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First report of crested cusk-eel, *Ophidion josephi* (Actinopterygii: Ophidiiformes: Ophidiidae), in the southwestern Gulf of Mexico

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Abstract

The crested cusk-eel, *Ophidion josephi* Girard, 1858, is a coastal marine species that is distributed in the northwestern Atlantic, from the northern Gulf of Mexico to Georgia, USA. Eighteen specimens (177–230 mm in standard length) were caught by beach purse seine at a depth of about 5 m, in Veracruz, in the southwestern Gulf of Mexico. This is the first documentation from Mexican marine waters and the southernmost confirmed records of this species, showing that its range extends further south than previously known and that it shares faunistic similarities with other species in the northwestern Atlantic.

Keywords

distribution, marine fish, morphometric, Mexico, new record, range extension

Introduction

The family Ophidiidae comprises four subfamilies and 280 valid species. The subfamily Ophidiinae contains 65 species (Fricke et al. 2022). Ophidiid fishes are characterized by having supramaxillary, dorsal fin rays usually equal to or longer than opposing anal-fin rays, scales present on body, pelvic fins rarely absent, when they are present with one or two soft rays (Cohen and Nielsen 1978; Nelson et al. 2016). Cusk eels have a wide distribution around the world in tropical, subtropical and temperate seas. The majority of species are coastal, mainly in the continental shelf, although many are found in deep waters, reaching 7965 m (Gerringer et al. 2021). In the western Atlantic, this family is represented by 26 genera and about 68 species (Nielsen and Robins 2002; Garrido-Linares and Acero-P. 2006). However, the limits of several species in both the southern and northern parts have not been clarified yet.

This genus *Ophidion* Linnaeus, 1758 is found nearly worldwide in warm-temperate and tropical coastal and shelf waters. The largest number of species is concentrated on both coasts of America (Matallanas and Casadevall 1999). A taxonomic revision of the genus *Ophidion* is necessary; there are several characters that are shared with other genera (Cohen and Nielsen 1978; Lea and Robins 2003). It is considered a paraphyletic group and its relation with other clades is unclear (Nielsen et al. 1999). This genus is diagnosed by the following combination of characters: scales absent from sides and top of head; scales on body elongated, arranged in a basketweave or anguilloid pattern; ethmoid spine absent,

or, if present, slender and anteriorly directed at its tip; total vertebrae 63 to 79; abdominal vertebrae 15 to 18; rays of each pelvic fin unequal in length; dorsal fin rays 129 to 150; anal fin rays 104 to 127; developed rakers on first gill arch 4 to 7 (Cohen and Nielsen 1978; Nielsen et al. 1999; Carnevale and Johnson 2015). Within them, the systematic and biogeographic review of the *Ophidion marginatum–josephi* complex is suggested and needed (Lea and Robins 2003), to understand the delimitation of species in their distribution areas. This group is characterized by having similarities of characters in early life history stages, such as an elongate body that becomes laterally compressed with development, the proportion of two or three pterygiophores per interneural space, the fact that the preanal length is short, and that the vertebrae ossify from both the anterior and posterior ends toward the middle (Fahay 1992; Fahay and Hare 2003).

In some species, there have been taxonomic problems. For example, Robins and Ray (1986) considered *Ophidion welshi* (Nichols et Breder, 1922) as a valid species. Later, Nielsen et al. (1999) considered it as a probable synonym. Finally, Nielsen and Robins (2002) indicate that it is a synonym for the crested cusk-eel, *Ophidion josephi* Girard, 1858. The latter is a coastal benthic species that is distributed in the northwestern Atlantic, from Georgia to northeastern Florida through the northern Gulf of Mexico (coastal bays to 55 m depth) (Nielsen et al. 1999; Fahay and Hare 2003). However, its southern distribution limit is unknown. This work describes a new and thus far southernmost record of *O. josephi* based on morphometrics and meristic characters.

