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Aplatophis zorro, a new species of eastern Pacific snake-eel, with comments on New World ophichthid distributions (Anguilliformes: Ophichthidae)

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Abstract: *Aplatophis zorro* n. sp., the first known eastern Pacific species of this New World genus, is described from a shallow water trawl-caught specimen from the Golfo de San Miguel, Pacific Panama. It is similar to its only known congener, *A. chauliodus* from the tropical western Atlantic, but differs in its vertebral number, dentition, coloration, and other characters. Comments concerning the distribution of New World ophichthids are provided.

Key words: New species, sibling species, Ophichthidae, Pisces, Pacific Panama, ophichthid distribution

In 1956, James E. Böhlke described a new genus and species of ophichthid eel from Puerto Rico and Atlantic Panama. He named it *Aplatophis chauliodus*, remarkable in its terrible appearance and the development of its fang-like dentition. Subsequently, ten additional specimens have been deposited in museums, their provenance ranging from the Gulf of Mexico, Colombia, Venezuela, Guyana and Suriname to French Guiana (Cervigón 1966, Uyeno *et al.* 1983, McCosker *et al.* 1989). The recent discovery by the junior author of a large specimen of *Aplatophis*, captured in shallow water by a shrimp trawler off Darien Province, Panama, is the first known Pacific specimen and it clearly represents a new species which we describe herein.

MATERIALS AND METHODS

Measurements are straight-line, made either with a ruler with 0.5 mm gradations (for total length, trunk length, and tail length) and recorded to the nearest 0.5 mm, or with dial calipers (all other measurements) and recorded to the nearest 0.05 mm. Body length comprises head and trunk lengths. Head length is measured from the snout tip to the posterodorsal margin of the gill opening; trunk length is taken from the end of the head to mid-anus; maximum body depth does not include the median fins. Vertebral formula (VF) represents the vertebral number at the location of the dorsal fin origin, the anal fin origin, and the last vertebral element. MVF is the rounded mean vertebral formula. Vertebral counts (which include the hypural) are

taken from radiographs. Institutional abbreviations follow the Standard Symbolic Codes for Institutional Research Collections in Herpetology and Ichthyology (Leviton *et al.* 1985).

Taxonomy

Aplatophis Böhlke, 1956

Aplatophis Böhlke, 1956: 1 (type species *A. chauliodus* Böhlke, 1956, by original designation.)

Remarks: The characteristics of the new species have not changed the generic characteristics of *Aplatophis* as defined by McCosker (1977: 74) and by McCosker *et al.* (1989: 354-355). Differences between the two known species are treated in Remarks below.

Aplatophis zorro, **new species**
Snaggle-toothed snake-eel (English)
Tieso sobredentado (Spanish)
(Figs. 1-3)

Holotype: USNM 360118, 1039 mm TL, a mature male. From Pacific Panama, Darien Province, Punta Patiña, at the mouth of the Golfo de San Miguel, 08°12.36'N, 78°19.58'W. Collected by the shrimp trawler *Leonidas* over a leaf and mud bottom at 5-10 m depth, ~1-2 km from shore, by D. R. Robertson and party at 1000 on 22 January 2000.

Other material examined: FMNH 61772, 466 mm TL, the holotype of *Aplatophis chauliodus*, and 9 other specimens from 9 lots, as listed in McCosker *et al.* (1989: 357).

Diagnosis: A stout ophichthin with nearly uniform gray/brown coloration, overlain on head with a prominent pattern of small white spots; depth 23 times in TL; head large, 6.7 times in TL; dorsal fin arises well behind pectoral fin tips; pectoral fins not elongate, rounded; eye small; jaws elongate, the lower projecting; nostrils tiny, in upper lip; jaw teeth conical, some enlarged as fangs anteriorly, biserial in jaws and uniserial on vomer; vertebrae 19-56-120.

