OCTOPUS MAYA, A NEW SPECIES FROM THE BAY OF CAMPECHE, MEXICO[1]

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ABSTRACT

A new species of ocellated octopus, *Octopus maya,* is described from nine specimens collected in the Bay of Campeche. The species, known only from the bay, was taken during a survey of the octopus fisheries and is the second described species of ocellated octopus from the Atlantic Ocean. It is characterized by a large double-ringed ocellus, large eggs attaining a length of 17 mm, and, in the male, a minute ligula. It is compared with other ocellated species from the Pacific and Indian oceans. A key to the eight species of shallow water octopus of the tropical Western Atlantic Ocean is included.

INTRODUCTION

During the course of a study of the octopus fishery at Campeche, Mexico, one of the writers (Solís) obtained a collection of the local octopus for laboratory study. While the specimens closely resembled *Octopus vulgaris* in external appearance, the eggs were found to be very large, quite unlike the eggs of that species.

In order to identify this important commercial species, specimens were sent to the other writer (Voss) for systematic study. Later, the writers studied the material together at Miami and compared it with material of related species. This paper is the result of the cooperative study.

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A full report on the fisheries and biology of this octopus in the Bay of Campeche is in preparation by Solís. The present paper is a preliminary report on the systematics of the species.

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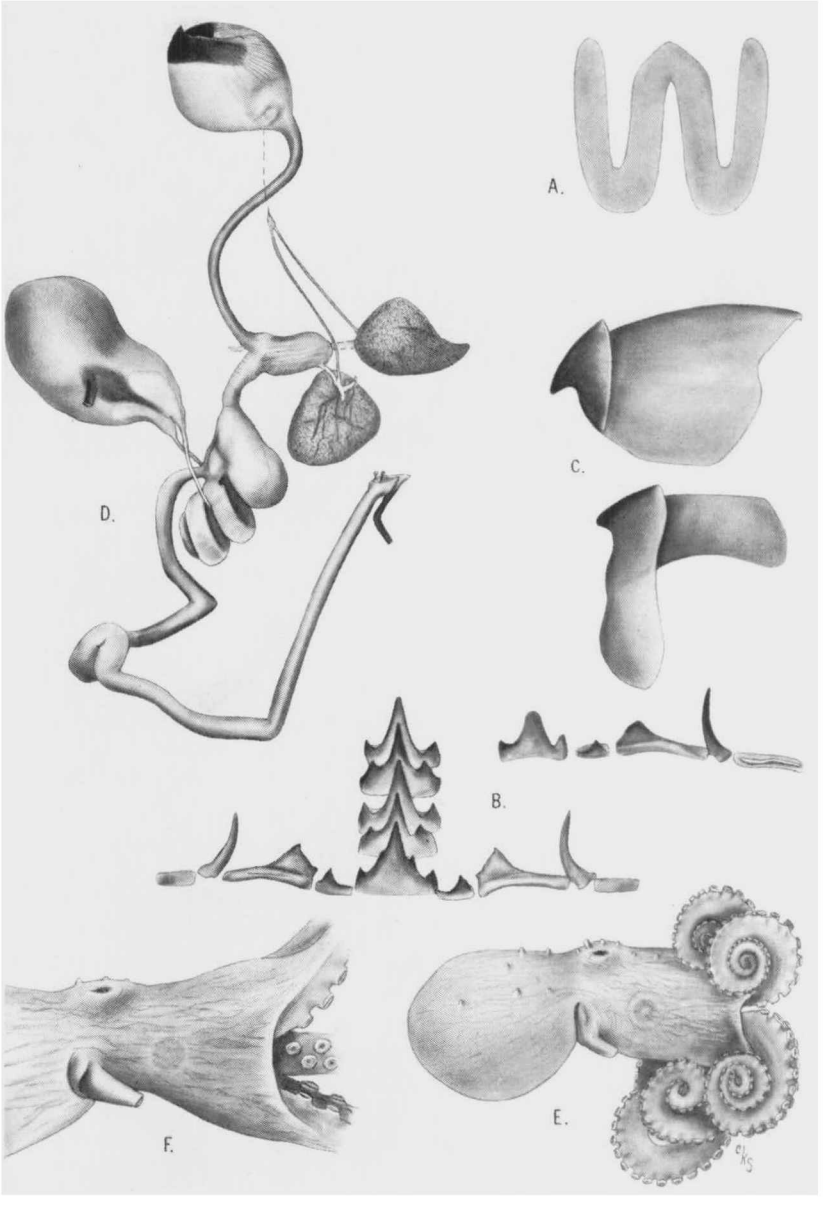

FIGURE 1. A. Funnel organ; B. Radula (left—unused portion; right—used portion); C. Mandibles; D. Digestive tract; E. Ocellus of young female from Puerto Real; F. Ocellus of adult.

