

MARINE RECORD

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A new record of the indo-Pacific Whitespotted surgeonfish, *Acanthurus guttatus*, in the eastern tropical Pacific (Isla del Coco, Costa Rica)

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Abstract

Background: *Acanthurus guttatus* is distributed from the Maldives to the Hawaiian Archipelago and the Pitcairn Islands, and as north as Ryukyu Islands and as south as New Caledonia. The only known locality in the Eastern Tropical Pacific is Clipperton Atoll where three vagrant specimens have been observed.

Methods: On June 2016 and April 2017 small groups of *A. guttatus* were observed and photographed during SCUBA diving and snorkeling surveys for touristic suitability at Isla del Coco National Park, Costa Rica.

Results: Six specimens of *A. guttatus* were observed swimming over shallow rocky reefs at Isla del Coco, a volcanic island located in the Eastern Tropical Pacific.

Conclusions: This study represents the first record of *A. guttatus* at Isla del Coco, the second known location of occurrence in the Eastern Tropical Pacific, and the easternmost known range for the Whitespotted surgeonfish.

Keywords: Acanthuridae, Cocos Island, Coral reefs, Costa Rica, East Pacific Barrier, First record, Oceanic island, Reef fish diversity

Background

The East Pacific Barrier (EPB) has long been considered one of the greatest obstructions to the dispersal of marine shallow-dwelling species (Ekman, 1953; Mayr, 1954; Briggs, 1961; Grigg & Hey, 1992; Robertson et al., 2004). This is a large extension of deep-waters arising from the Line Islands (Central Pacific) to Clipperton Atoll (Eastern Tropical Pacific), without any islands or shallow waters for about 4000 km to 7000 km (Ekman, 1953; Briggs, 1961; Robertson et al., 2004). The EPB has been widely acknowledged in contributing to the remarkable differentiation between the fauna from both sides of the Pacific basin (Ekman, 1953; Vermeij, 1987; Emerson, 1982). However, further revisions have found that several taxonomic groups share species distributed at both Indo-Pacific and Eastern Tropical Pacific (ETP) regions: corals (Dana, 1975; Glynn & Wellington,

1983; Cortés, 1986; Grigg & Hey, 1992; Glynn & Ault, 2000), crustaceans (Chase Jr., 1942; Garth, 1965, 1974; Holthuis & Loesch, 1967; Wicksten & Hendrickx, 2003), mollusks (Emerson, 1967, 1978, 1982; Vermeij, 1987), echinoderms (Nishida & Lucas, 1988; Lessios et al., 1996) and fishes (Rosenblatt et al., 1972; Briggs, 1974; Leis, 1983; Robertson et al., 2004; Robertson & Allen, 2015).

Isla del Coco (also known as Cocos Island) is one of the five oceanic islands in the ETP and is widely recognized as a hotspot of marine biodiversity (Cortés, 2008, 2012, 2016). It is also considered one of the most effective and successful Marine Protected Areas worldwide, due to its isolation, extension, degree of enforcement, time since creation and a complete ban on fishing activities (Edgar et al., 2014). The fish fauna had been extensively studied since Garman (1899), and then by several expeditions and studies (see Fourrière et al., 2016). Recent contributions on fish fauna knowledge of Isla del Coco are Bussing and López (2005, 2009), Garrison (2005), and Cortés (2012). The most updated and detailed list of the fish species for

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Isla del Coco was provided by Fourrière et al. (2016), who reports 514 species. The island and its surrounding waters support ~ 39% and ~ 56% of the reported fish species for the ETP and Costa Rica, respectively (Cortés, 2012; Robertson & Allen, 2015; Fourrière et al., 2016).