Materials and methods

During four fishing events (15 November 2018, 15 November 2019, 18 October 2020, and 27 September 2021), 18 specimens of *Ophidion josephi* were captured by an artisanal fisherman from Las Barrancas community (19°0′24″N, 095°57′52″W), in Veracruz, the southwestern Gulf of Mexico (Fig. 1). The specimens were captured by beach purse seine between about 3 to 5 m of depth. The specimens were identified following the keys of Hoese and Moore (1998) and McEachran and Fechhelm (1998). Morphometric measurements expressed in proportion to the standard (SL%) and cephalic lengths (HL %) were carried out on the fresh specimen with electronic calipers to the nearest 0.1 mm according to Nielsen et al (1999). Sex was determined by the presence of the typical supraoccipital crest in males and its absence in females (Courtenay 1971). The meristic count was conducted on five specimens, which were cleared and differentially stained with alizarin red S and Alcian blue (Kelly and Bryden 1983) and by X-ray. The samples were fixed in 10% buffered formaldehyde, preserved in 70% ethyl alcohol, and deposited in the Ichthyological Collection of the Facultad de Estudios Superiores Iztacala (CIFI).

Figure 1. Distribution of *Ophidion josephi* in the Western Atlantic, including previous records (circles) obtained from GBIF (2021), and new records (diamond).

Results

Systematic account

Order Ophidiiformes
Family Ophidiidae
Subfamily Ophidiinae
Genus *Ophidion* Linnaeus, 1758

***Ophidion josephi* Girard, 1858**

Fig. 2; Table 1

New records. MEXICO • 7 specimens (177–212 mm SL); Las Barrancas, Alvarado, Veracruz; 19°00′24″N, 095°57′52″W; 15 Nov. 2018; Pedro Ramon Roman leg.; CIFI–222 • 5 specimens (198–213 mm SL); Las Barrancas, Alvarado, Veracruz; 19°00′24″N, 095°57′52″W; 15 Nov. 2019; Pedro Ramon Roman leg.; CIFI–1417 • 5 cleared specimens (182–230 mm SL); Las Barrancas, Alvarado, Veracruz; 19°00′24″N, 095°57′52″W; 18 Oct. 2020; Pedro Ramon Roman leg.; CIFI 1649 • 1 specimen (198 mm SL); Las Barrancas, Alvarado, Veracruz; 19°00′24″N, 095°57′52″W; 27 Sep. 2021; Pedro Ramon Roman leg.; CIFI–1907.

Identification. The Mexican specimens of *Ophidion josephi* measured 177–213 mm SL and weighed 40.0–67.5 g (Fig. 2). The morphometric and meristic data are reported in Tables 1 and 2, respectively.

Description. Dorsal fin rays: 139–147; anal fin rays: 108–117; pectoral fin rays: 21–23; pelvic fin rays: 2; caudal fin rays: 9; branchiostegal 7; gill rakers total: 7; and trunk vertebrae total 16, and caudal vertebrae number 50 to 52. Elongate body covered with diminutive elongated cycloid scales, except for cephalic region. Identified by following combination of characteristics: short blunt snout (3.3%–4.4% of SL), slightly subterminal mouth, maxilla ending behind orbital margin. Moderate eye size, its length approximating that of snout (3.3%–4.3% SL). Five to four gill rakers on lover limb. Head length 17.9%–19.5% SL, with straight dorsal profile or in males strong crest, in straight line over preopercular region. Strong supraopercular spine covered by dermal fold. Pectoral fins shorter than head (57.5%–70% HL), round in shape, its coloration intense yellow, and in some cases, black. Distal margin of dorsal and anal fin black; that of anal fin wider. Predorsal fin length 24.7% to 27.4% in SL and its origin on middle part of pectoral fin. Yellow body coloration, some brown regions. Ventral part slightly lighter that dorsal one. Base of dorsal fin black along its entire length, becoming fainter near caudal fin. Three rows of dark spots on sides, upper one continuous, remaining ones interrupted and blurred. Body covered with cycloid and elongate scales, having basket-shaped pattern.

Diagnosis. This species is distinguished from its congeners by having three to four rows of spots usually fused into a solid stripe, with a distinct crest on the spots; and a swollen nape or crest.

Table 1. Morphometrics measurements expressed as proportion to the standard length (SL) and head length (HL) of *Ophidion josephi* collected in the southwestern Gulf of Mexico.

