First record of the chocolate shrimp-goby (Gobiidae: Cryptocentrus malindiensis) from Réunion Island with a brief description of its natural habitat

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Ichthyological note – *Note ichtyologique*

First record of the chocolate shrimp-goby (Gobiidae: *Cryptocentrus malindiensis*) from Réunion Island with a brief description of its natural habitat

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Résumé – Premier signalement du gobie de Malindi (Gobiidae : *Cryptocentrus malindiensis*) à La Réunion avec une brève description de son habitat naturel.

Cette note présente le premier signalement du gobie de Malindi *Cryptocentrus malindiensis* (Smith, 1959) à La Réunion, sur la base de preuves photographiques. Un spécimen d'une longueur totale d'environ 7 cm a été photographié à 9:00, le 8 novembre 2012, par 8 m de profondeur, dans une eau à 26°C, sur une coulée de lave préhistorique du Piton de la Fournaise. L'habitat se composait de failles et de surplombs rocheux peu profonds, près de fonds sablo-vaseux basaltiques, avec un recouvrement important des substrats durs par les algues calcaires, les éponges encroûtantes et les hydraires, témoignant sous ces latitudes d'un environnement à faible luminosité. Un envasement significatif, probablement généré par la proximité d'une embouchure de rivière, suggère la présence de conditions hydrodynamiques modérées, qui pourraient être dues à la nature confinée de l'habitat.

Keywords. – Gobiidae - *Cryptocentrus malindiensis* - Réunion Island - Piton de la Fournaise volcano - Rocky reef fish - First record.

Since the late 18th century, fish specimens collected in Réunion and Mauritius islands have been sent to Paris. The most recent exhaustive list of fish species of Réunion included 984 marine and freshwater species belonging to 164 families (Fricke *et al.*, 2009). However, this species richness conceals high sampling disparity among habitats and a more sustained sampling effort of specific habitats would likely lead to many new records. Réunion is one of the few places in the world where volcanic activity is very frequent, with 27 eruptions occurring between 1998 and 2007 and a mean frequency of an eruptive phase every 9 months in the past century (Tanguy *et al.*, 2011). It is also one of few places where lava flows into the ocean on a frequent basis. In this context, the Biolave program was conducted in November 2011 to compile a baseline inventory of marine biodiversity on several lava flows from the Piton de la Fournaise volcano, which were previously virtually unexplored. During these investigations, nine teleost species were recorded for the first time in Réunion (Pinault *et al.*, 2013; 2014)

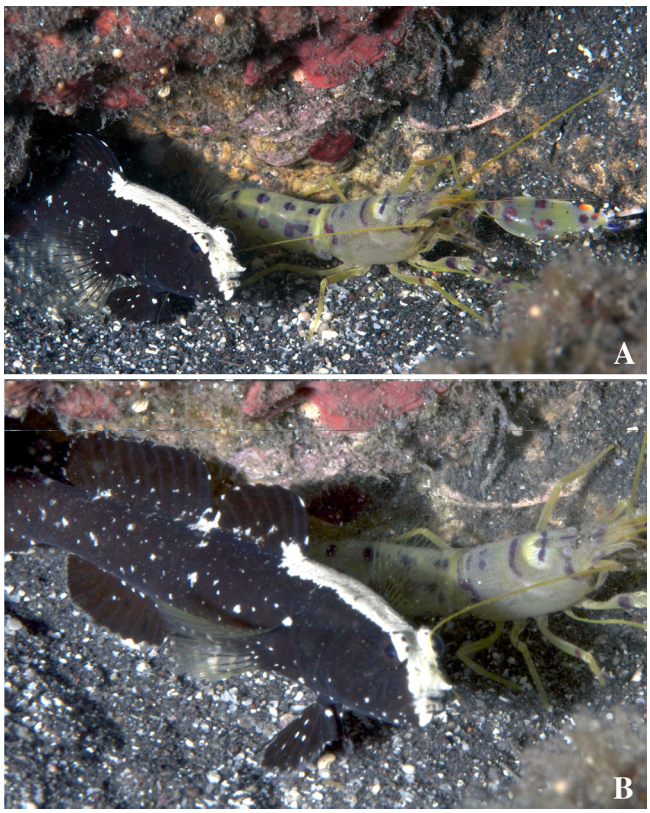

Figure 1. - Association between *Cryptocentrus malindiensis* and the shrimp *Alpheus rubromaculatus* near a lava flow of the Piton de la Fournaise, Réunion Island. **A**: General view; **B**: Close-up.

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but one of them was mistakenly recorded as *Lotilia graciliosa* (Klausewitz, 1960). After studying the identification keys, based on photographs taken during additional fieldwork conducted one year after the Biolave program, this species appeared to be the chocolate shrimp-goby *Cryptocentrus malindiensis* (Smith, 1959) that had not previously been recorded from the island. This study offers a morphological characterization and a brief description of the habitat, based on photographic evidence, of the specimen observed during the new investigations.

MATERIALS AND METHODS

Réunion is an oceanic island of the Mascarene archipelago, which includes Mauritius and Rodrigues, located at 21°06 S and 55°33 E, 690 km east of Madagascar. The west coast has discontinuous stretches of fringing reef for 25 km and is highly urbanized. In contrast, the southeast region, marked by the volcanic activity of the Piton de la Fournaise, is sparsely inhabited. This coast is exposed to trade winds and is further characterized by regular swell, which can sometimes be very strong, particularly during the austral winter, and by widespread runoff and percolation generated by very heavy rainfall (Pinault *et al*., 2015). The shoreline of the most recent lava flows consists of sea cliffs 3-8 m high that continue vertically underwater to depths of between 3 and 5 m. The deeper areas of the flows consist largely of unconsolidated lava boulder, loose rocks and rubble, with the bottom sloping into deep water at an angle of c. 30°.