The measurements and indices given in this paper are those defined by Pickford (1945) and Pickford & McConnaughey (1949). The illustrations were executed by Constance Stolen to whom grateful thanks are extended.

Octopus maya, new species
Figures 1 & 2

Material Examined.—HOLOTYPE: No. 4. Male, mantle length 115.0 mm, (alcohol), off Lerma, Campeche, 3 fathoms, August 12, 1963. Leg. Consuelo Gutierrez & Manuel Miss.

PARATYPES: No. 1. Female, mantle length 48.0 mm, (formalin), near wharf, at Puerto Real, Campeche in 1.5 fathoms (in an old automobile tire on broken shell bottom), May 23, 1963. Leg. Dilio Fuentes & Manuel Solís R., EBPC-9 (M-36).—No. 2. Male, mantle length 108.0 mm, (formalin), in front of fishery biology station at Campeche, 2 fathoms, (rocks with beds of *Thalassia*), November 22, 1965, Leg. Manuel Arjona, UMML 31.512.—No. 3. Male, mantle length 77.0 mm, (alcohol), Bahia de Campeche, 3 fathoms, August 6, 1963. Leg. Consuelo Gutierrez & Manuel Miss., EBPC-20 (M-7b).—No. 5. Female, mantle length 113.0 mm, (formalin), Bahia de Campeche, without data, UMML 31.513.—No. 6. Male, mantle length 119.0 mm, (formalin), from Playa Bonita, near Erma, Campeche, 2 fathoms, October 1965. Leg. Candelario Zapata & Manuel Arjona.—No. 7. Female, mantle length 115.0 mm, (formalin), NE of Campeche, Campeche, in front of St. Matias's bulkhead, (caught with her clutch of eggs in rock hole), December 9, 1964. Leg. Manuel Solís R. & Leopoldo Duran P.—No. 8. Female, mantle length 116.0 mm, (formalin), NE section of Bahia de Campeche, January 27, 1965, (caught on her clutch of eggs). Leg. Dilio Fuentes, Juan De la Garza & Avelino Miss.—No. 9. Male, mantle length 84.0 mm, (alcohol), Bahia de Campeche, November 14, 1964. Leg. Leopoldo Duran P., EBPC-37 (M-14c).

Description.—This is a species of large octopus. The mantle length of the females is from 48.0 to 116.0 mm, the males 77.0 to 119.0 mm in the collection at hand. The mantle wall is thick and muscular. The mantle is large, oval, and strong, but rather narrow, with a MWI of from 41.0-64.5 (females 43.0-64.5, males 41.9-59.7). It is somewhat pointed posteriorly in some, rounded in others. The neck region is narrow, conspicuously so in most specimens.

The mantle aperture is very wide. The funnel is long, tubular, and free for over half of its length. The funnel organ (Fig. 1A) is moderately wide and W-shaped, with the ends of the limbs reaching to the level of the median portion.

