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Occurrence of the rough eagle ray *Aetomylaeus asperimus* (Chondrichthyes: Myliobatidae) along the north Pacific coast of Costa Rica

Presencia de la raya águila de piel áspera *Aetomylaeus asperimus* (Chondrichthyes: Myliobatidae) en la costa del Pacífico Norte de Costa Rica

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ABSTRACT

Almost 25% of skates and rays' information worldwide is insufficient to assess their extinction risk. We reported the first seven confirmed records of the rough eagle ray (*Aetomylaeus asperimus*) along the north Pacific coast of Costa Rica. These findings suggest that encounters with this species are rare, possibly associated with oceanographic patterns. More information is needed to make accurate assumptions on the species' abundance, ecology, and conservation needs.

Keywords: Conservation, data deficient, elasmobranchs, range extension, Eastern Tropical Pacific

RESUMEN

A nivel mundial, casi el 25% de los batoides carece de información suficiente para evaluar su riesgo de extinción. Se reportan los primeros siete registros confirmados de la raya águila de piel áspera (*Aetomylaeus asperimus*), en la costa del Pacífico Norte de Costa Rica. Se sugiere que la presencia de *A. asperimus* es rara, posiblemente asociada con patrones oceanográficos.

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Se necesita más información para poder evaluar la abundancia, la ecología y las necesidades de conservación de la especie.

Palabras clave: Conservación, especie con datos deficientes, elasmobranquios, extensión de rango, Pacífico Oriental Tropical

INTRODUCTION

The genus *Aetomylaeus* Garman 1908 is one of the two extant genera (together with *Aetobatus*) of the eagle ray family Myliobatidae (Last *et al.* 2016). Once considered a third genus for the family, *Pteromylaeus* is currently considered a junior synonym of *Aetomylaeus* (Aschliman, 2014; White, 2014; Last *et al.* 2016). This genus includes seven extant species, six broadly distributed along the Western Indian Ocean and Indo-West Pacific, and one species (*Aetomylaeus asperrimus* Gilbert, 1898) reported for the Eastern Pacific (Last *et al.* 2016; White *et al.* 2016).

The rough eagle ray (*A. asperrimus*) primarily inhabits demersal soft bottoms in tropical coastal waters, where it presumably feeds on hard-shelled and bottom-dwelling invertebrates (Last *et al.* 2016). Its distributional range is still unclear and currently derives entirely from country or region-wide taxonomic checklists and identification guides. The species is listed as Data Deficient (DD) under IUCN Red List criteria, because current information is inadequate to assess extinction risk based

on distribution and population status (Valenti & Kyne, 2016).

The presence of the species had been reported in taxonomic checklists from Mexico (Castro-Aguirre & Espinosa-Pérez, 1996; Ehemann *et al.* 2018), Panama (McEachran & Notarbartol di Sciara, 1995), and Galapagos (Grove & Lavenberg, 1997). Consequently, it was expected to occur from Mexican waters to northern Peru (Castro-Aguirre & Espinosa-Pérez, 1996; Bussing & López, 2009; Espinoza *et al.* 2018; Robertson & Allen, 2015; Weigmann, 2016; Ehemann *et al.* 2018). However, Panama is the only country where a specimen had been actually described (*type specimen*: female, 79 cm disc width). Our observations represent the first records for this species in Costa Rica.

MATERIALS AND METHODS

Sightings of *A. asperrimus* were video recorded during apnea dive surveys in the Gulf of Santa Elena, specifically at “La Cornuda” (11° 33' N, 85° 41' W) in April 2015 and December 2017, and in the Gulf of Papagayo, specifically at “Punta Naranja” (10° 33' N, 85° 41' W) in September