The Indo-Pacific Whitespotted surgeonfish, *Acanthurus guttatus* Forster, 1901, is widely distributed in the Indo-Pacific region at the Hawaiian Archipelago, Pitcairn Islands, to the west to the Maldive Islands, Chagos Archipelago, Mascarenes, Seychelles, to the north to the Ryukyu Islands, south to the Great Barrier Reef, Australia and New Caledonia (Abesamis et al., 2012; Fig. 1), occurring mainly in the surge zone of clear seaward reefs (Lieske & Myers 1994). This specie was reported for the first time in the ETP at Clipperton Atoll, the only known location for this species in the ETP (Bearez & Séret, 2009; Fourrière et al., 2014). The present report details the first record of *A. guttatus* in Isla del Coco, a new location of this species in the ETP, and the easternmost extension of the species.

Methods

A total of six specimens of *A. guttatus* were observed at two different locations in Isla del Coco during different times. Two specimens were observed on June 13th 2016 at 16:04 h during a scuba-diving survey, 5–8 m depth, at El Arco (5°31'53.22"N; 87°01'37.86"W) located on the east side of Isla del Coco (Fig. 1). A video was recorded showing the two specimens. A grab from the video is shown in Fig. 2a. Four specimens were observed swimming together during a snorkeling survey at 4 m depth on April 12th 2017 at 09:20 h at Bahía Porites (5°31'33.96"N;

87°05'32.28"W) in the west side of Isla del Coco (Figs. 1 and 2b). The sites were characterized as shallow rocky reefs next to coral reef areas dominated by *Porites lobata* (Dana, 1846). The identification was made following Robertson and Allen (2015), and corroborated by Ross Robertson, Smithsonian Tropical Research Institute, Panamá.