The head is narrow (HWI 26.8-47.9) with small, rather inconspicuous

TABLE 1

MEASUREMENTS (IN MM) OF 4 FEMALES AND 5 MALES OF *Octopus maya*, NEW SPECIES

Character	1	2	3	4	5	6	7	8	9
Sex	♀	♂	♂	♂	♀	♂	♀	♀	♂
Mantle length	48.0	108.0	77.0	115.0	113.0	119.0	115.0	116.0	84.0
Mantle width	31.0	55.0	46.0	68.0	59.0	50.0	50.0	50.0	39.0
Head width	23.0	46.0	30.0	31.0	33.0	32.0	32.0	34.0	23.5
Left arm length									
I	91.0	241.0	239.5	369.0	119.5+	237.0+	354.5	253.5+	324.0
II	108.0	200.0+	283.0	369.0	238.5+	357.0+	426.5	240.5+	374.0
III	96.0	342.0	300.0	386.0	238.5+	217.0+	456.5	422.0+	374.0
IV	115.0	319.0+	284.0	376.0	320.5	328.0+	411.0	313.5+	368.5
Hect. arm length	--	295.0	233.0	278.0	--	257.0	--	--	292.5
Ligula length	--	5.0	4.0	5.0	--	5.0	--	--	4.2
Calamus length	--	2.0	1.8	2.0	--	2.0	--	--	1.5
Sucker diam.	4.2	11.0	8.0	13.0	10.0	12.8	--	11.0	11.0
Arm width	7.5	25.0	18.0	24.0	20.0	18.2	24.5	27.0	19.8
Length of gills	15.0	38.0	37.5	38.0	24.0	31.0	28.5	45.0	27.5
No. of gills	9	10	10	10	10	10	10	10	9
Total length	148.0	465.0	373.0	512.0	443.0	500.0	553.5	555.5	538.0
Web depth									
A	19.0	69.0	51.0	56.0	54.0	112.0	69.0	104.0	46.0
B	29.0	97.0	60.0	61.0	64.5	98.0	62.0	--	52.5
C	32.0	89.0	59.0	53.0	92.0	89.0	85.0	113.0	55.0
D	34.0	77.0	45.0	57.0	70.0	66.0	88.0	119.0	65.5
E	34.0	87.0	57.0	61.0	48.0	78.2	75.5	110.5	71.0

eyes which in the preserved specimens do not project above the surface of the head.

The web is of medium depth (females WDI 19.3-29.5, males WDI 15.8-20.0). In the small collection available, the web is deeper in the females than in the males. The web formula is variable but sector B has a slightly greater frequency than all others for greatest depth and sector A is the shallowest with greater frequency than others. The variation of this feature is shown in Table 1.

The brachial crown is very strong, well developed, and massive. The arms are long (ALI 69.5-83.0), moderately stout (AWI 15.3-23.5), and taper to long, slender, attenuate tips. The suckers are in two rows, closely spaced on the proximal and middle portion of the arms but crowded on the tips. The suckers are of moderate size (SIn females 8.7-9.5, males 10.0-13.0), a little larger in the males. Although the SIn is larger on the average in the males than in the females, no conspicuously larger specialized suckers were seen in the males.

The hectocotylized arm of the male is the third right arm and is conspicuously shorter and wider than its fellow and is not attenuate. It is bordered on the ventral side by a conspicuous spermatophoral groove which begins at the base of the arms and extends to the ligula.

The ligula is minute (LLI 1.4-1.9). It consists of a deep groove the sides of which are turned in, completely obscuring the calamus which is well developed but lies entirely beneath the lateral folds. The calamus is well developed with a distinct spout. The CLI is about 24-27. The ligula and calamus are shown in Figure 2A.

The gills are large, with 9 to 10 lamellae on the outer demibranch including the terminal lamellae. Among the nine specimens, 7 had 10 lamellae and two only had 9.

The radula (Figure 1G) is a typical octopodan type. It is symmetrical with an A_3 seriation of the rhachidian teeth alternating rather regularly with A_2 seriation. The first, second, and third laterals are normal but the lateral plates are slender and square in the earlier portion of the ribbon. On the distal portion the mature plates are very slender and sinuous.

The mandibles are normal in appearance with no specific features of interest. They are shown in Figure 1C.

The digestive tract is shown in Figure 1D. The oesophagus is bordered anteriorly by the anterior salivary glands. It leads into a large and compact crop. The posterior salivary glands are attached to the distal end of the crop by large, short ducts. The stomach is small in comparison with the size of the crop but the spiral caecum is large and consists of three whorls. The intestine leads off from the stomach near the opening of the spiral caecum and makes three sharp turns before ending at the anus. The second turn is partly formed by the intestinal caecum. This, instead of being