2019, both sites located in the northern Nicoya Peninsula (Fig. 1). Additional specimens were opportunistically caught during bull shark (*Carcharhinus leucas*) fisheries independent surveys in front of the mouth of the Bongo River ($9^{\circ} 44' \text{ N}$, $85^{\circ} 14' \text{ W}$), in the Marine Protected Area of the Caletas-Arío National Wildlife Refuge (NWR) (Fig. 1), Southern Nicoya Peninsula, between March 2017 and August 2019. The fishing gear was rigged to catch bull sharks and consisted of a 250-300

m mainline built with 4 mm braided nylon rope, set at the bottom at $\sim 8\text{-}12$ m depth. Every 6 to 8 m a gangion with a hook was clipped to the mother line. Gangions consisted of 1 m of monofilament line (2 mm) and a 45 cm extension of stainless-steel wire leader, to which circle hooks (no.14 and 15, 10° offset) were attached. Hooks were baited with frozen sardine (*Clupeidae*) and skipjack tuna (*Katsuwonus pelamis* Linnaeus, 1758). Rough eagle ray specimens caught were measured

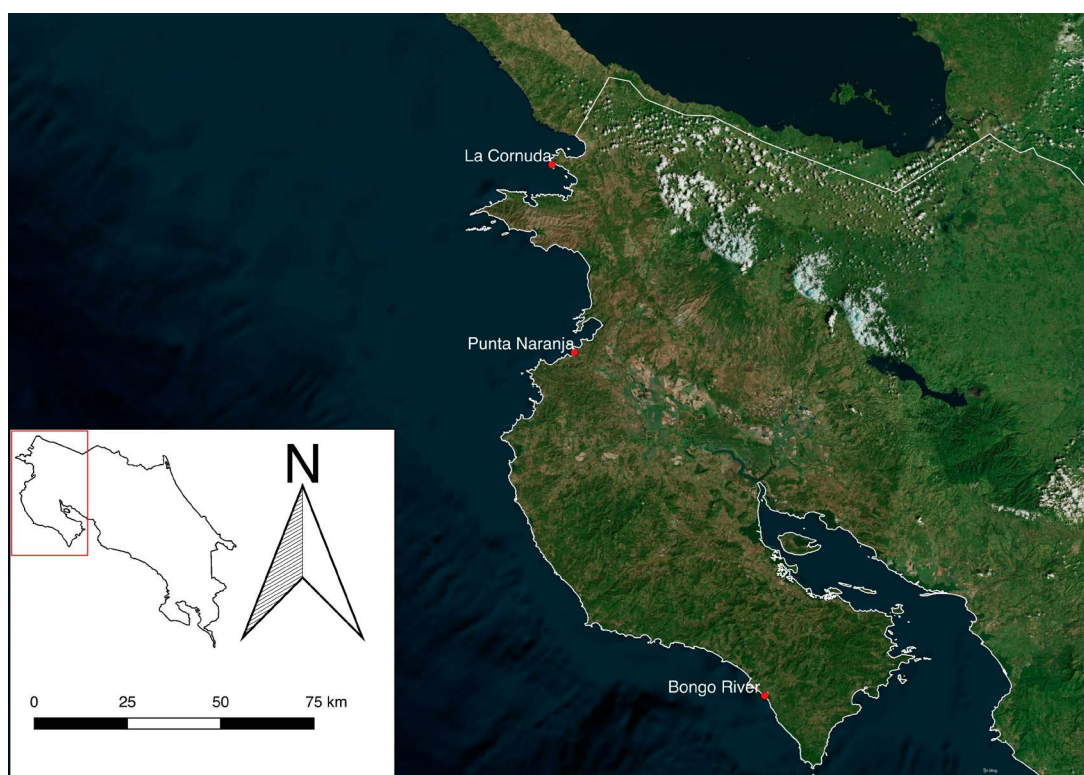


Fig. 1. *Aetomylaeus asperimus* sighting locations in the north Pacific coast of Costa Rica

Fig. 1. Lugares de avistamientos de *Aetomylaeus asperimus* en la costa del Pacífico Norte de Costa Rica

(Disc Width, or DW), sexed, and photographed. Species identification was based on morphological characteristics described in the literature (e.g., Last *et al.* 2016).