Measurements and counts of the holotype (measurements in mm): Total length 1039; head 155.5; head and trunk 534; tail 505; origin of dorsal fin 223; body depth at gill opening ~46; body width at gill opening ~43; body depth at anus ~46; body width at anus ~41; snout 28.4; upper jaw 53.7; gill

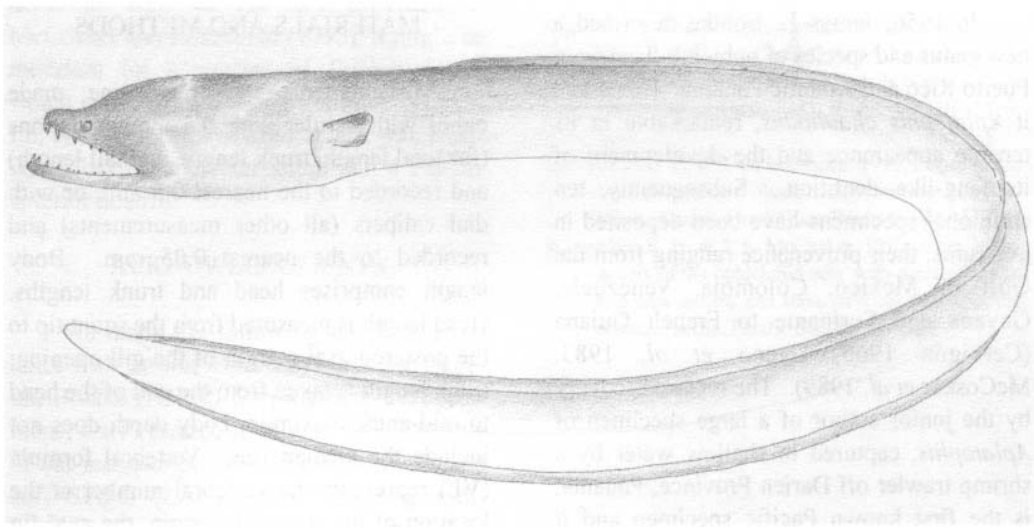

Fig. 1. Holotype of *Aplatophis zorro*, USNM 360118, 1039 mm TL.

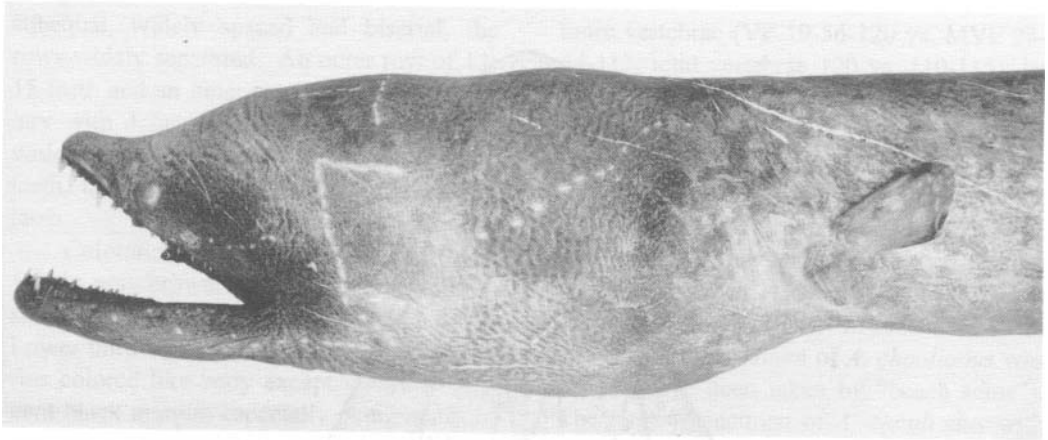

Fig. 2. Head of holotype of *Aplatophis zorro*, USNM 360118, 1039 mm TL.

opening height ~29; pectoral fin length 27.7; pectoral fin base 11.0; isthmus 23.5; eye diameter 4.7; interorbital distance ~23; gasbladder length 98; gasbladder width 35. Total vertebrae 120; predorsal vertebrae 19; preanal vertebrae 56. 19 right and 20 left branchiostegal rays. Total lateral line pores 122; 12 pores before gill opening; 57 pores before anus.