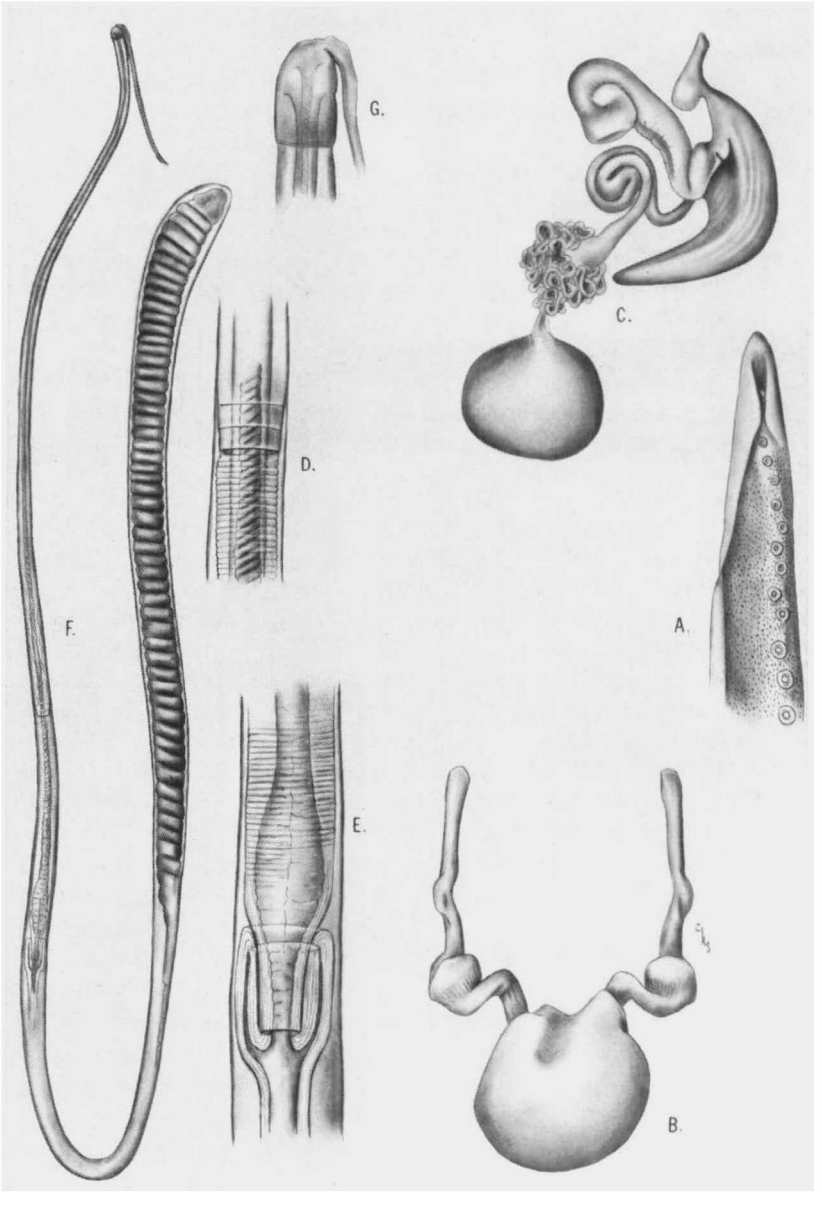

FIGURE 2. A. Ligula of adult male; B. Female genitalia; C. Male genitalia; D. Midportion of horn; E. Anterior end of cement body; F. Spermatophore; G. Cap with ejaculatory thread.

simply a thin-walled area of the intestine, is so turned upon itself that it seems to form a distinct, thin-walled pouch. The intestine then leads back to the dorsal surface of the funnel wall, terminating in a small opening with dorsal and ventral lips and two, large, spoon-shaped anal flaps. The ink sac is deeply involved in the liver and lies partly below the two lobes of the pancreas. It is rounded anteriorly but drawn out to a narrow point posteriorly. The duct makes a sharp turn from the surface of the liver and terminates in a small pore in the dorsal lip of the anus.

The female genitalia (Figure 2B) consist of a large posterior ovary with paired oviducts. The proximal oviducts are about equal in diameter to the distal oviducts. The oviducal glands are large, roundish, and darker in color than the ducts.

The eggs are very large, averaging over 17 mm in length. They are long and slender, and about 4.5 mm wide. The distal end is rounded, the anterior end pointed and possessing a small slender attachment thread. The eggs are fastened in festoons to the underside of rocks.

