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Anthopleura mariscali outside the  
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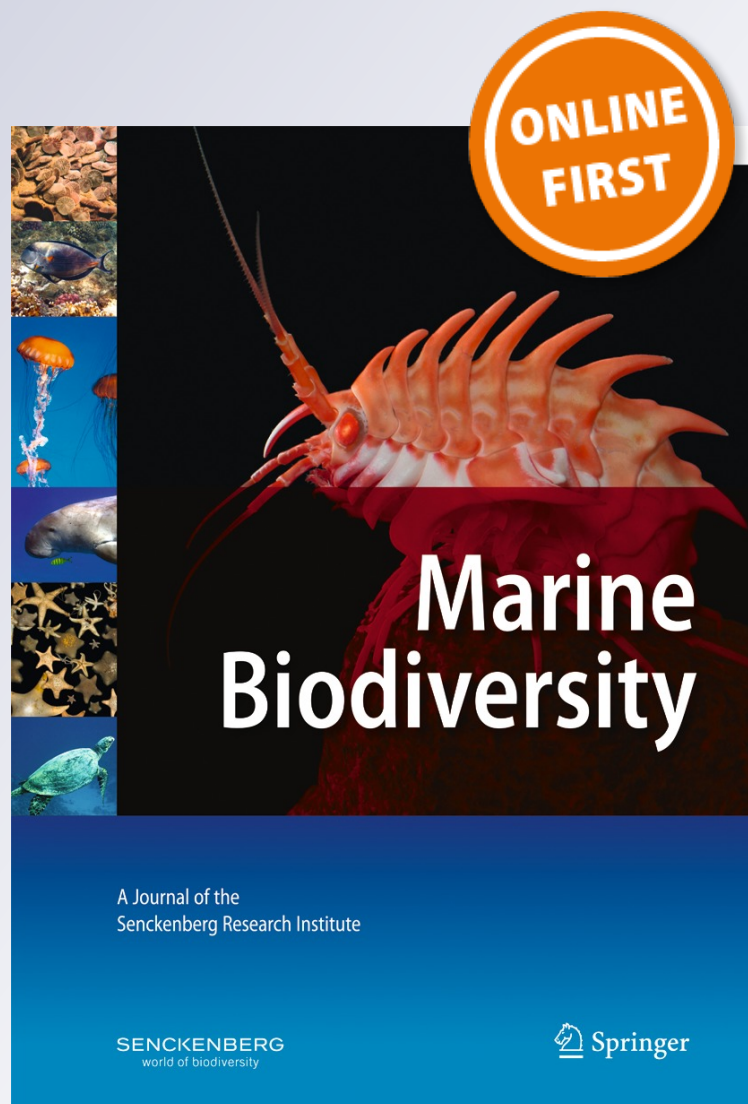
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# First record of the sea anemone *Anthopleura mariscalii* outside the Galápagos Archipelago

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**Abstract** The sea anemone *Anthopleura mariscalii* Daly and Fautin 2004 is described as an endemic species of the Galápagos Archipelago. Its authors suggested that it may have been overlooked elsewhere because of its small size and because it is usually found inside cracks and crevices. This report presents the first record of *A. mariscalii* outside its type locality. Eight specimens were collected from a rocky promontory in Playa Agujas, Puntarenas, on the Pacific coast of Costa Rica. Analyses of their cnida composition are presented along with images of some live sea anemones.

**Keywords** Actiniidae · Central America · Costa Rica · Pacific coast · Sea anemone

## Introduction

*Anthopleura* is a genus of sea anemones (Hexacorallia, Actiniaria) comprising 45 valid species, 12 of which

are distributed throughout both coasts of the Americas (Fautin 2013). *Anthopleura dowii* Verrill, 1869, *A. elegantissima* (Brandt, 1835), *A. nigrescens* (Verrill, 1928), and *A. xanthogrammica* (Brandt, 1835) have been reported on the Pacific coast of Central America (Daly 2004; Acuña et al. 2013; Fautin 2013). *Anthopleura mariscalii* was first described from the Galápagos Archipelago (Daly and Fautin 2004) and has not subsequently been recorded anywhere else. Here, we extend the distribution of this species to the Pacific coast of Central America, about 1300 km to the northeast.

