

**Short Communication**

**First record of the Indo-Pacific swimming crab *Charybdis hellerii* (A. Milne-Edwards, 1867) in the eastern Pacific Ocean coast**

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**ABSTRACT.** The presence of the invasive swimming crab *Charybdis hellerii* is reported for the first time on the Mexican coast of the Pacific Ocean. Three specimens were collected as bycatch during artisanal fishing for crab *Callinectes arcuatus* in Laguna de Cuyutlán, Colima. The specimens found include 1 female and 2 males. Due to their size (57 to 75 mm carapace width) and separated abdomen, they are considered adults. Further sampling and monitoring are required to find conclusive evidence that the species is established in this area and to understand the impacts it could have on the populations of other economically important native crab species.

**Keywords:** *Charybdis hellerii*; Portunidae; invasive species; Cuyutlán Lagoon; Manzanillo; Colima; México

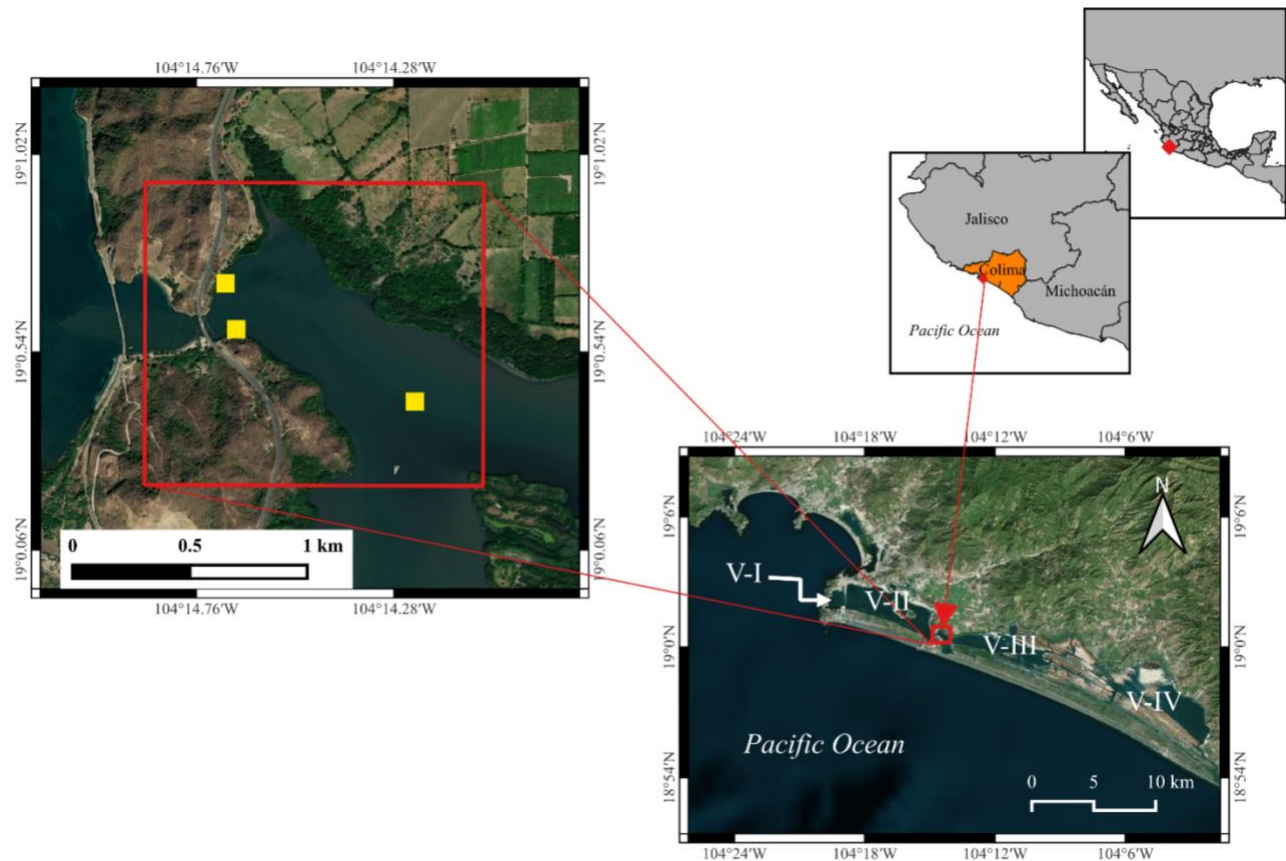
**INTRODUCTION**

*Charybdis hellerii* (Milne-Edwards, 1867) has a broad Indo-Pacific native range spanning from the Red Sea and East Africa, throughout the Indian Ocean to northern Australia and New Caledonia, and north to China and Japan (Stephenson 1972, Sakai 1976, Kensley 1981).

Since the eighties, this species has been recorded as an invasive species in many countries on the west coast of the Atlantic Ocean (Campos & Türkay 1989, Gómez & Martínez-Iglesias 1990, Tavares & Mendonça 1996, Galil & Zenetos 2002, McMillen-Jackson 2008). It is believed that the route of introduction to the area was through ballast water from ships from the Mediterranean (Negri et al. 2018). In these areas, large densities of this species have been found, in addition to ovigerous females, which means this species is already established (Mantelatto & Días 1999). In Mexico, this species was reported to be present only in the Atlantic Ocean. In the northern and southern areas of the Yucatan

Peninsula (Simoes et al. 2019), there are unpublished reports of its presence in Veracruz and Tamaulipas (both located along the Gulf of Mexico coastline). There are no scientific reports of the presence of this species on the American coasts of the Pacific Ocean, so this study provides the first report of *C. hellerii* on the eastern coast of the Pacific Ocean.