Description: Body stout, its depth at gill openings 23 times in TL. Body and trunk nearly cylindrical, tail becomes laterally compressed posteriorly and tapers to a blunt, finless point. Head and trunk slightly longer than tail, 1.95 and head 6.7 times in TL. Head large, the forehead notably swollen above and behind eyes; the snout short and narrowing notably, its dorsal profile concave. Dorsal fin origin behind pectoral fin tips by more than their length. Pectoral fins somewhat rounded, about equal to snout in length and narrow-based, located in the upper half of the gill opening. Gill openings low-lateral, nearly vertical and elongate. Snout short, rounded as seen from above; jaws elongate, the lower slightly longer than the upper. Anterior nostril in a short tube, appearing as a small barbel in upper lip in advance of and below the eye. Posterior nostril closely behind anterior nostril, a small opening in lip beneath anterior margin of eye. Eye small, its posterior margin located at middle of jaw. A fleshy shelf extends medially from each side of the palate, divided by a gap that continues forward to the last vomerine tooth. Tongue and glossohyal appear, when mouth is closed, to fit into gap. Two small cone-shaped fleshy teats flank the ventral midline of the buccal cavity at the level of the rictus. (It appears, by pressing the ventral surface of the posterior end of the glossohyal, that when the mouth is open the teats could be elevated and function as a lure.) Gasbladder stout, muscular, in posterior third of trunk/visceral cavity.

Head pores (Fig. 2) minute and difficult to ascertain. A median interorbital pore not observed; median temporal pore present. Supraorbital (SO) pores 3; infraorbital (IO) 2 + 2; preoperculomandibular (POP) 5 + 2. Twelve left lateral line pores before gill opening, 57 before anus, and 122 total, the last pore 50 mm before tail tip.

Teeth (Fig. 3) elongate, conical (but not recurved) and prominent, the anterior fangs and outer rows of jaw teeth visible when mouth is closed. Skin through which jaw teeth project is elevated, giving the appearance of a platform supporting the biserial rows. An outer ring of 10 fang-like intermaxillary teeth at end of snout, those teeth the largest (as large as 1.5 times eye diameter), followed by a smaller pair of teeth beneath ethmoid, followed by 8 nearly uniserial vomerine teeth. Maxillary teeth smaller and

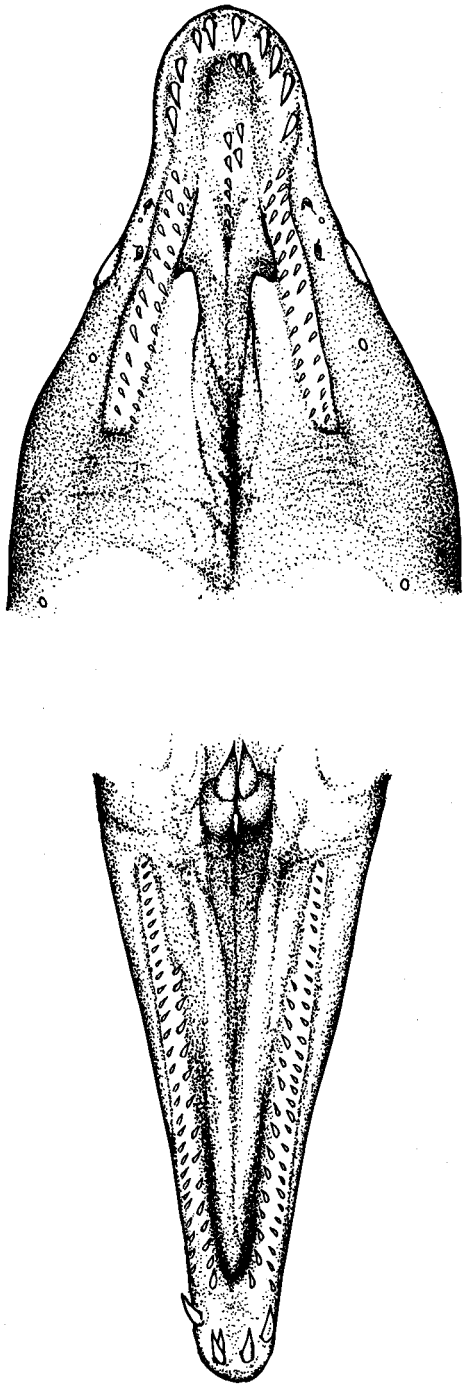

Fig. 3. Dentition of holotype of *Aplatophis zorro*, USNM 360118, 1039 mm TL.

subequal, widely spaced and biserial, the rows widely separated. An outer row of 13-15 teeth and an inner row of 14 teeth. Dentary with 4 fangs anteriorly, followed by 2 widely-spaced rows of smaller subequal teeth, the outer row 29-30, the inner 14-16 teeth.

