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NOTES ON GEOGRAPHIC DISTRIBUTION

# Occurrence of *Asymmetron lucayanum* Andrews, 1893 (Cephalochordata, Branchiostomatidae) from Cozumel Island, Mexican Caribbean

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**Abstract.** Records of cephalochordates, also known as lancelets, are rare in the Gulf of Mexico and the Caribbean Sea. In this work, we present evidence of the presence of *Asymmetron lucayanum* Andrews, 1893 (Amphioxiformes, Branchiostomatidae) on Cozumel Island, Mexico. This species was identified based on 12 specimens (5.36–9.99 mm in total length) that were collected a sandy beach between March and August of 2024. It is characterized by having 55–63 myotomes. Data on its morphology and meristics are provided. This is the first confirmed record of this species in Mexico.

**Key words.** Chetumal, new records, lancelet, Mexico, range extension

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## INTRODUCTION

The cephalochordates, also known as lancelets or amphioxus, are a group defined by several autapomorphies, including the presence of asymmetric larvae and developed oral cirri, among others (Stach 2008). Currently, 30 species are recognized and grouped into three genera: *Asymmetron* Andrew, 1893, *Branchiostoma* Costa, 1834, and *Epigonichthys* Peters, 1876. These are all within the family Branchiostomatidae (Madrid Concepcion et al. 2025). The genus *Asymmetron* comprises only two species and is characterized by a urostyloid caudal process and gonads that are only developed on the right side (Nishikawa 2004).

Four species of cephalochordates have been recorded in Mexico: *Branchiostoma californiense* Andrews, 1893, from along the Pacific coast; *B. caribaeum* Sundevall, 1853, *B. longirostrum* Boschung, 1983, and *Asymmetron lucayanum* Andrews, 1893 in the Gulf of Mexico and the Caribbean Sea (Del Moral-Flores et al. 2016). Studies of the cephalochordates along the Mexican coast of the Gulf of Mexico and the Caribbean Sea are scarce, with only a few records in the Veracruz Reef System region (Chávez 1964, 1965; Boschung 1986). While records of *A. lucayanum* in the Caribbean region have been based on organisms in the larval stage, there has been no specific record for Mexico (Del Moral-Flores et al. 2016). This work, however, confirms the first valid record from the Mexican Caribbean.

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## METHODS

From March to August 2024, sediment was collected by scuba diving from five beaches on the west coast of Cozumel Island, Mexico (Figure 1). A manual PVC corer, measuring 15 cm long in length and 6 cm in diameter, was used for this purpose. Lancets were only found on Mantarraya beach (20°29′26″N, 086°58′00″W). Samples were taken in duplicate and placed in jars with purified water added to stun the organisms. At each site, the following physicochemical parameters were determined: depth, transparency, temperature, electrical conductivity, saturated oxygen, salinity and pH using a Hanna H198194 multiparameter. The sediment samples were manually passed through a column of meta sieves with mesh openings of 2, 1, 0.5, 0.25, 0.125 and

