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First record of the cryptic fishes *Ptereleotris calliura* (Gobiidae) and *Liopropoma rubre* (Serranidae) from the Veracruz reef system in Mexico

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Abstract

Based on several in situ observations, the species *Ptereleotris calliura* (family Gobiidae) and *Liopropoma rubre* (family Serranidae) are added to the taxonomic fish inventory of the Veracruz reef system, Mexico. While *P. calliura* was found on sandy substratum in the lagoon, *L. rubre* was detected on the reef slope. With their addition, the checklist of reef fishes in the Veracruz reef system is expanded to 479 species. Given these findings, we predict that additional survey efforts (beyond visual transects) will reveal more previously unrecorded species of cryptic fishes in the Veracruz reef system.

Keywords

coral reef system, peppermint basslet, blue dartfish, cryptobenthic fish

Introduction

The Veracruz reef system (Sistema Arrecifal Veracruzano, SAV) is the largest coral-reef system on the continental shores of the southwest Gulf of Mexico (Tunnell Jr et al. 2007). Located off the coast of Veracruz port, Mexico, the SAV comprises 50 reefs and six islands (Liaño Carrera et al. 2019). The SAV was declared as a Marine Protected Area since 1992; in the last official change its cover an area of around 65 ha (Diario Oficial de la Federación 2012). Although interest in the geology and biology of the SAV has increased in the past decades (Granados-Barba et al. 2007), relatively few researchers have explored these reefs compared to the northern Gulf of Mexico and Greater Caribbean. Currently the Veracruz reef-fish assemblage includes 477 species (Del Moral-Flore et al. 2013, Del Moral-Flores et al. 2020, Robertson et al. 2019), including three invasive species; the

lionfish *Pterois* sp. (Santander-Monsalvo et al. 2012), the damselfish *Neopomacentrus cyanomos* (González-Gándara and de la Cruz-Francisco 2014), and the tube blenny *Protemblemaria punctata* (Argüelles-Jiménes et al. 2020).

As the largest continental reef system in the southwestern Gulf of Mexico, the SAV is an important coral reef outpost and the center of an ecological reef corridor in the southwestern Gulf that connects the Sistema Arrecifal Lobos Tuxpan (SALT) to the north and Arrecifes de los Tuxtlas to the south (Ortiz-Lozano et al. 2013). However, the limited connectivity of these reef tracts with other reefs in the Gulf of Mexico and Greater Caribbean has led to the establishment of a fairly unique assemblage of reef fishes at the SAV (Rangel Avalos et al. 2007), which comprises several endemic species such as the cryptobenthic the jarocho goby *Elacatinus jarocho* (Taylor and Akins 2007), the cinta goby *Tigrigobius redimiculus* (Taylor and Akins 2007) and the serranids *Hypoplectrus castroaguirrei* (Flores-Del Moral et al. 2011) and the jarocho hamlet *H. atlahua* (Tavera and Acero 2013).

The majority of biodiversity assessments at the SAV have been performed visually. However, visual census tend to overlook substantial numbers of small-bodied, bottom-dwelling ('cryptobenthic') species (Brandl et al. 2018). Thus, it is likely that increased scrutiny of fish assemblages at the SAV will reveal predominantly cryptic species (Rangel Avalos et al. 2007). During surveys on the reefs and adjacent habitat in 2020, we recorded and visually documented two resident cryptic fish species that had not been previously recorded in the SAV. With these reports, the Veracruz fish assemblage increases to 479 species.

Methods

The Veracruz reef system is divided in two subareas by the outflow of the Jamapa river: 1) the northern reefs, directly off the coast of Veracruz 2) the southern reefs, off the coast of Anton Lizardo. In the southern area of the SAV (Fig. 1), visual, photographic, and video graphic censuses of fishes in the reef lagoon and coral reef areas were carried out using SCUBA diving equipment to maximum depths of 25 m in 2020. All species encountered during those surveys were identified using the Smithsonian Tropical Research Institute's Atlantic fish taxonomic and photographic database and Humann and Deloach (2002).

Results

During these surveys we found two reef-fish species that were not previously recorded in the SAV: *Ptereleotris calliura* (Jordan & Gilbert, 1882) and *Liopropoma rubre* Poey, 1861. With their record the taxonomic listing of fishes in the SAV increases to 479 species.