Coloration in life and in formalin uniformly gray/brown, darker along chin, jaws, snout and dorsal surface above the midline. Lower third of tail and tail tip pale. Median fins colored like body except with a prominent black margin, especially along anal fin. Pectoral fin colored like body. Several small white spots irregularly located along lower jaw, not associated with mandibular pores. Head overlain with a series of what appear to be sensory neuromasts within small white spots. Appearing like a broad letter Π as seen from above, connecting along its lateral margin to a prominent series of spots forming the letter "Z" as seen from the right side (reversed along the left), followed by an upward rising line of 10 white spots ascending posteriorly from mid-head. Inside of mouth colored like head except for central portion of palate posterior to the vomerine teeth which is white. The peritoneum is pale and the eyes are blue (eyes cloudy and grayish in fresh specimen).

Etymology: Named *zorro* for the remarkable coloration of the pore pattern along the face, reminiscent of the slash mark of the swordsman Zorro. Here considered a noun in apposition.

Remarks: Although we have but a single specimen of the new species, it is unlikely that additional specimens of *A. zorro* would be or have been misidentified in collections. We have no doubts concerning its generic placement and distinction from its only congener, the western Atlantic *A. chauliodus*. The two species are very similar in overall appearance, proportions, dentition, and their remarkable physiognomy. They differ however in the following conditions (those data for *A. chauliodus* are based on McCosker *et al.* 1989: 354-357): *A. zorro* has more vertebrae (VF 19-56-120 vs. MVF 23-54-112, total vertebrae 120 vs. 110-115); its dorsal fin origin is slightly farther forward (21.5% of TL vs. 25-28%); its eye is smaller (3% of HL vs. 4-6.3%); its coloration is gray rather than tan; and the development of its tongue "lure" is less extensive than that of *A. chauliodus*. They seem to live in similar habitats, however *A. zorro* was captured in shallower water (5-10 m vs. 33-91 m, although one specimen of *A. chauliodus* was said to have been taken by "beach seine"). The largest specimen of *A. chauliodus* with which we are familiar (n=13) is 815 mm (Cervigón 1966), smaller than the only known specimen of *A. zorro*. Other minor differences in pore pattern, which are difficult to ascertain on all *Aplatophis*, might be clarified with more specimens of *A. zorro*, and the teeth of *A. zorro* are very similar in pattern to those of its congener, but appear to be slightly smaller. We presume that the species of *Aplatophis*, like other robust, sharp-toothed and toothy ophichthines such as species of *Xyrias*, *Brachysomophis*, and *Echiophis*, occupy permanent or semi-permanent burrows in the substrate with only the snout and eyes exposed, and dart out to feed on other fishes and crustaceans (McCosker 1977, McCosker *et al.* 1989, McCosker 1998). The only other ophichthid known to possess a lure and presumably feed by attracting prey is *Glennoglossa wassi*, a fragile myrophine by comparison to the above-mentioned ophichthines (McCosker 1982). *Glennoglossa* has an elongate tongue with "appendages" and "eyes" that extends well beyond the mouth as well as fleshy labial lappets, and probably lies buried in the sand with its mouth open and only its snout and chin tip exposed, luring prey by flicking its tongue. Such behavior by a distantly-related ophichthid (occupying a different subfamily) seems to be convergently-derived and similar in effect.

We were struck by the stout and muscular nature of the gasbladder of the new species and that of *Aplatophis chauliodus*.

Although a systematic survey of ophichthid gasbladders has not been conducted, McCosker's (1977: 48) cursory analysis of a myrophine (*Myrophis vafer*) and an ophichthine (*Ophichthus zophochir*) described their gasbladders as "thin walled, ... white, shiny and flexible" and their lengths as "approximately one-fourth to two-ninths" of the trunk length. The gasbladder/trunk lengths of *A. zorro* and that of *A. chauliodus* (ANSP 116366, 439 mm TL) are .26 and .25, respectively. Although no ophichthid (or other anguilliform, for that matter) has yet been shown to make noise, we wonder if the gasbladder might function as a resonating device to assist an eel such as *Aplatophis*, which presumably inhabits a burrow for much of its existence, in intraspecific communication.