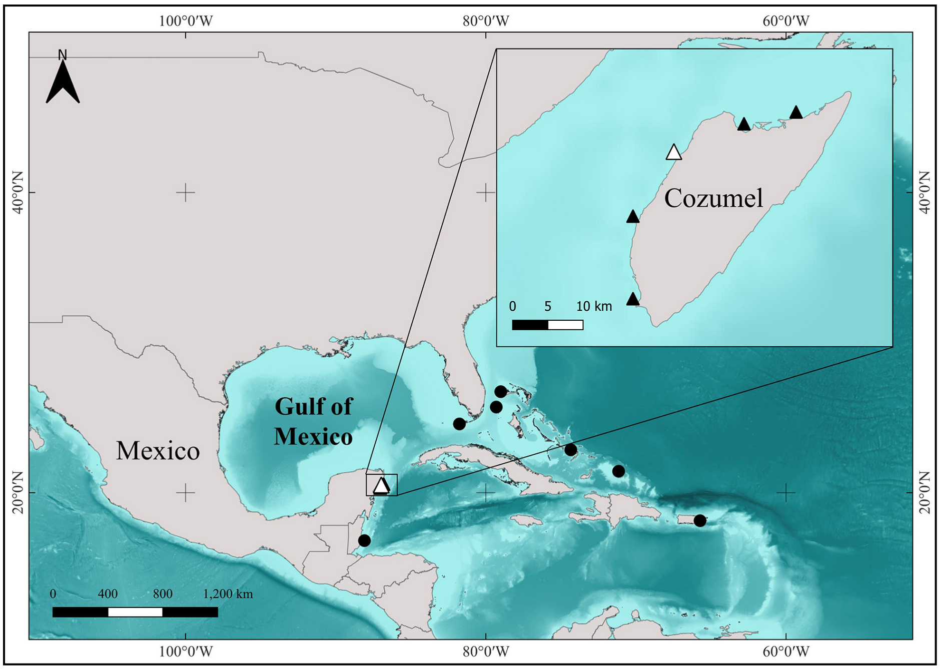


**Figure 1.** Map of the Gulf of Mexico and Caribbean Sea showing previous records (dark circles) and the new record (white triangle) of *Asymmetron lucayanum* in the Cozumel Island. Dark triangles are the collection points where no lancets were found. Previous records obtained from GBIF 2025.

0.0625 mm and the average grain size of the sediment (φ) was determined using the "Udden-Wentworth" dimensional scale. The specimens were fixed with saline formalin (10%) and preserved in ethyl alcohol (70%) within the Ichthyological Collection of the Faculty of Higher Studies Iztacala of the National Autonomous University of Mexico, under catalogue numbers CIFI-2404 and CIFI-2405. The specimens were stained with Rose Bengal (5%) for the observation of their morphological structures, which enable determination through taxonomic keys and the myotome formula (Del Moral-Flores et al. 2016).

## RESULTS

Phylum Chordata Haeckel, 1874
Subphylum Cephalohordata Haeckel, 1866
Class Leptorcardii Müller, 1845
Order Amphioxiformes Berg, 1937
Family Branchiostomatidae Bonaparte, 1846

***Asymmetron lucayanum*** **Andrews, 1893**
Figure 2

**New records.** MEXICO / CARIBEAN SEA — Quintana Roo • Cozumel Island, west coast, Mantarraya Beach; 20°29′26″N, 086°58′00″W; 3 m depth; 18.VII.2024; Camila Itamar Canul-Quiñonez leg.; 35.92 PSU, 29.62 °C, 469.1% satured oxygen, 8.17 pH, 1 grain size (φ) = medium sand; 6.30–9.99 mm total length; 6 specimens; CIFI-2405 • Cozumel Island, west coast, Mantarraya Beach; 20°29′27″N, 086°57′59″W; 3 m depth; 4.V.2024;

**Figure 2.** *Asymmetron lucayanum* specimen (CIFI-2405, 6.3 mm total length), collected from Cozumel Island, Mexico.

Camila Itamar Canul-Quiñonez leg.; 36.78 PSU, 29.02 °C, 64.53% saturated oxygen, 8.28 pH, 0 grain size (φ) = coarse sand; 5.36–9.26 mm total length; 6 specimens; CIFI-2404.

**Identification.** Body elongated and the notochord extends anteriorly to generate a long rostral process and posteriorly beyond the musculature to present the urostyloid process. Preoral bell large, the large cirri are fused at their base. Metapleura are asymmetrical, with the right one being continuous with the mid-ventral fold. There are 58–63 myotomes, with the formula 36 preanal + 18 anal + 9 postanal. Only four organisms showed gonadal development on the right axis (Figure 2).

## DISCUSSION

*Asymmetron lucayanum* has a wide circumtropical distribution (Poss and Boschung 1996). Genetic studies have proven that it actually is a species complex (Kon et al. 2006, 2007; Subirana et al. 2020). Andrews (1893) first described *A. lucayanum* based on specimens collected in the Bahamas. According to Nishikawa (2004), organisms from various regions of the Atlantic have similar characteristics, except for the number of myotomes, which ranges from 52 to 72. This coincides with the variation in myotomes observed in organisms from Cozumel (58–63). These characteristics, together with a low number of dorsal chambers, distinguish *A. lucayanum* from *A. inferum* Nishikawa, 2004, which has 83 myotomes and 270 dorsal chambers (Nishikawa 2004).