The male genitalia are illustrated in Figure 2C. They are typically octopodan with no distinctive features. The penis is deeply involved in the visceral wall. It is small, with a short round diverticulum.

The spermatophores (Figure 2D-G) are long and slender. They have a spermatophore length index of 56. They are not strongly divided into sperm sacs and horns, however, even in uninjured examples, so that this character cannot be given. In all examples there are four to eight turns of the horn near the middle piece and about four turns near the middle of the horn. In others the middle turns are lacking. There do not appear to be any turns near the cap. The cap is simple with a long thread.

In the living specimens the color usually is dark brown, but when molested the animal may flush to a reddish shade when trying to escape. When lying on sandy bottom at rest the animal is lighter in color, mimicking the color of the sand.

In preserved specimens the colors are somewhat variable. Specimens preserved in alcohol tend to be reddish-brown, often with a reticulate pattern. Specimens preserved in formalin and later transferred to alcohol are brownish-purple with a greenish cast on the arms and web. The mantle is light grayish-brown with dark spots representing the contracted papillae.

The most distinctive feature of this species is the presence in all specimens of both sexes of a dark spot or ocellus located beneath the eye and between it and the bases of the second and third arms (Figure 1E). In the large adults (Figure 1F) the ocellus is an often indistinct spot consisting of a dark, indistinct ring and a lighter center. In the well preserved small female No. 1 from Puerto Real, the ocellus consists of a narrow outer ring enclosing the smaller somewhat broader inner ring with the central light area. The outer ring is not visible in any of the larger specimens in the

collection. The ocellus index of the outer ring is about 21. The index of the inner ring is about 9.5. The rings in preserved specimens are dark reddish-brown.

The sculpture in the preserved specimens consists of a granular texture on the arms, head, and dorsal part of the mantle. The ventrum is smooth. In the specimen from Puerto Real there is a large cirrus over each eye with several smaller ones around it. There are scattered papillae over the dorsal part of the web and brachial crown, on the head, and on the dorsum of the mantle. In the large specimens the papillae are strongly retracted into the skin and their pattern cannot be accurately described.

Type.—A male, mantle length 115.0 mm (in alcohol), deposited in the U. S. National Museum.

Type Locality.—Off the town of Lerma, Campeche, Mexico on the east side of the Bay of Campeche, in 3 fathoms.

Discussion.—The discovery of a new species of ocellated octopus from the Western Atlantic raises again the question of the relationship and the identity of the various ocellus-bearing species of *Octopus* of tropic seas. The only other species of ocellated octopus known from the Atlantic is *O. hummelincki* Adam, 1936. This is a small species which somewhat resembles the present species if young specimens are compared. However, the LLI is over 4 in *hummelincki* compared with under 2 in *maya.* Also, *hummelincki* has small eggs while those of *maya* are among the largest known for the genus. The ocelli also differ strongly; in *hummelincki* there is no external ring and there is a distinct blue or purple inner ring. The latter is absent in *maya.*

Two recognized ocellated species occur in the eastern Pacific Ocean: *Octopus bimaculatus* Verrill, 1883 and *Octopus bimaculoides* Pickford & McConnaughey, 1949. Both have a LLI of 2 ± 0.8 which is within the range of *maya* (LLI 1.4-1.9). However, *bimaculatus* has small eggs and can be eliminated on this basis alone. *O. bimaculoides* has eggs of comparable size (up to 17 mm in length). The mantle and head, however, are much wider in *bimaculoides,* the web is deeper, and the calamus is much longer (CLI 24-27 in *maya,* 39-50 in *bimaculoides*). The radula is quite different for the two species.

The only ocellated octopus in the Indo-Pacific region which approaches the new species is *O. cyaneus* Gray, 1849 which has a LLI of under 2 and an ocellus with an outer ring closely resembling that of *maya.* This species is easily recognized, however, by the characteristic zebra-like marking between the bases of the suckers on the ventral side of the arms. These are lacking in *O. maya* which differs from *cyaneus* in the details of the internal anatomy and especially the structure of the radula.