During the biological-fishery sampling campaigns of the commercial fishing of crab *Callinectes arcuatus* in Cuyutlán Lagoon (CL), Colima (Fig. 1), carried out by the Mexican Institute for Research in Sustainable Fisheries and Aquaculture (IMIPAS, by its Spanish acronym) in November 2023 and June 2024, three specimens were found of the Indo-Pacific swimming crab. Crab fishermen captured these organisms incidentally with a crab net consisting of a round-shaped structure of galvanized wire 35 cm in diameter, covered with a monofilament thread mesh with a 76 mm opening. The bait was pieces of sailfish *Istiophorus platypterus* (Shaw, 1792) skin tied in the center of the ring (Salas-Maldonado et al. 2021). Specimens were



**Figure 1.** Main crab fishing areas in storage reservoirs I to IV of Laguna de Cuyutlán, Colima. The yellow boxes represent capture points where catches of the swimming crab (*Charybdis hellerii*) were reported. Figure by M. Salas Maldonado.

captured at three points (Fig. 1, Table 1) in storage reservoir III of the CL, close to the mouth of the lagoon, and the type of sediment was rocky.

The specimens were transported for identification to the laboratories of the Regional Aquaculture and Fisheries Research Center (CRIAP, by its Spanish acronym) of Manzanillo, Colima, where they were fixed in 10% formaldehyde and then preserved in 70% alcohol. To identify flying crabs, the criteria proposed by Lemaitre (1995), Apel & Spiridinov (1998), and Simoes et al. (2019) were used. The sex of the organisms was determined by direct observation of external sexual characteristics such as abdomens. The maturity of the organisms was verified through the analysis of the abdomen; in mature individuals, the abdomen is mobile from the ventral sternum in females and males (Bolaños et al. 2011). Crabs were weighed (total weight; TW) with an Ohaus ProScout 6000 digital scale ( $\pm 0.1$  g). The carapace width (CW) in millimeters was recorded with a vernier caliper with a precision of 0.1 mm. A specimen was deposited in the

