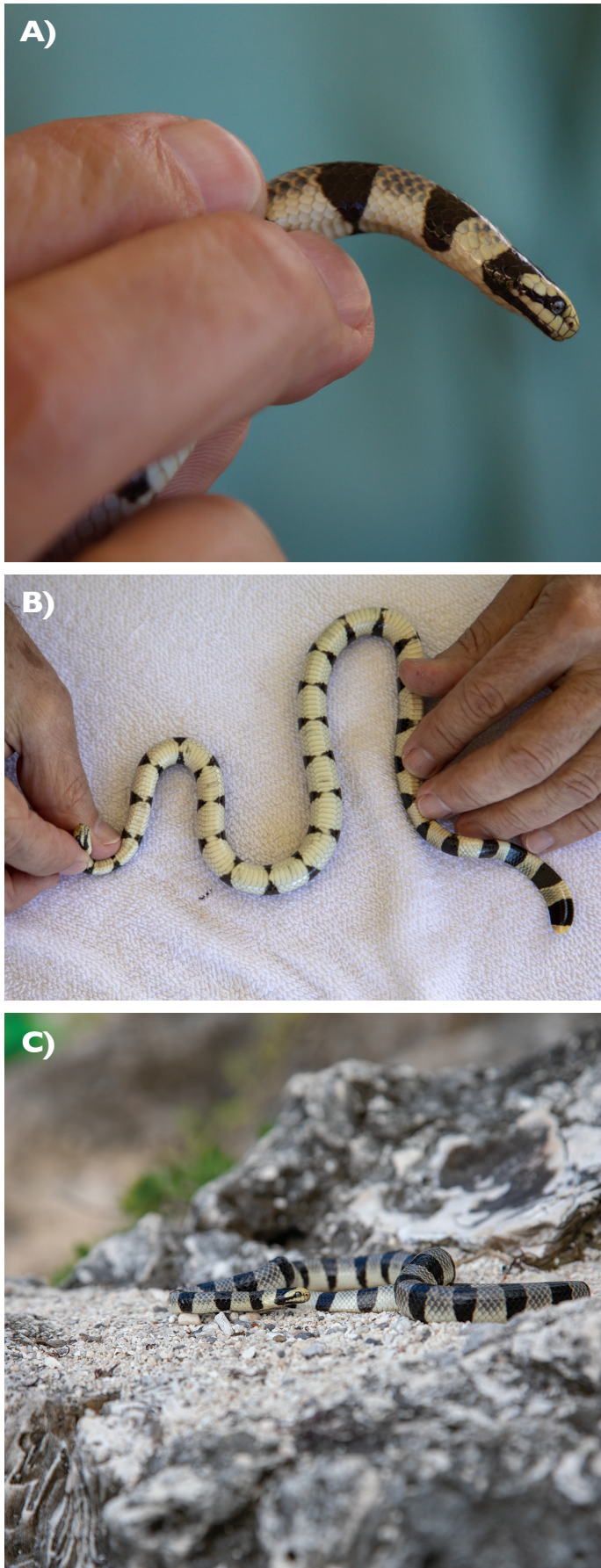


Fig. 3. Adult male *Laticauda frontalis* from Mebuet Bay – (a) anterior body; (b) ventral surface; (c) whole-body photograph. Photographer Terri Shine.

across from Vanuatu by cyclonic conditions. On Vanuatu, *L. frontalis* is less common than is its larger congener *L. colubrina* (Cogger and Heatwole 2006; Shine *et al.* 2002a,b) and the same relative rarity may well hold true on the Loyalty Islands. The low number of museum specimens may say more about sampling effort than about abundance; by comparison, the extensive review by Heatwole *et al.* (2005; their Appendix II) reported only five museum specimens of the widespread *L. saintgironsi* from the Loyalty Islands, but nobody has suggested that these represent occasional storm-swept individuals.