## Materials and methods

Eight specimens of *A. mariscalii* were collected from a rocky promontory in Playa Agujas, Puntarenas, on Costa Rica's Pacific coast (9°43'47"N, 84°39'00"W). Specimens were collected during a low tide on 25 March 2012 from pools and crevices in the upper intertidal zone. The intertidal zone at the collection site was colonized by filamentous algae, patches of encrusting coralline algae, several species of gastropods, zoanths, and large numbers of *A. nigrescens*. The *A. mariscalii* specimens were removed from the rocky substrate and transported live in seawater to the laboratory at the Centro de Investigación en Ciencias del Mar y Limnología (CIMAR) of the Universidad de Costa Rica, where they were placed in a small aquarium and photographed. Specimens were then placed in a jar, fixed with 5 % formalin and later preserved in 70 % alcohol. Permanent fixed slides of tentacle, acrorhagus, column, actinopharynx, and mesenterial filament tissue from four of the specimens were prepared

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(see Yanagi 1999; Häussermann 2004). Species identification was based on the cnida composition and description given in Daly and Fautin (2004). Cnidae were observed at a magnification of  $\times 1000$  and measurements of cnida length were made with Leica Application Suite X 1.9 software. Cnida nomenclature follows England (1991). The specimens were deposited in the Museo de Zoología of the Universidad de Costa Rica (MZUCR-2431).

## Results

### Systematics

#### Order Actiniaria

Suborder Nynantheae Carlgren, 1899

Infraorder Thenaria Carlgren, 1899

Superfamily Actinioidea Rafinesque, 1815 (~Endomyaria Stephenson, 1921)

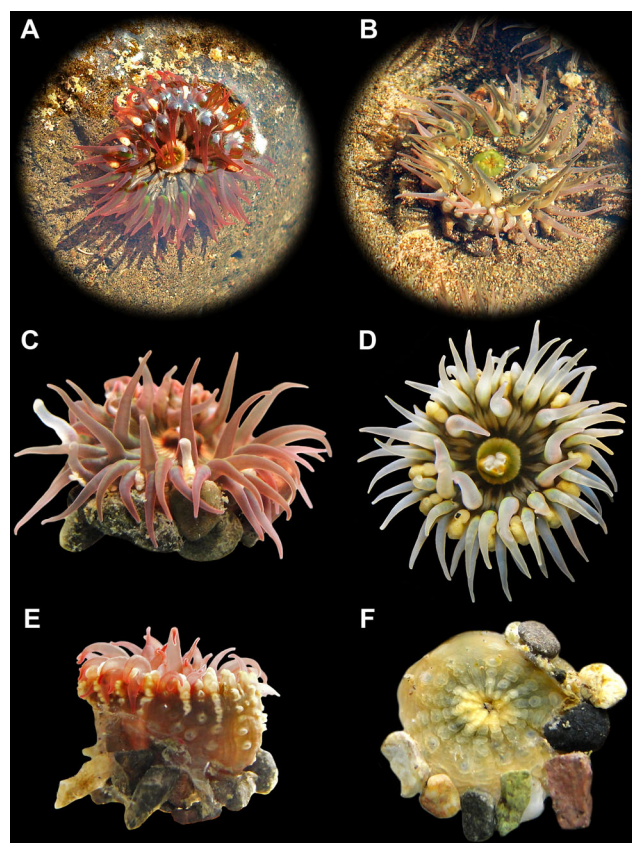
Family Actiniidae Rafinesque, 1815

Genus *Anthopleura* Duchassaing de Fombressin Michelotti, 1860

*Anthopleura mariscali* Daly and Fautin 2004

### Description

Oral disk dark brown to black, with patches of radial white stripes in some specimens (Fig. 1). Mouth elevated on an oral cone in the center of the disk. Mouth is the same color as the oral disk or is surrounded by a white disk that becomes greenish towards the actinopharynx, which is white. Tentacles arranged in three cycles, with faint white spots of variable size and a longitudinal green stripe that usually extends onto the oral disk. Two color variants were observed: one with only red tentacles and another with gray tentacles in the two inner cycles and tentacles with a pink hue in the outer cycle. The number of tentacles in the studied specimens ranged from 50 to 64. Column orange-pink (yellowish in specimens with gray tentacles) proximally, becoming dark gray-green distally. All specimens had broad white patches on the margin, giving the upper column a striped appearance, which is diagnostic of this species. Acrorhagi also white and were absent or underdeveloped in half of the collected specimens. Gravel was attached to verrucae on the column. The specimens did not release adhered gravel when disturbed or collected (noted by Daly and Fautin 2004; Hickman 2008).