RESULTS

Seven rough eagle rays were reported along the North Pacific coast of Costa Rica, from April 2015 to August 2019 (Table 1). Three individuals were observed during apnea diving activities in coastal waters of the Gulfs of Santa Elena and Papagayo in April 2015, December 2017, and July 2019. The individuals were observed actively

swimming about 5 - 8 m above a sandy and coarse sandy-gravel bottom (Fig. 2). Four additional individuals, two females and two males, were caught and released at the mouth of the Bongo River (Fig. 3). The specimens caught measured between 69-150 cm of DW (Table 1). The morphological identification of the specimens was evident by inspecting the disk from a dorsal view, with its distinctive brownish to greyish coloration, including the distinctive 7-9 white band pattern on the front end of the disk, and numerous white spots, mostly in the back end of the disk (Fig. 2 and 3).

Table 1. *Aetomylaeus asperimus* specimens reported along the North Pacific coast of Costa Rica

Cuadro 1. Individuos de *Aetomylaeus asperimus* reportados a lo largo del Pacífico Norte de Costa Rica

Date	Region	Specific Location	Sex	DW (cm)	Habitat type	Method	Type of evidence
April 1, 2015	Gulf of Santa Elena	La Cornuda	ND	150*	Rocky reef with sandy-gravel bottom	Apnea diving	Video footage
March 23, 2017	Caletas-Arío NWR	Bongo River mouth	F	ND	Sandy-mud bottom	Research fishing	Direct observation
December 14, 2017	Gulf of Santa Elena	La Cornuda	ND	100*	Rocky reef with sandy-gravel bottom	Apnea diving	Direct observation
August 1, 2019	Gulf of Papagayo	Punta Naranja	ND	ND	Sandy bottom	Apnea diving	Video footage
July 4, 2019	Caletas-Arío NWR	Bongo River mouth	M	69	Sandy-mud bottom	Research fishing	Photo
July 5, 2019	Caletas-Arío NWR	Bongo River mouth	M	72	Sandy-mud bottom	Research fishing	Photo
August 10, 2019	Caletas-Arío NWR	Bongo River mouth	F	90	Sandy-mud	Research fishing	Photo

*Estimated size from video; DW= Disc Width; F=Female; M= Male; ND= Not determined.