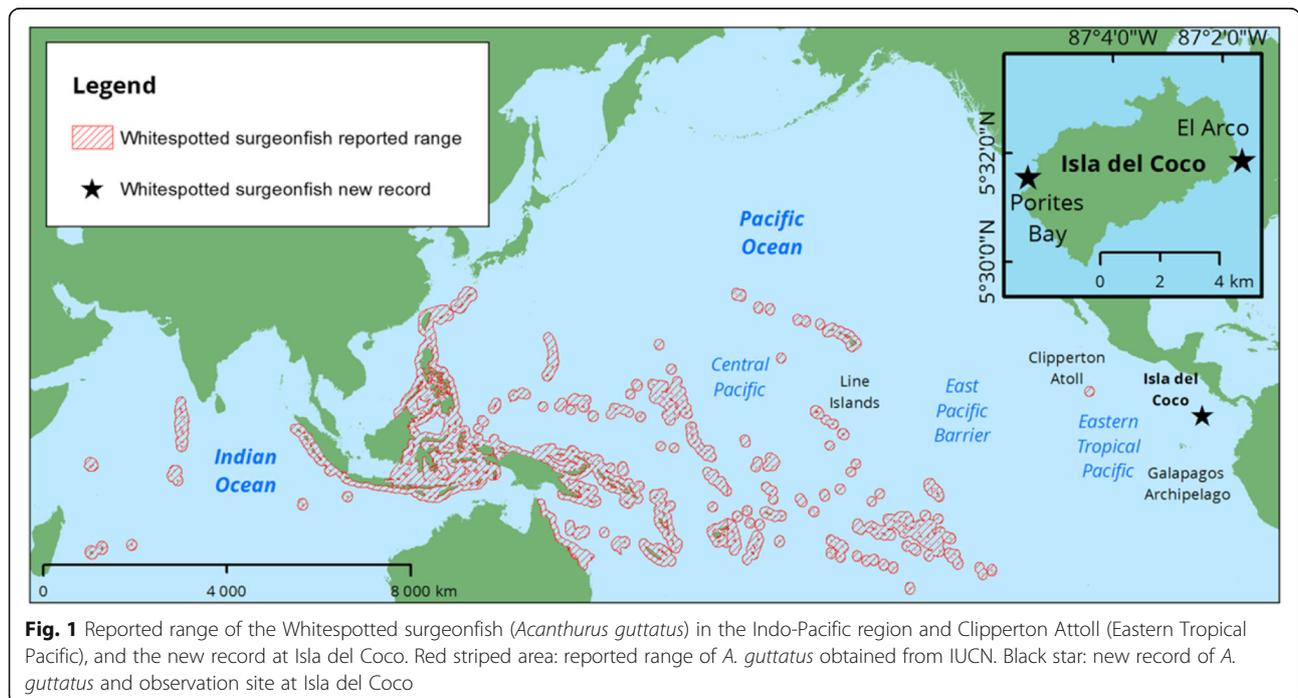
Results

A total of six Whitespotted surgeonfish specimens had been sighted at Isla del Coco between 2016 and 2017. In the first sighting, the two individuals were swimming in a shallow rocky reef, together with other species, *Anisotremus interruptus* (Gill, 1862), *Paranthias colonus* (Valenciennes, 1846) and *Prionurus laticlavus* (Valenciennes, 1846).

The observed fishes and the photographs display the morphological characteristics that allow the identification of this reef fish (Fig. 2). These characteristics are: an oval-shaped gray body with two white bars, and many little white spots on the posterior body, as described by Robertson and Allen (2015). These characteristics differentiate *A. guttatus* from other similar surgeonfishes occurring in the ETP such as *Acanthurus achilles* (Shaw, 1803), *Acanthurus nigricans* (Linnaeus, 1758), *Acanthurus triostegus* (Linnaeus, 1758), *Acanthurus xanthopterus* (Valenciennes, 1835), and *Ctenochaetus marginatus* (Valenciennes, 1835).

Discussion

This report represents the easternmost recorded range of *A. guttatus* (Fig. 1). Previous to this record, Clipperton Atoll was the easternmost known range (Bearez &



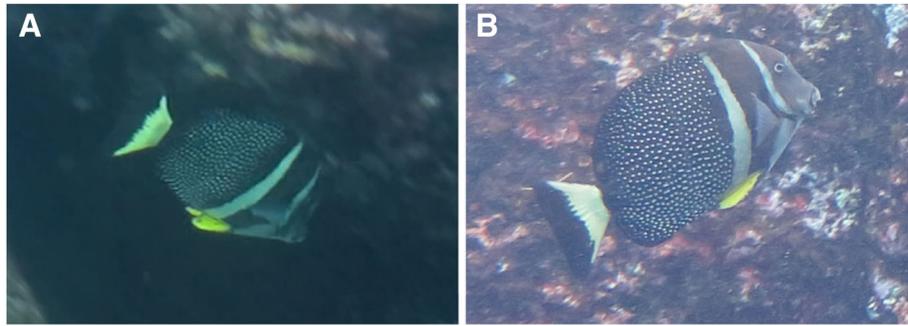


Fig. 2 *Acanthurus guttatus* observed swimming at Isla del Coco, Eastern Tropical Pacific. **a** Grab from a video featuring *A. guttatus* at El Arco (5–8 m depth), June 13th 2016. **b** Photograph of *A. guttatus* at Porites Bay (4 m depth), April 12th 2017. Credits: Fig. 2a Marta Cambra, and 2B Roberto Cubero

Séret, 2009; Fourrière et al., 2014, Fig. 1), where three adults were observed (one collected) in March 2005. This species was not previously observed at Clipperton Atoll during two expeditions in 1994 and 1998, and is considered a vagrant in the ETP (Robertson & Allen 2015). Before being recorded in the ETP, *A. guttatus* eastward range was the Hawaiian Archipelago and Pitcairn Islands (Abesamis et al. 2012; Fig. 1).

This study represents a new record for Isla del Coco and a novel addition to its coral reef fish diversity. *Acanthurus guttatus* was not previously recorded during recent expeditions and studies on the fishes of Isla del Coco (Busing & López, 2009; Cortés, 2012; Friedlander et al., 2012; Alvarado et al., 2016; Fourrière et al., 2016). An analysis of completeness of the fish inventory at Isla del Coco showed that about 93.7% of the fish species richness is known, and therefore, around 20 species are still to be discovered (Fourrière et al., 2016). The Whitespotted surgeonfish is a remarkable and conspicuous reef fish, and it is hardly probable that it was present during previous fish surveys. Therefore, we suggest that *A. guttatus* is probably a recent vagrant at the island.