Character	CIFI–222 (*n* = 7)	CIFI–1417 (*n* = 5)	CIFI–1907 (*n* = 1)
Weight [g]	40.0–67.5	43.5–60.2	55.3
Total length [mm]	180–215	201–218	201
Standard length [mm]	177–212	198–213	198
In %SL			
Body depth	13.3–16.3	12.7–15.9	13.5
Head depth	12.1–13.8	11.3–12.9	11.8
Head length	17.9–19.5	18.0–19.3	19.0
Depth at dorsal fin	13.6–16.1	13.0–15.7	13.0
Depth at anal fin	12.4–13.7	11.5–13.7	12.8
Preanal length	39.0–41.8	37.2–39.0	37.6
Predorsal length	24.7–27.4	25.7–27.0	26.4
Prepectoral length	15.4–17.8	15.4–17.1	16.0
Prepelvic length	5.0–6.9	4.7–6.0	5.5
Dorsal fin base	72.3–75.0	71.9–74.5	72.7
Anal fin base	57.6–61.3	59.1–62.1	62.1
Pectoral fin length	10.6–16.3	11.0–13.3	13.3
Pelvic fin length	6.6–15.4	13.9–16.1	16.1
Postorbital length	10.2–11.8	10.5–11.8	10.6
Eye length	3.3–4.3	3.2–4.0	3.5
In %HL			
Snout length	18.3–21.0	20.0–23.3	20.5
Interorbital width	16.9–20.9	15.2–16.6	16.5
Eye length	18.4–24.1	16.7–21.1	18.6
Upper jaw length	40.3–44.7	39.6–43.0	39.6

Discussion

Ophidion josephi is a common species found in shallow coastal waters, which inhabits soft bottoms. It is the second most abundant cusk-eel in the bycatch of shrimp fishing (Hoese and Moore 1998). It has a narrow depth

Table 2. Meristic counts of five specimens of *Ophidion josephi* (182–230 mm SL) collected in the southwestern Gulf of Mexico (CIFI–1649).

Character	CIFI–1649 (1) female	CIFI–1649 (2) female	CIFI–1649 (3) male	CIFI–1649 (4) male	CIFI–1649 (5) female
Caudal fin	9	9	9	9	9
Pectoral fin	23	21	21	22	22
Pelvic fin	2	2	2	2	2
Dorsal fin	142	139	139	147	142
Anal fin	115	108	112	117	115
Branchiostegal rays	7	7	7	7	7
Gill rakers (upper–lower)	2 + 4	2 + 4	2 + 4	2 + 4	2 + 4
Vertebrae (thoracic–caudal)	16 + 50	16 + 51	15 + 52	15 + 51	16 + 52