Genetic comparisons of cytochrome c oxidase subunit I revel a similarity between populations in the Bahamas and in other regions of the western Atlantic. These populations were grouped into clade C by Kon et al. (2006). These results support the hypothesis that the specimens found in the Mexican Caribbean belong to *A. lucayanum*, and that genetic flow is maintained through the Gulf Stream (Kon et al. 2006).

The substrate where the specimens were found was covered with shell fragments similar to those reported for the type locality (Andrews 1893), limestone pavement, and loose rocks. Other species, such as *B. californiense*, have been found in various environments and on different substrates, ranging from shallow waters to depths of 11 m, as well as in estuarine mouths (Barraza-Sandoval and Melara-Pérez 2022), seagrass beds (Campos-Dávila et al. 2019), and hydrothermal vents (Rodríguez-Uribe et al. 2019). In contrast, its congener, *A. inferum* lives at great depths (229 m) in anaerobic environments with high sulfide concentrations caused by whale decomposition (Nishikawa 2004; Kon et al. 2007).

Cozumel Island is located south of Cancún, México, the largest tourist destination in the Caribbean. According to Fernández-Rodríguez et al. (2019), cruise ship tourism has a sociocultural and environmental impact. The discharge of waste, including fuel, ballast water, sewage, and solid waste, has also been observed (Palafox-Muñoz and Vilchis-Onofre 2019), which may affect the marine environment and sediment. Studies of plastic waste on Cozumel beaches have shown its relationship with visitor numbers and beach location (Mansilla-García et al. 2024). In the Caribbean, hydrocarbon concentrations are related to tourist activity and the time of year (Medina-Moreno et al. 2014). Therefore, future studies should analyze and relate possible environmental characteristics to the presence of lancelets on Cozumel Island, as they have only been found on one beach (Mantarraya).

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## ADDITIONAL INFORMATION

**Conflict of interest**

The authors declare that no competing interests exist.

**Ethical statement**

No ethical statement is reported.

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## Author contributions

Conceptualization: Conceptualization: CICQ, LFDMF. Data curation: CICQ, LFDMF. Formal analysis: CICQ, MAGA. Funding acquisition: MAGA, LFDM. Investigation: CICQ, MAGA, LFDMF. Methodology: CICQ, MAGA. Resources: CICQ, MAGA, LFDMF. Supervision: CICQ, MAGA, LFDMF. Visualization: CICQ, LFDMF. Project administration: CICQ, MAGA. Software: CICQ, LFDMF. Validation: CICQ, MAGA, LFDMF. Writing – original draft: CICQ, MAGA, LFDMF. Writing – review and editing: CICQ, MAGA, LFDMF.

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## Data availability

All data that support the findings of this study are available in the main text.

# REFERENCES

**Andrews EA** (1893) An undescribed acraniate: *Asymmetron lucayanum*. Johns Hopkins University, Biological laboratory, Studies 5: 213–247.

**Barraza-Sandoval JE, Melara-Pérez, VE** (2022) New records of *Branchiostoma californiense* (Amphioxiformes: Branchiostomatidae) in El Salvador, Central America. UNED Research Journal 14 (2): e4302. http://doi.org/10.22458/urj.v14i2.4302

**Boschung H** (1986) Occurrence of *Branchiostoma longirostrum* from Veracruz, Mexico. Northeast Gulf Science 8 (2): 151.

**Campos-Dávila L, Pérez-Estrada CJ, Rodríguez-Estrella R, Morales-Bojórquez E, Brun-Murillo FG, Balart EF** (2019) Seagrass *Halodule wrightii* as a new habitat for the amphioxus *Branchiostoma californiense* (Cephalochordata, Branchiostomidae) in the southern Gulf of California, Mexico. ZooKeys 873: 113–131. https://doi.org/10.3897/zookeys.873.33901

**Chávez H** (1964) *Branchiostoma caribaeum* in Mexican waters of the Gulf of Mexico. Copeia 1964 (4): 705. https://doi.org/10.2307/1441449

**Chávez H** (1965) Segundo registro de *Branchiostoma caribaeum* (Sundevall) en aguas mexicanas. Anales del Instituto Nacional de Investigaciones Biológico Pesqueras 1: 153.