**Fig. 1** *Anthopleura mariscali* Daly and Fautin 2004: **a** partially submerged specimen in the field with red tentacles, **b** submerged specimen in the field with gray and pink tentacles, **c** side view of a specimen with an extended acrorhagus, **d** top view of a specimen showing oral disk and white actinopharynx, **e** side view of a partially contracted specimen showing diagnostic white patches on the margin, **f** top view of a contracted specimen with the attached gravel removed

Preserved specimens brown-gray in color, oral disc 4–10 mm in diameter.

**Cnidae** Spirocysts, basitrichs, S-shaped basitrichs, microbasic p-mastigophores, microbasic b-mastigophores, and holotrichs (Table 1). The cnida makeup and sizes agree with the description of this species (Daly and Fautin 2004). However, in the present study, the acrorhagi also contained spirocysts and no p-mastigophores were found in the actinopharynx tissue, although nematocysts were scarce there.

### Discussion

The species was previously recorded from Pinzón Island, Plaza Sur Island, Santa Cruz Island, and Santa

**Table 1** Cnidae of *Anthopleura mariscalii*

Tissue	Cnida	N	n	A	Sizes (µm)			
					Length range	Mean length	Width range	Mean width
Tentacles	Spirocysts	4/4	125	vc	11.7–22.4	17.4 (2.2)	1.9–3.4	2.5 (0.3)
	Basitrichs	4/4	106	vc	12.8–18.8	16.0 (1.3)	1.6–2.6	2.0 (0.2)
Acrorhagi	Spirocysts	4/4	115	vc	17.1–37.5	27.2 (4.1)	1.9–3.4	2.6 (0.3)
	Holotrichs I	4/4	112	vc	34.5–55.2	44.8 (4.5)	3.0–4.4	3.9 (0.3)
	Holotrichs II	4/4	110	vc	38.5–63.0	52.1 (4.9)	4.6–6.3	5.1 (0.4)
Column	Basitrichs	4/4	113	c	10.2–18.8	13.5 (1.2)	1.4–2.8	2.1 (0.2)
	Holotrichs III	3/4	21	r	14.1–19.3	16.5 (1.3)	2.7–4.4	3.2 (0.4)
Actinopharynx	Small basitrichs	4/4	19	r	9.1–14.9	13.1 (1.6)	1.6–2.3	2.0 (0.2)
	Basitrichs	4/4	81	u	18.8–25.4	21.4 (1.4)	2.1–3.0	2.5 (0.2)
Filaments	Small basitrichs	4/4	23	r	9.2–14.7	10.7 (1.3)	0.9–2.2	1.6 (0.3)
	Basitrichs	4/4	130	vc	13.4–20.3	17.2 (1.1)	1.8–3.0	2.4 (0.3)
	S-shaped basitrichs	4/4	22	r	22.6–42.0	29.1 (4.4)	1.0–1.9	1.4 (0.2)
	p-mastigophores	4/4	50	u	13.7–20.4	16.9 (1.5)	3.5–5.5	4.4 (0.5)
	Large b-mastigophores	4/4	103	c	17.8–31.0	22.7 (3.1)	3.4–6.4	4.3 (0.7)
	Small b-mastigophores	4/4	60	u	12.9–18.4	15.3 (1.4)	2.1–4.2	3.0 (0.4)

Standard deviations of mean length and width are in *parentheses*

*N* the proportion of examined specimens with a given type of cnida, *n* the number of capsules measured, *A* abundance of a given type of cnida in each tissue type (*vc* very common, *c* common, *u* uncommon, *r* rare, *vr* very rare)