The species *P. calliura* can be identified by the following characteristics, which are visible to divers: very elongate body, compressed; head strongly compressed; mouth very oblique, opens above, lower jaw projecting, two separate dorsal fins (VI + I, 22-24); caudal fin long

and pointed. Color pattern: bluish-gray to pale lavender head and body and dorsal, anal and caudal fins; caudal fin sometimes with dark upper and lower margins; dorsal fins with a black stripe along outer edge; Fig. 2 shows photographic images of two individuals that confirm the morphological features described for this species.

Two species of the genus *Ptereleotris* are known from the southwest Gulf of Mexico: *P. calliura* and *P. helenae*. Morphologically, the biggest differences between the two are the shape of the caudal fin and coloration. *Ptereleotris calliura* has a long, pointed caudal fin while that of *P. helenae* is oval and shorter. In addition, the dorsal and anal fins of *P. helenae* are greenish-yellow, while *P. helenae* has red borders to the second dorsal and anal fins and the upper and lower edges of the caudal fin are red.

During our surveys we found four individuals of *P. calliura* in the reef lagoon of Cabezo reef, in a depth of 3 m (Fig. 2). The area where these fish were located was dominated by sand and coral rubble; in the vicinity of a seagrass meadow. Each individual was approximately 12 cm in total length (TL) and all sheltered in individual burrows.

The second previously unrecorded species we found was *L. rubre*. It can be identified by the following characteristics: body moderately elongate and compressed; head pointed, with nearly horizontal upper profile; dorsal fin divided to its base between spines and rays; caudal fin slightly concave. Head, body and tail fin yellow-brown, with 5 dark red-brown stripes; tail with 2 joined black, white edged blotches, on the rear edges of upper and lower lobes; rear end of 2nd dorsal fin and anal fin with a black, white-edged blotch. The white edging of the black blotches in the caudal, dorsal and anal fins is confined to the outer part of each blotch and does not completely encircle the blotches

Another species in the same genus that has been previously reported in the taxonomic inventory of Veracruz is *L. carmabi*. The two species differ in their coloration. *L. carmabi* has a yellow head, body and caudal fin, with 4-5 purple, red-edged stripes along the body; the caudal fin has two separate black, blue-ringed ocelli, on each at the rear end of the upper and lower lobes; the 2nd dorsal fin, but not the anal fin has a black, blue-edged ocellus.

Thus, these two species can be easily distinguished by divers as follows: the white-edged black blotches on the tail of *L. rubre* are joined, while blotches in *L. carmabi* form a discrete blue-ringed ocellus on each caudal lobe. In addition, *L. rubre* has a large white-tipped black blotch at the end of the anal fin, which is absent in *L. carmabi* (Fig. 3).

We found a single individual, approximately 5 cm long in a depth of 9 m on the reef slope of Santiaguillo reef. The fish sheltered behind a plate-shaped brain coral *Colpophilia natans* (Houttuyn, 1772), and promptly retreated into the cave formed underneath the plate coral. However, the fish appeared from the cave on two occasions, enabling us to examine, record (Fig. 4) and photograph the individual clearly to determine that it was indeed *L. rubre* and not *L. carmabi* (Fig. 3).

Discussion

The taxonomic fish inventory in the SAV is wide and has increased in the last years (Taylor and Akins 2007, Flores-Del Moral et al. 2011, Del Moral-Flores et al. 2020, Del Moral-Flore et al. 2013, Tavera and Acero 2013, Robertson et al. 2019). However, surveys focused on cryptobenthic reef fishes have not been done (Brandl et al. 2018). The two species included in this note can be considered as cryptobenthic reef fish species (Depczynski and Bellwood 2003). The record of this previously unrecorded fish species in the area denotes the necessity of an urgent survey focused on the smallest vertebrates on the reef. Is important to evaluate the contribution of the cryptobenthic reef fish community in the SAV to understand better the trophodynamics of the system (Depczynski and Bellwood 2003). It has been demonstrated that the cryptobenthic reef fish community plays a critically important role in coral reef ecosystem functioning (Brandl et al. 2019). Also, will contribute to the assessment of microhabitats with which cryptobenthic fishes are associated (Depczynski and Bellwood 2004) and which can be easily perturbed.