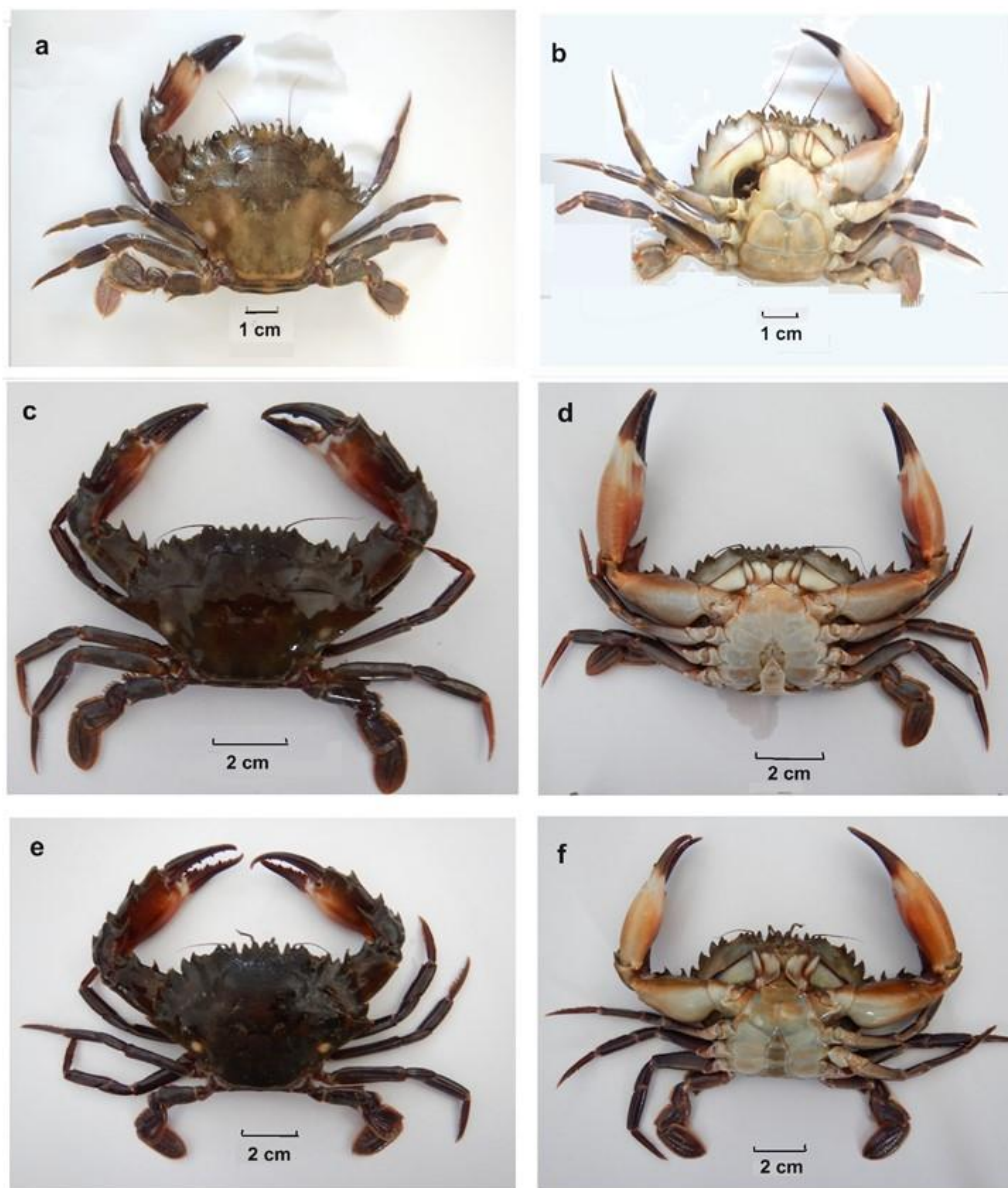
"Colección de Crustáceos de Yucatán", UMDI-Sisal, Universidad Nacional Autónoma de México, Yucatán (YUC-CC) under catalog number YUC-CC-255-11-007392.

Three specimens of the *C. hellerii* species were identified, which presented all the characteristics specified by various authors (Lemaitre 1995, Apel & Spiridinov 1998, Simoes et al. 2019). The sizes of the specimens ranged between 57 to 75 mm CW and 30 to 68 g TW. One of the specimens was female, and the other two were male. All crabs were mature specimens (Fig. 2).