Sampling effort for sea kraits on the Loyalty Islands has been low for at least three reasons. First, the islands are remote from research centres. Second, the main source of museum specimens of seasnakes (commercial trawling) is not carried out in this region because coral reefs would destroy the nets (more generally, the reef-associated habitats of laticaudines render them less vulnerable to trawling than are hydrophiines). Third, there was no incentive for herpetological collectors to target these taxa because the presence of *L. frontalis* was unsuspected. The species was originally described by de Vis (1905) based on a single juvenile specimen, but was relegated to the synonymy of *L. colubrina* by all subsequent authors until the late 1980s (Cogger and Heatwole 2006). Hence, the general consensus during that intervening period was that only a single widespread species of sea krait (then known as *L. colubrina*, but later recognised as *L. saintgironsi*) occurred on these islands. An additional reason for the scarcity of museum specimens is that seasnakes (of all species) are less common on the Loyalty Islands than they are in some parts of Grande Terre and Vanuatu, probably because shallow coral-reef habitats are far less extensive around the Loyalty Islands than around those larger islands. The long timespan for records of *L. frontalis* on Maré (1875 to 2019), and the records from Lifou as well as on Maré, suggest that this species is a valid component of the fauna of the Loyalty Islands, and hence of New Caledonia more generally. Dwarf Sea Kraits may well be rare on the Loyalty Islands, but we doubt that the species' persistence depends on occasional long-distance migrants from Vanuatu, to replenish populations after local extirpation. It seems more likely that these snakes persist as breeding (self-sustaining) populations in the Loyalty Islands, but further sampling is required to test that inference.

The new record also reduces uncertainty about whether or not *L. frontalis* and *L. saintgironsi* warrant recognition as separate species. Several morphological traits differ between the two taxa (Cogger and Heatwole 2006), but genetic analyses reveal <1% sequence divergence (Lane and Shine 2011). In some seasnake lineages, barriers to interspecific hybridisation appear to be weak (Sanders *et al.* 2014), but in this case sympatry without interbreeding shows that the two closely-

related taxa function as separate species (Mayr 2000). That evidence was heretofore unavailable, because the two taxa are largely allopatric: *L. saintgironsi* in New Caledonia versus *L. frontalis* in Vanuatu (Cogger and Heatwole 2006). We now know that these taxa occur sympatrically on Maré. Specific collection localities for *L. saintgironsi* include Pede Bay (A. Lane, pers. comm.), only 7 km from the Mebuet site where we found *L. frontalis*. Slightly further south, *L. saintgironsi* has also been recorded from Medu (spelt “Medou” in Roux 1913). Other specific records of *L. saintgironsi* come from the east coast of Maré (Roux 1913; Bauer and Sadlier 2000) and at scattered sites on the other main islands of the Loyalty Islands (Lifou and Ouvéa: Bauer and Sadlier 2000; Ineich and Laboute 2002). Mark-recapture and telemetric studies on *L. saintgironsi* in New Caledonia have documented very extensive foraging movements, with some individuals moving >30 km over the course of a single feeding excursion (Brischoux *et al.* 2007) and >50 km during ontogenetic dispersal from hatching sites to the islands where the snakes live as adults (Bonnet *et al.* 2015). Given that vagility, it is clear that *L. saintgironsi* is very widely distributed along the reefs of Maré; and hence, that this species must occur in syntopy with *L. frontalis* (in the same way that *L. frontalis* and *L. colubrina* occur in syntopy in Vanuatu: Shine *et al.* 2002a). Thus, snakes of these two species have opportunities for hybridisation, but apparently do not interbreed. Although we have

no data on mechanisms that maintain that interspecific separation, studies on a similar situation showed species-specific responses by males to skin lipids (pheromones) of each species (Shine *et al.* 2002a). Similar divergence in skin chemistry and in cues for male courtship likely underlie the apparent lack of hybridisation between *L. saintgironsi* and *L. frontalis* on Maré.

Lastly, we point out (as have previous authors) that further sampling is needed to reveal the true geographic distribution of seasnakes in this poorly-known region. For example, it remains possible that *L. colubrina*, like *L. frontalis*, occurs in the Loyalty Islands as well as in Vanuatu. If the dwarf species has crossed the deep-water trench between these two island groups (>2000 m deep; Heatwole *et al.* 2005), then perhaps the same is true for its larger congener. That would create an interesting situation, with four sympatric taxa of sea kraits (*frontalis*, *saintgironsi*, *colubrina*, *laticaudata*): more than is known for any other part of the Indo-Pacific. As rising sea levels threaten the biodiversity of Pacific island ecosystems, we urgently need to find out more about the species that depend upon those reef systems.

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