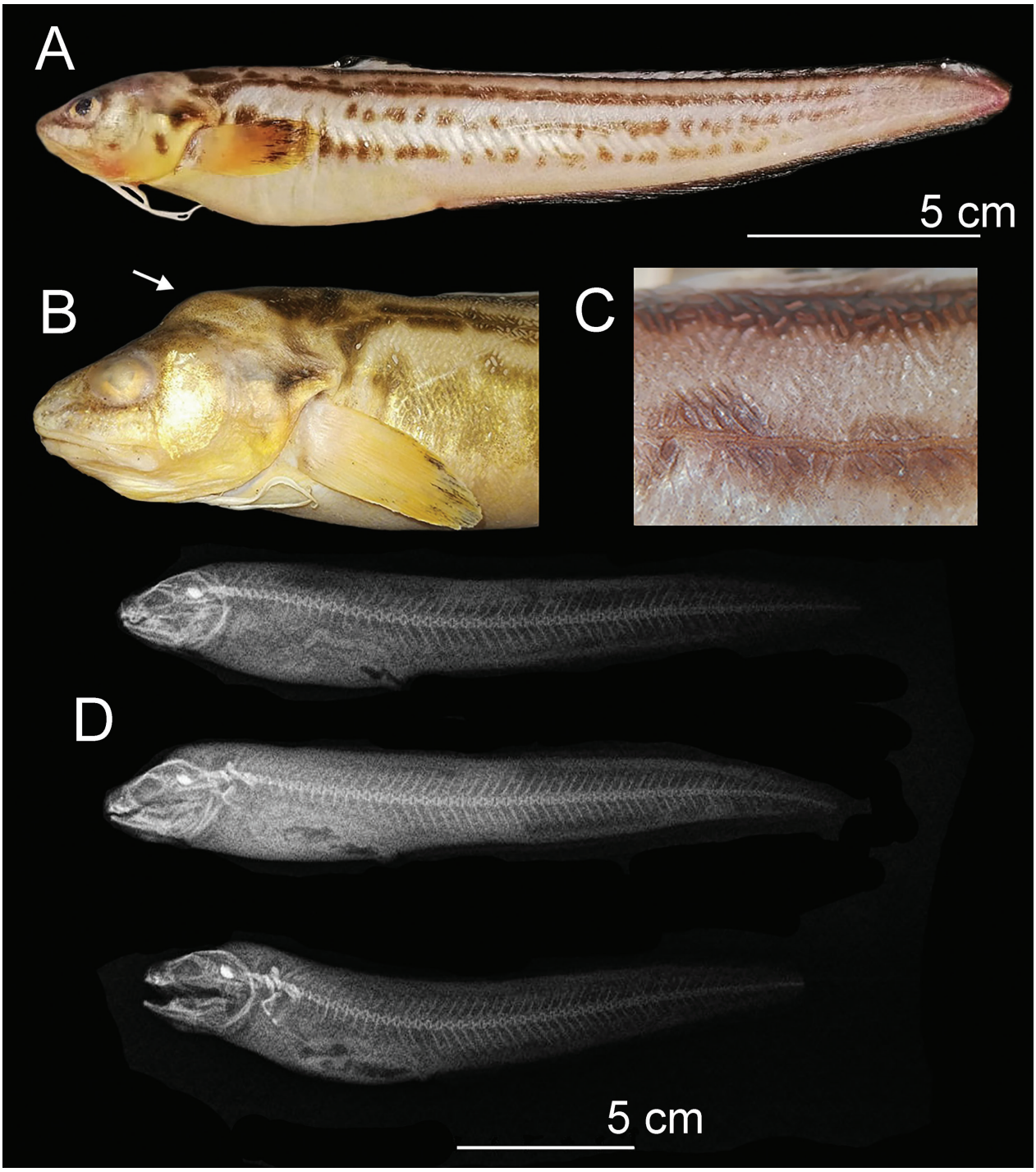

Figure 2. The Mexican specimen of *Ophidion josephi*, CIFI–222. **A**) An adult female, 181 mm SL. **B**) An adult male, 212 mm SL, the arrow points to the typical supraoccipital ridge of males. **C**) Arrangements of scales in body side. **D**) Radiographs of three specimens, 182–230 mm SL (CIFI-1949).

range of 9–55 m (Fahay and Hare 2003); spawn in the fall, has a rapid growth rate, and lives at least 27 months (Retzer 1991; Kells and Carpenter 2011).

The lack of detailed taxonomic sampling and analysis of the ichthyofauna in Mexican littorals is a possible cause of the absence of valid records of the species in the study area. However, Bautista-Hernández et al. (2001) mentioned *Ophidion welshi*, a synonym of *O. josephi*, as a species that is usually caught as a part of the bycatch of the sardine fishery practiced in the community of Las Barrancas, Veracruz. Chávez-López and Morán-Silva (2019) mentioned *O. josephi* as part of the incidental bycatch in shrimp fishing in the Campeche and estuarine zone or the Papalopan River. However, there is no valid record deposited in any collection. The presently reported study describes the finding of *Ophidion josephi* from the coast of Veracruz, Mexico which constitutes the southernmost record of this fish in the western Atlantic.

Information about their biology is unknown, but, like other species of *Ophidion*, they can be organisms that tend to bury themselves in the area during the day and leave their shelter at night to feed (Matallanas and Riba 1980). As the work of the fishermen begins during the day, it is unlikely that the organisms are captured.

Despite the similarity with the Caribbean, the biogeographic affinity of coastal and reef fish in the central-southern region of Veracruz also has a temperate affinity for the Carolinian Province (Del Moral-Flores et al. 2013). The warm-temperate Carolina Province contains a biogeographic area that is delimited into two sections: within the Gulf of Mexico, its limits are between Cabo Romano, Florida and Cabo Rojo, Mexico; and in the Atlantic section it is found between Cape Hatteras, North Carolina, and Cape Canaveral, Florida (Briggs and Bowen 2012). Larval dispersion can be a factor that does not allow to delimit a clear biogeographic barrier between the North and South of the Gulf of Mexico. In the Veracruz Reef System, near the area of this record, the oceanographic conditions, such as the presence of "nortes" (north winds) and the Campeche gyre (Salas-Pérez and Granados-Barba 2008) have an influence on larval diversity and abundance (Ayala-Rodríguez et al. 2016). Besides, it allows the establishment and extension of the range of distribution of various species of marine fish. This finding is relevant to understanding the geographic ranges of the species, a component of the Mexicana fauna.

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