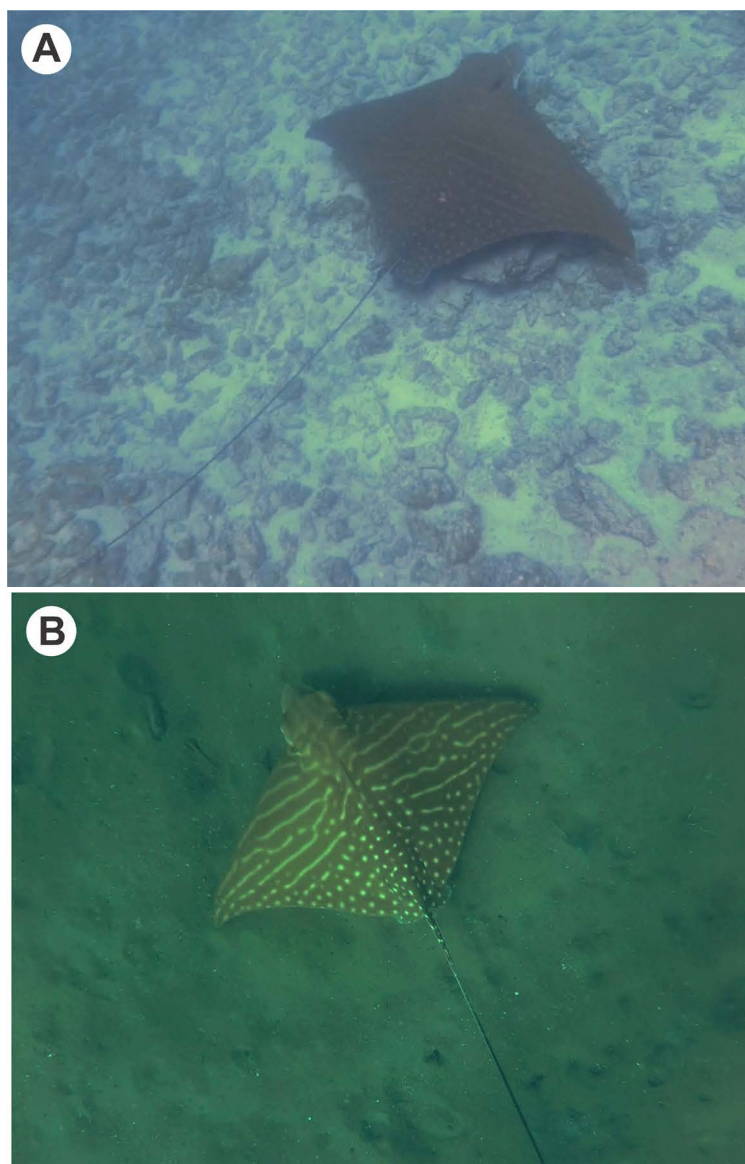


Fig. 2. Dorsal view photographs of two *Aetomylaeus asperrimus* specimens, recorded at (a) La Cornuda, a rocky reef in the Gulf of Santa Elena, April 2015; and (b) Punta Naranja, a sandy beach in the Gulf of Papagayo, July 2019

Fig. 2. Vista dorsal de dos especímenes de *Aetomylaeus asperrimus* registrados en (a) “La Cornuda”, un arrecife rocoso en el Golfo de Santa Elena, abril de 2015; y (b) “Punta Naranja”, una playa de arena en el golfo de Papagayo, julio de 2019

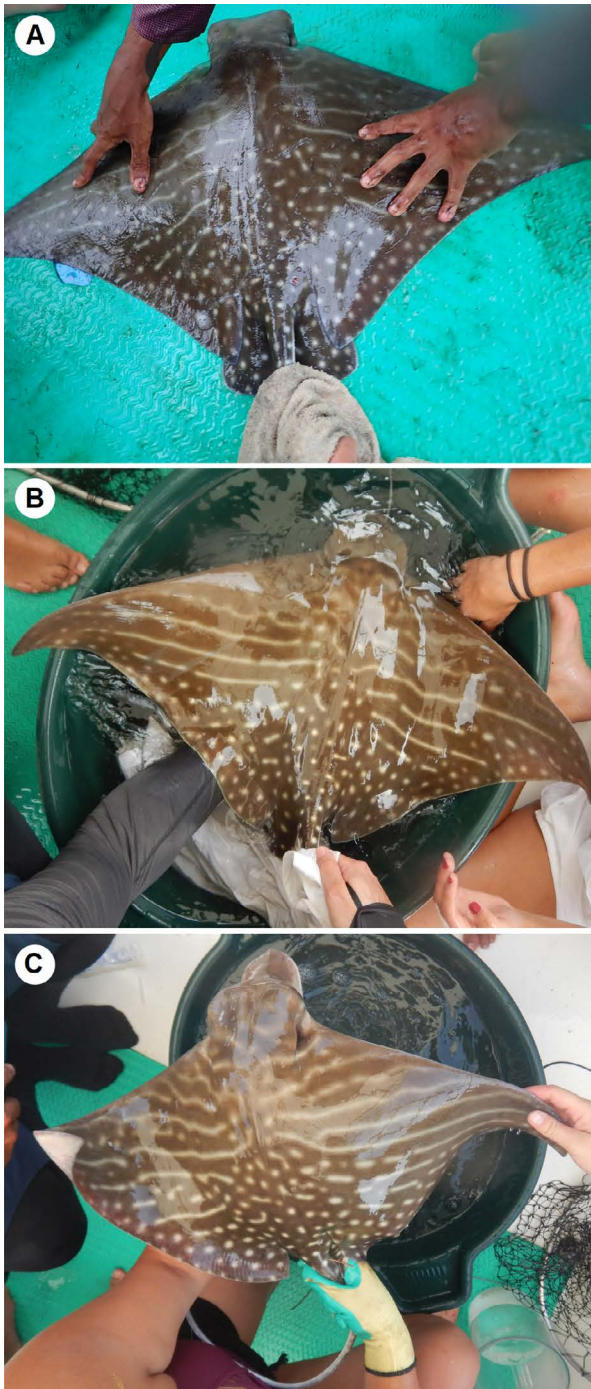


Fig. 3. Dorsal view photographs of the three *Aetomylaeus asperrimus* specimens caught in front of the mouth of the Bongo River during bull shark *Carcharhinus leucas* research surveys (a) female 90 cm disc width (DW), August 2019; (b) male 69 cm DW, July 2019; (c) male 72 cm DW, July 2019