**Del Moral-Flores LF, Guadarrama-Martínez, MÁ, Flores-Coto C** (2016) Composición taxonómica y distribución de los cefalocordados (Cephalochordata: Amphioxiformes) en México. Latin American Journal of Aquatic Research 44 (3): 497–503.

**Fernández-Rodríguez AG, Rivera-Villagrán IE, Pacheco Cocom MY** (2019) Criuse ship tourism in Cozumel: an approach derived from its impacts related to sustainability. Tla-Melaua Revista de Ciencias Sociales 12 (45): 152–172. https://doi.org/10.32399/rtla.12.45.767

**Global Biodiversity Information Facility GBIF** (2025) *Asymmetron lucayanum*. GBIF occurrence download. https://doi.org/10.15468/dl.6d572e. Accessed on: 2024-03-03.

**Kon T, Nohara M, Nishida M, Sterrer W, Nishikawa T** (2006) Hidden ancient diversification in the circumtropical lancelet *Asymmetron lucayanum* complex. Marine Biology 149: 875–883. https://doi.org/10.1007/s00227-006-0271-y

**Kon T, Nohara M, Yamanoue Y, Fujiwara Y, Nishida M, Nishikawa T** (2007) Phylogenetic position of a whale-fall lancelet (Cephalochordata) inferred from whole mitochondrial genome sequences. BMC Evolutionary Biology 7: 127. https://doi.org/10.1186/1471-2148-7-127

**Madrid Concepcion ME, Macdonald KS III, Dirskell AC, Wetzer R, Di Domenico M, Collin R** (2025) Lost of lancelets of not? Diversity of cephalochordates in the Tropical Eastern Pacific. Diversity 17: 411. https://doi.org/10.3390/d17060411

**Mansilla-García AV, Cuarón AD, Vázquez LB** (2024) Characterizing plastic pollution on beaches of Cozumel Island, Mexico: abundance, distribution, and influencing factors. Revista Ciencias Marinas y Costeras 16 (2): 51–69. https://doi.org/10.15359/revmar.16-2.3

**Medina-Moreno SA, Jiménez-González A, Gutiérrez-Rojas M, Lizardi-Jiménez MA** (2014) Hydrocarbon pollution studies of underwater sinkholes along Quintana Roo as a function of tourism development in the Mexican Caribbean. Revista Mexicana de Ingeniería Química 13 (2): 509–516.

**Nishikawa T** (2004) A new deep-water lancelet (Cephalochordata) from off Cape Nomamisaki, SW Japan, with a proposal of the revised system recovering the genus *Asymmetron*. Zoological Sciences 21 (11): 1131–1136. https://doi.org/10.2108/zsj.21.1131

**Palafox-Muñoz A, Vilchis-Onofre AA** (2019) El lado obscuro del turismo de cruceros en Cozumel. Études Caribéennes 43–44. https://doi.org/10.4000/etudescaribeennes.16562

**Poss SG, Boschung HT** (1996) Lancelets (Cephalochordata: Branchiostomatidae): how many species are valid? Israel Journal of Zoology 42: S13–S66.

**Rodríguez-Uribe MC, Chávez-Dagostino RM, Del Moral-Flores LF, Bravo-Olivas ML** (2019) First record of amphioxus *Branchiostoma californiense* (Amphioxiformes: Branchiostomatidae) adjacent to a shallow submarine hydrothermal system at Banderas Bay (Mexico). Diversity 11 (12): 227. https://doi.org/10.3390/d11120227

**Stach T** (2008) Chordate phylogeny and evolution: a not so simple three-taxon problem. Journal of Zoology 276: 117–141. https://doi.org/10.1111/j.1469-7998.2008.00497.x

**Subirana L, Farstey V, Bertrand S, Escriva H** (2020) *Asymmetron lucayanum*: how many species are valid? PLoS ONE 15 (3): e0229119. https://doi.org/10.1371/journal.pone.0229119