The introduction route for these specimens to the area is likely through ballast water since the CL is located very close to the Port of Manzanillo, Colima, which is considered the most important port in Mexico for the entry and handling of commercial vessels in international trade. Much of this cargo comes from the distribution areas of this species, such as The Philippines, Indonesia, China, and Malaysia (Altamaritima 2024, Drip Capital 2024). The port

**Table 1.** Details of Indo-Pacific flying crab captures. CW: carapace width, TW: total weight, F: female; M: male. \*Was missing a chelae.

N°	Date	Location	Bottom type	TW (g)	CW (mm)	Sex	Fishing gear
1	November 13, 2023	19°00'38"N 104°14'43"W	Rocky	30*	57	F	Crab net
2	June 6, 2024	19°00'35"N 104°14'39"W	Rocky	52	67	M	Crab net
3	June 6, 2024	19°00'35"N 104°14'39"W	Rocky	68	75	M	Crab net



**Figure 2.** Specimens of *Charybdis hellerii* collected in Cuyutlán Lagoon. a-b) One female (YUC-CC-255-11-007392) and two males; c-d) specimen 2; e-f) specimen 3. Photographs by L.A. Flores Ramírez.

moves approximately 69,000 t of merchandise annually.

Based on the above, the most probable origin of the *C. hellerii* specimens found in this work could be Southeast Asia, which coincides with the organisms found in the Hawaiian Islands, the closest area in the Pacific Ocean where it has been detected (Evans et al. 2018).

The results of the present study place the *C. hellerii* species as occasional and rare since the organisms reported by crab fishermen in the CL are scarce ( $n = 3$  ind). In addition to the previous records, since 2019, there have been five more sighting reports by the citizen science database Naturalist (iNaturalist 2024). Therefore, it could be considered that this species is in an invasion stage 3 because its presence is reported, but its number is very low (Colautti & MacIsaac 2004). It is important to continue monitoring to evidence or corroborate whether the presence of the *C. hellerii* species is growing, with a high probability of spreading.

No studies have evaluated the effect of introducing this species in Mexico, but *C. hellerii* could compete for resources and space with native crabs (Dineen et al. 2001, Meyer 2021). For example, this situation has occurred in Brazil, where some authors mention that it competes with *Callinectes danae*, *C. sapidus*, *C. exasperatus*, and *C. ornatus* (Braga et al. 2005, Sant'Anna et al. 2012). Furthermore, Oliveira (2016) found that an increase in the populations of *C. hellerii* resulted in a decrease in the populations of six species of crabs, including *Menippe nodifrons* (Oliveira 2016).

In CL, there is an artisanal fishery of blue crab (*Callinectes arcuatus*), the second most important fishery in the lagoon, after the estuarine fish fishery (Salas-Maldonado et al. 2021). This native species could be affected by the presence of the Indo-Pacific swimming crab, possibly due to competition for food. *C. hellerii* presents the same prey preferences, such as crustaceans and mollusks (Dittel 1993, Sant'Anna et al. 2015, Mendes-Izar et al. 2023). This invasive species is an important consumer of benthic native prey, having the potential to change food webs through predation pressure on bioengineers and associated fauna (Mendes-Izar et al. 2023). In addition, *C. hellerii* juveniles occupy different niches than mature organisms, which is a strategy to avoid predation of juveniles by adult organisms (Mantelatto & Souza-Carey 1998). Therefore, we cannot rule out the possibility that juveniles of invasive species compete with and prey on juveniles of native species, which

would once again increase the potential impact of this invasive species (Oliveira 2016).

Future studies on the presence of this species in the area will have to be based on informative population-level marker studies that indicate the areas of origin and introduction routes of these specimens (Evans et al. 2018).

In conclusion, continuous monitoring on the Mexican coast of the Pacific Ocean is necessary to know the status and expansion of *C. hellerii* and its ecological effects.

#### Credit author contribution

M. Salas-Maldonado: conceptualization, validation, methodology, formal analysis, and writing-original draft; A.T. Wakida-Kusunoki: conceptualization, supervision, writing-original draft review, and editing; A. Bartoleño Sánchez: validation, supervision, review, and editing; L. A. Flores Ramírez & C. López-Terán: methodology, formal analysis, review, and editing. All authors have read and accepted the published version of the manuscript.

#### Conflict of interest

The authors declare no conflict of interest.

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