Acanthuridae is considered among the tropical fish families with high proportion of vagrant species (Feary et al., 2013). Briggs (1961) reported four species of surgeonfish with a transpacific distribution. Genetic connection studies of two surgeonfish species and 18 other transpacific species, also indicate that EPB is sporadically permeable (Lessios & Robertson, 2006). Further revisions have revealed that from the 13 species of Acanthuridae reported at the ETP, 11 have a transpacific distribution (Robertson et al., 2004; Bearez & Séret, 2009; Robertson & Allen, 2015).

Larval duration is thought to play an important role in species dispersal ability (Lester and Ruttenberg, 2005). The spiny acronurus larvae of some surgeonfish have pelagic larval durations up to >100 days (Briggs, 1961; Robertson et al., 2004). Several studies had demonstrated the high dispersal ability of the genus *Acanthurus* (Eble et al., 2011, DiBattista et al.

2016). We suspect that the specimens observed in Isla del Coco may have crossed the East Pacific Barrier during early stages of development.

Oceans currents can have a strong influence on population connectivity (White et al. 2010). Isla del Coco is located at an area seasonally influenced by the Pacific North Equatorial Countercurrent (NECC) from May to October, which intensifies during El Niño phenomena (Lizano, 2008). A stronger Pacific NECC can enhance the eastward dispersal of marine larvae, including those of tropical reef fishes (Glynn & Ault, 2000; Robertson, 2001; Hickman, 2009; Acuña-Marrero & Salinas-De-León, 2013). Craig (2008) associated eastward dispersal of a surgeonfish species from the western Indian Ocean to Chagos via direct larval transport during El Niño phenomena. A strong El Niño 2014–2016 event, known as El Niño Godzilla, was a 14 month warming of the Pacific Ocean (Kintisch, 2016). We suggest that the vagrant *A. guttatus* found at Isla del Coco in June 2016 and April 2017 were most likely transported as larvae from the Indo-Pacific region to the ETP by a strong Pacific NECC during El Niño Godzilla. Further records at Clipperton Atoll and Isla del Coco, along with genetic analyses could reveal the precedence of the specimens at Isla del Coco.

Conclusions

This finding increases the reported reef fish diversity at Isla del Coco and reveals an eastwards expansion of *A. guttatus* geographical range of distribution. This indicates that the Eastern Pacific Barrier (EPB) is permeable to occasional migrations, particularly from west to east, likely due to strong El Niño events which magnify the action of the Pacific NECC. Given that this species has not been recorded in Clipperton Atoll since 2005 and that there is no evidence of reproductive populations in the ETP, we propose that *A. guttatus* is considered a

vagrant species in Isla del Coco, until reproductive populations are observed.

Acknowledgements

We are very grateful to Área de Conservación Marina Isla del Coco (ACMIC) for all their support during the fieldwork of this study. We thank Ross Robertson for the corroboration of the species. We would like to thank Jorge Cortés and Marco Corrales-Ugalde for their comments on the manuscript. We are grateful to the IUCN Red List and Instituto Tecnológico de Costa Rica for providing the geographic information of the *A. guttatus* known distribution and the Costa Rican territory, respectively.

Funding

The surveys were possible with the financial support of Área de Conservación Marina Isla del Coco (ACMIC).

Availability of data and materials

Not applicable.

Authors' contributions

MC, RC and IC performed the monitoring dives which conduct to the finding the new record. MC and RC took the photographs of the specimens and identified the species. JCAS prepare the figures and the map. All authors contributed to draft, read and approve the final manuscript.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Received: 8 January 2018 Accepted: 22 March 2018

Published online: 10 April 2018

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