The Biolave fieldwork was conducted over an eight-day period in late November 2011 (austral summer). Thirty-eight stations at depths ranging from 5 to 35 m were sampled using underwater visual census techniques (UVC) along the basaltic shore of the Piton de la Fournaise according to the methods of Pinault *et al*. (2013). The specimen of *C. malindiensis* that was identified *in situ* as *L. graciliosa* was recorded in shallow-water on a prehistoric lava flow of the volcano, near the Waterfalls Bay area, a few meters offshore of the White Wood river mouth (Pinault *et al*., 2013). During complementary fieldwork, conducted one year after the Biolave program, the specimen described in this study was photographed at 9:00 AM on 8 November 2012 in exactly the same place as in 2011 and identified following Polunin and Lubbock (1977). Proportional body measurements were recorded *ex post*, on photographic basis, to calculate standard length (SL), head length (HL), body depth (BD) and orbit diameter (OD), and presented as percentages of the SL following Polunin and Lubbock (1977).

RESULTS

The photographed specimen was a single cryptic fish, hidden in a burrow during the day, in association with the alpheid shrimp *Alpheus rubromaculatus* Karplus, Szlep & Tsurnamal, 1981. It had an estimated TL of 7.0 cm, a SL of 5.6 cm, a HL of 1.4 cm, a BD of 0.9 cm and an OD of 0.3 cm. The HL was 24.7%, the BD was 16.5% and the OD was 5.7% of SL. The general shape of the specimen was characteristic for the genus *Cryptocentrus* with elongate body form, prominent eyes located high on the head, transverse sensory papillae pattern just visible on cheeks and an oblique mouth with fleshy lips (Fig. 1). The colour was mainly black, with a large white stripe on the face, extending from the chin to the base of the first dorsal fin. There were large white spots at the origin of the second dorsal and pectoral fins and smaller white spots, varying in size, scattered over body, head, pelvic fins and proximal portions of dorsal, caudal, pectoral and anal fins. The second dorsal and caudal fins were mainly dark with white distal margins while the pectoral fins were dark basally, becoming hyaline distally.

The habitat included shallow-water cracks, crevices and rocky overhangs, near basaltic sandy bottoms with a significant percentage of silt and bioclastic rubble. Fish and shrimp were photographed at the entrance of a burrow, which was located at the interface between rocky and sandy substrates. They were very timid and quickly took refuge in the burrow upon the approach of divers. The rocky substrate was covered with calcareous algae, encrusting sponges and hydroids, but without coral. Significant sedimentation suggested the presence of a relatively low wave and current energy, which could be the effect of the confined nature of the habitat, but the shallow location of the habitat, on a rocky coast facing to trade winds, probably exposes it to occasional high swell events.

DISCUSSION

Since its first description on the Malindi coast (Kenya) by Smith in 1959, the species *Cryptocentrus malindiensis*, initially described as *Iotogobius malindiensis*, has been rarely mentioned in the literature. Polunin and Lubbock (1977) provided a detailed description from two specimens collected in the Seychelles. The species may also have been observed or identified from underwater photographs in Sodwana Bay, Aldabra Atoll and Mauritius Island (Larson, 2001). Hoese and Larson (2004) placed the species in the *C. leucostictus* (Günther, 1872) species complex with six other species, all sharing similar colour pattern.

The photographed fish corresponds to the description of the specimens of *C. malindiensis* from the Seychelles by Polunin and Lubbock (1977). In Réunion, the only other congener so far is *C. fasciatus* (Playfair, 1867); however, these two species may be easily distinguished by colour pattern, as *C. fasciatus* lacks the bright white stripe from chin to first dorsal fin, even in the dark-pigmented form (Polunin and Lubbock, 1977). The confusion made by Pinault *et al*. (2013) between *C. malindiensis* and *L. graciliosa* can be attributed to the similarity of the two species from the snout to the base of the pectoral fins and to the frequent association of *L. graciliosa* with *A. rubromaculatus* (Karplus and Thompson, 2011). However, the large round black ocellus edged with orange, present on the first dorsal fin of *L. graciliosa*, is absent in *C. malindiensis* (Larson, 2001) (Fig. 1).

Although the shrimp *A. rubromaculatus* has previously been recorded from Réunion (Poupin, 2008), the association between *C. malindiensis* and *A. rubromaculatus* has not been reported before. Only one photograph from Polack (2003), available in FishBase (Froese and Pauly, 2015), also shows an association between these two species. Association between non-burrowing gobiid fish and burrowing alpheid shrimp was studied by Karplus and Thompson (2011) and characterized as a mutualistic, co-evolved partnership. It is generally believed that the primary function of the goby-shrimp mutualism is to directly reduce the rates of death for both partners (Karplus and Thompson, 2011). From the perspective of the goby, the shrimp provides a burrow within which the fish seeks shelter from predators. Rates of death are also expected to be alleviated for the shrimp as gobies warn shrimp when active outside the burrows of the presence of predators through tactile communication.

This study represents a first brief description of the *C. malindiensis* habitat in Réunion, which can be characterized as shallow, exposed to siltation and relatively low hydrodynamism. The observed benthic organisms indicate a low light environment at

these latitudes (Jameson *et al*., 1998). These environmental conditions may partly explain the recorded rarity of this gobiid species that lives in a little studied habitat. At Réunion, the characteristic species of estuaries and rocky reefs represent only 11.1% and 28.0% of the total species richness respectively (Fricke *et al*., 2009). These low values could be partly due to the sampling effort centred on the west coast of the island that is characterized by the presence of coral reefs. This study confirms that a targeted sampling conducted on the least studied habitats could favour recording of new species for Réunion and possibly for science.

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