The SAV has been perturbed since Spanish colonization (Rodríguez et al. 1992). At the present, it is located next to the second most important trading port in Mexico which has been responsible for most of the deterioration of the reef conditions (Ortiz-Lozano et al. 2013). Furthermore, the study of Brandl et al. (2018) points five anthropogenic disturbances that can affect cryptobenthic reef fishes. The SAV is affected by all of them:

1. harvesting (Jiménez-Badillo 2007, Escamilla-Pérez et al. 2021),
2. invasions (Santander-Monsalvo et al. 2012, González-Gándara and de la Cruz-Francisco 2014, Argüelles-Jiménes et al. 2020),
3. pollution (Horta-Puga and Carriquiry 2014),
4. climate change in a minor way, probably because of the turbid waters reduce levels of irradiance of the Sun (Carricart-Ganivet et al. 2011) and
5. habitat change (Horta-Puga 2003).

It is difficult to estimate the threats that cryptic fishes face in the SAV, based just in visual census, that do not produce reliable estimates of cryptobenthic reef fishes assemblages (Ackerman and Bellwood 2000). This report intendeds to make an invitation to the scientific society to use different sampling strategies that can cover the entire fish community in the reefs of Veracruz and surrounding areas.

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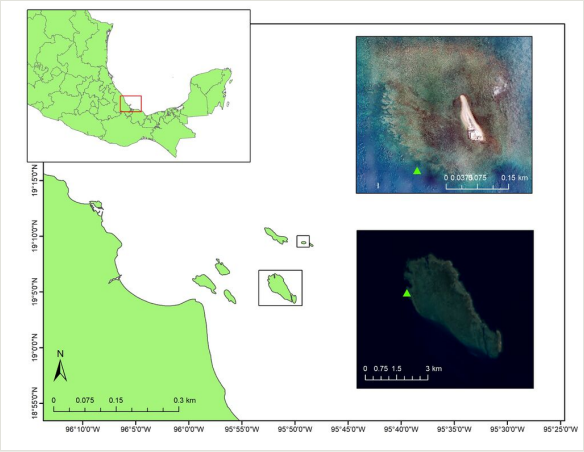

Figure 1.

Southern reefs of the Veracruz reef system. Top right: *Liopropoma rubre* at Santiaguillo reef: 19°08'30.7"N, -95°48'33.5"W. Bottom right: *Ptereleotris calliura* at Cabezo reef: 19^{0}04'47.1"N, -95^{0}52'02.1"W.

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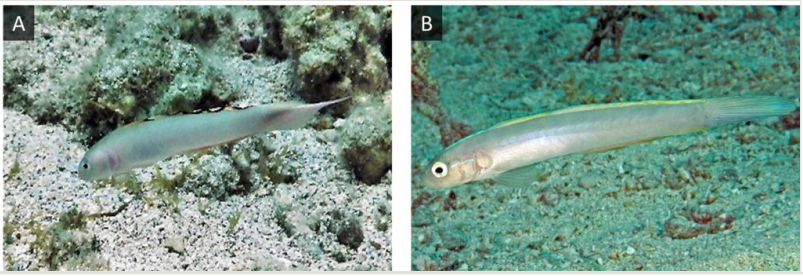

Figure 2.

Ptereleotris spp. **A** *P. calliura* at the reef lagoon of Cabezo reef in Veracruz reef system, Mexico. TL 12 cm, photography by Mariana Rivera-Higueras **B** *P. helenae*, photography by Graham Edgar.

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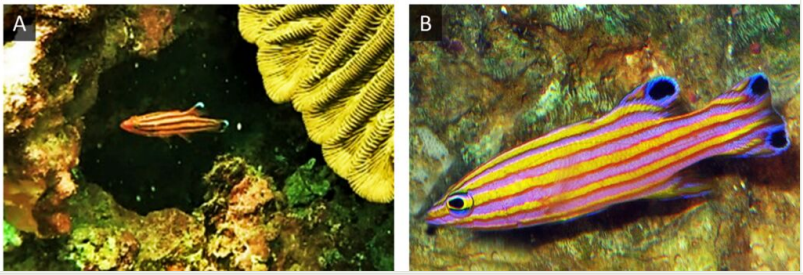

Figure 3.

Liopropoma spp. **A** *L. rubre* in Santiaguillo reef in Veracruz reef system, México. TL 5 cm, photography by Mariana Rivera-Higueras. **B** *L. carmabi*, photography by Ross Robertson.

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Figure 4.

Liopropoma rubre, recorded in Santiaguillo reef in Veracruz reef system, México. Video by Mariana Rivera-Higueras.