Fig. 3. Vista dorsal de tres especímenes de *Aetomylaeus asperrimus* capturados frente a la desembocadura del río Bongo durante los estudios de investigación del tiburón toro *Carcharhinus leucas*. (a) hembra de 90 cm de ancho de disco (DW), agosto de 2019; (b) macho de 69 cm DW, julio de 2019; (c) macho de 72 cm DW, julio de 2019

DISCUSSION

Assumptions regarding the distribution and habitat use of species listed by the IUCN as DD, such as the rough eagle ray, are often based on information regarding congeneric species (Sievers *et al.* 2019). Deficient information on this species' biology, distribution range, and population trends, as well as on the impact of its incidental catch and induced mortality in commercial fisheries, could limit the adequate management and implementation of conservation measures for the species. In Costa Rica, almost half (41%) of the 99 chondrichthyan species reported are cataloged as DD (Espinoza *et al.* 2018). Further research on these DD species is urgent, especially considering the biological traits that they share as elasmobranchs (long-lived, late maturity, low fecundity) that make them so vulnerable to anthropological impacts (i.e., habitat degradation, trawling, and longline fisheries), particularly coastal elasmobranch species (Dulvy *et al.* 2014; Espinoza *et al.* 2018), such as the rough eagle ray.

The three locations where the species was reported in Costa Rican waters (Gulf of Santa Elena, Gulf of Papagayo and the mouth of the Bongo River) are located near artisanal fishing communities that target demersal fish with bottom longlines, which considerably increases their rate of

interaction with them. Because domestic consumption and trade of ray species is not common in Costa Rica, fishers were persuaded to release incidentally caught rays on-site at no expense to the operation.

The presence of a rough eagle ray was confirmed in the Gulf of Santa Elena in April 2015, following a lead provided by a local fisher, who observed "a distinguishably large, brown eagle ray with a huge head" in March of that same year. Due to the numerous white spots present on the back end of the disc, *A. asperimus* could be easily confused with the spotted eagle ray *Aetobatus laticeps* Gill, 1865 (Grove & Lavenberg, 1997). Nevertheless, fishers in this area that target octopus in La Cornuda (Gulf of Santa Elena) all year round claim to have never seen this species before 2015. In addition, the well-known diver Carlos Hiller (resident of the nearby coastal community of Playas del Coco), who provided the video footage of the sighting at Punta Naranja, had never personally seen this species before. These claims suggest that reports of the rough eagle ray in coastal habitats of Costa Rica are rare and are possibly associated with changes in oceanographic patterns such as El Niño-Southern Oscillation (ENSO). ENSO events occur at variable year intervals (usually 2 to 7 years). During these events, the conditions in the Eastern Tropical Pacific change, affecting a variety of

marine species and ecosystems (Fiedler, 2002). Although ENSO effects have been documented on corals, birds, sea turtles, and pinnipeds across the Eastern Tropical Pacific (Trillmich & Limberger, 1985; Valle *et al.* 1987; Saba *et al.* 2007; Romero-Torres *et al.* 2020; Martínez-Castillo *et al.* 2022), the potential impact of ENSO on elasmobranchs has not been sufficiently studied. Further data about the species' presence through time is required to evaluate this assumption. Nonetheless, more information regarding the local and regional status of the rough eagle ray, along with its distributional range in the Eastern Pacific Ocean, is needed to make more accurate assumptions on the species' abundance, ecology, and conservation needs in Costa Rica.

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Supporting information

The supporting video taken from the encounter is available for viewing at:

<https://youtu.be/a7KKIYGUnSQ>