Fe Island in the Galápagos Archipelago, Ecuador (Daly and Fautin 2004; Fautin et al. 2007; Hickman 2008). This is the first record of *Anthopleura mariscalii* outside the Galápagos Archipelago. It is likely that this species has been overlooked in previous surveys along the Pacific coast of Central America due to its small size, and to the lack of taxonomic specialists in the region. It is possible that *A. mariscalii* is distributed throughout the Pacific coast of Central America, just like other species in the genus such as *A. nigrescens* (Acuña et al. 2012). This new record increases the number of sea anemones (*sensu stricto*) in Costa Rica to 16 species, 8 of which are on the Pacific Coast and in the Isla del Coco National Park (Acuña et al. 2013; Quesada et al. 2015). This number of sea anemone species is low when compared to other cnidarians (e.g., scleractinians) and invertebrates (Daly et al. 2007), but Fautin et al. (2013) suggest that sea anemone richness follows a bimodal distribution, peaking at 30–40°N and S, and with lower numbers at tropical latitudes. Future studies are needed on both coasts of Costa Rica, mainly in subtidal areas, to complete the inventory of sea anemones as well as other groups of Anthozoa, such as Ceriantharia, Zoantharia and Corallimorpharia.

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## References

- Acuña FH, Alvarado J, Garese A, Cortés J (2012) First record of the sea anemone *Anthopleura nigrescens* (Cnidaria: Actiniaria: Actiniidae) on the Pacific coast of Central America. *Mar Biodivers Rec* 5:5–7
- Acuña FH, Garese A, Excoffon AC, Cortés J (2013) New records of sea anemones (Cnidaria : Anthozoa) from Costa Rica. *Rev Biol Mar Oceanogr* 48:177–184
- Daly M (2004) Anatomy and taxonomy of three species of sea anemones (Cnidaria: Athozoa: Atiniidae) from the Gulf of California, including *Isoaulactinia hespervolita* Daly, n. sp. *Pac Sci* 58:377–390
- Daly M, Fautin DG (2004) *Anthopleura mariscalii*, a new species of sea anemone (Cnidaria: Anthozoa: Actiniaria) from the Galápagos Islands. *Zootaxa* 416:1–8
- Daly M, Brugler MR, Cartwright P, Collins AG, Dawson MN, Fautin DG, France SC, McFadden C, Opresko DM, Rodriguez E, Romano SL (2007) The phylum Cnidaria: a review of phylogenetic patterns and diversity 300 years after Linnaeus. *Zootaxa* 1668:127–182
- England K (1991) Nematocysts of sea anemones (Actiniaria, Ceriantharia and Corallimorpharia: Cnidaria): nomenclature. *Hydrobiologia* 216(217):691–697

- Fautin DG (2013) Hexacorallians of the world. <http://geoportal.kgs.ku.edu/hexacoral/anemone2/index.cfm>. Accessed 12/02/2015
- Fautin DG, Hickman CP, Daly M, Molodtsova T (2007) Shallow-water sea anemones (Cnidaria: Anthozoa: Actiniaria) and tube anemones (Cnidaria: Anthozoa: Ceriantharia) of the Galápagos Islands. *Pac Sci* 61:549–573
- Fautin DG, Malarky L, Soberón J (2013) Latitudinal diversity of sea anemones (Cnidaria: Actiniaria). *Biol Bull* 224:89–98
- Häussermann V (2004) Identification and taxonomy of soft-bodied hexacorals exemplified by Chilean sea anemones; including guidelines for sampling, preservation and examination. *J Mar Biol Assoc UK* 84:931–936
- Hickman CP (2008) A field guide to corals and other radiates of Galápagos. Sugar Spring, Lexington
- Quesada AJ, Acuña FH, Cortés J (2015) First record of the sea anemone *Bunodosoma californicum* (Cnidaria: Actiniaria) on the Pacific coast of Costa Rica. *Mar Biodivers Rec* 8:e71
- Yanagi K (1999) Taxonomy and developmental biology of Japanese *Anthopleura* (Anthozoa: Actiniaria). PhD Dissertation. Tokyo University of Fisheries, Tokyo, Japan