The worm-eels and snake-eels that comprise the family Ophichthidae represent the largest family of true eels, with more than 260 species distributed among 56 genera and two subfamilies. Their diversity and adaptations are as wide-ranging as those of any group of anguilliform fishes, however their burrowing behavior has made their capture difficult and therefore any assumptions about their distribution and centers of evolution are complicated and incomplete. The capture of the first Pacific specimen of *Aplatophis* is instructive in that there have been numerous exploratory expeditions and commercial trawling has been active in Panama, Costa Rica, and beyond for more than half a century, yet no one has previously come forward with a specimen of this large, remarkable and bizarre eel. Seven other New World ophichthid species are still known to ichthyologists from single specimens, perhaps the most extreme being *Ethadophis byrnei* which was captured alive by a beachwalker in the intertidal zone in the Gulf of California (Rosenblatt and McCosker 1970).

We currently recognize 52 species and 25 genera in the western Atlantic (McCosker *et al.* 1989). In the eastern Pacific, we are aware of 47 species distributed among 23 genera (McCosker & Rosenblatt 1995, 1998, Rosenblatt & McCosker in prep.). At present there are nine genera (*Ahlia, Aprognathodon, Asarcenchelys, Caralophia, Hyphalophis, Kertomichthys, Lethogoleos, Mixomyrophis* and *Stictorhinus*) that are known only from the western Atlantic and four genera (*Leptenchelys, Leuropharus, Paraletharchus* and *Scytalichthys*) unique to the eastern Pacific. There are seven genera (*Aplatophis, Echiophis, Ethadophis, Gordiichthys, Herpetoichthys, Letharchus* and *Pseudomyrophis*) that may be considered amphi-American (*Echiophis, Ethadophis* and *Pseudomyrophis* extend to the eastern Atlantic). This is considerably different than Rosenblatt's (1967) pioneering proposal that four western Atlantic, four eastern Pacific, and two amphi-American ophichthid genera were uniquely situated, and reflects the subsequent discovery and description of many new ophichthid taxa.

As with so many other species of genera limited to warm temperate and tropical waters, we presume that the last opportunity for adult and larval mixing across the New World was eliminated by the uplift of the Isthmus of Panama during the mid-Pliocene, approximately 3.5 MYA (Coates *et al.* 1992). The limitation of so many ophichthid genera to either side of Central America must therefore demonstrate that these remarkable adaptations have occurred since the uplift, and/or are the result of a variety of factors including but not limited to habitat specificity and availability, extinction events, or, as the discovery of this large and distinctive new species has clearly demonstrated, our incomplete sampling of the New World ichthyofauna.

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RESUMEN

Un Tieso grande y distintivo, de la familia Ophichthidae, fue capturado por una rastra camaronera en aguas someras (5-10 m), en el Golfo de San Miguel, Pacífico de Panamá. Es la primera especie conocida del género *Aplatophis* para el Pacífico oriental, conocido previamente solo por *A. chauliodus* en el Atlántico occidental tropical. Hemos denominado a la nueva especie *Aplatophis zorro* y le hemos dado el nombre común de "Tieso sobredentado" debido a la remarcable condición de su dentadura. *Aplatophis zorro* es muy similar a su pariente del Atlántico, pero difiere de *A. chauliodus* por tener más vertebras (120 vs. 100-115), la aleta dorsal más larga (78.5% de la longitud total vs. 72-75%), dientes ligeramente más pequeños; y un patrón distintivo de puntos blancos en su cabeza y la coloración del cuerpo es gris en vez de marron claro. El único espécimen conocido de *A. zorro* mide 1039 mm; el espécimen más grande de *A. chauliodus*, de los 13 conocidos, mide 815 mm. Es muy probable que *A. zorro* viva en agujeros en la arena o el fango y atraiga presas grandes usando su lengua como carnada. La nueva especie de *Aplatophis* para el Pacífico de Panamá eleva a siete el número de géneros de ophichthidos amphiamericanos, con otros nueve géneros endémicos para el Atlántico occidental y cuatro géneros endémicos para el Pacífico oriental. El descubrimiento de este extraordinario espécimen demuestra que la fauna de peces cercanos a la costa del Pacífico oriental es muestreada inadecuadamente y no entendida completamente.

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