It would be unusual, indeed, if a species such as *maya,* with large eggs

TABLE 2
MANTLE LENGTH, NUMBER OF PRIMARY GILL LAMELLAE, INDICES OF BODILY PROPORTIONS, AND SPERMATOPHORE CHARACTERISTICS

Character	Females	Males	Number Female	Number Male
ML	48 – *98* – 116	77 – *101* – 119	4	5
(adults)	113 – *115* – 116	– – –	3	5
MWI	43 – *51* – 64	42 – *52* – 60	4	5
HWI	28 – *34* – 48	27 – *33* – 43	4	5
ALI	73 – *79* – 83	70 – *75* – 80	4	5
MAI	25 – *32* – 42	22 – *28* – 32	4	5
(adults)	25 – *28* – 35	– – –	3	–
AWI	16 – *20* – 23	15 – *21* – 24	4	5
WDI	19 – *26* – 30	16 – *18* – 20	4	4
SnDI	9 – *9* – 10	10 – *11* – 13	3	5
GL	9 – *9.8* – 10	9 – *9.8* – 10	4	5
LLI	– – –	1.4 – *1.7* – 1.9	–	5
CLI	– – –	24 – *25* – 27	–	5
PLI	– – –	18 – *20* – 23	–	3
SpL	– – –	56	–	1
SpLI	– – –	47	–	1
SpRI	– – –	33.4	–	1

typical of species with an immediately benthonic young and with no intermediate planktonic stage, were to have a wide geographic range. The warm-water, cosmopolitan species are characterized by the possession of small eggs with planktonic larvae, insuring a wide distribution. The absence of planktonic young would not have prevented distribution of the species on both sides of Central America during one or more of its several submergences and *O. hummelincki* and *O. maya* may well be related to the eastern Pacific species *bimaculatus* and *bimaculoides.*

Remarks.—The specific name, *maya,* is derived from the name of the Indians of Yucatan, the ancient Maya, whose descendants still inhabit the peninsula.

THE SHALLOW WATER OCTOPODS OF THE TROPICAL WESTERN ATLANTIC

In 1945, Pickford published her review of the littoral octopods of the Western Atlantic. At that time, five species were recorded from the area: *Octopus macropus, O. vulgaris, O. briareus, O. joubini,* and *O. hummelincki.* The key given in her paper is widely used today among field workers and specialists alike but the discovery of three new shallow water octopus in the ensuing years has out-dated the key and made its use misleading.

The first addition to the fauna was made by the publication of the

description of *Octopus burryi* from the Florida Keys (Voss, 1950), followed in 1964 by the discovery of the presence of *O. defilippi* Verany in western Atlantic waters (Voss, 1964). This species had been confused with *O. vulgaris* in the Western Atlantic but its recognition now is not difficult. The addition of yet a third species, *O. maya,* indicates the need for a revised key to the shallow water octopods of the western Atlantic Ocean. The following key is mainly original but is based upon Pickford's earlier key (Pickford, 1945). Like all keys, it should be used with discretion.

KEY TO THE SHALLOW WATER SPECIES OF *Octopus* OF THE TROPICAL WESTERN ATLANTIC

1. An ocellus or dark spot or ring on each side of the head between the eye and the second and third arms 2
1. No ocellus or dark spot or ring present 3

2. Ocellus with a narrow blue ring within the spot; animals small; gills 6-7; ligula index 4-5; eggs small ..... *Octopus hummelincki* Adam
2. Ocellus without a blue ring; animals large; gills 9-10; ligula index 1.4-1.9; eggs large, to 17 mm ..... *O. maya,* new species

3. Mantle, head, and arms covered with close-set papillae; dark purplish or brownish band on dorsal side of arms; size small; gills 8-11; ligula index 4.1-5.5; eggs small ..... *O. burryi* Voss
3. Mantle, head, and arms not covered with close-set papillae; no dark band on dorsal border of arms 4

4. First arms always largest and usually longest, stoutest or coequally stoutest with second arm; animals medium to large; gills 9-13; ligula index up to 14; eggs small ..... *O. macropus* Risso
4. Second and/or third arms longest, usually conspicuously so; 5

5. Second and third arms much larger and stouter than first and fourth arms; animals medium to large; gills 6-8; ligula index 3-4; eggs large, to 10-14 mm ..... *O. briareus* (Robson)
5. Second and third arms not markedly larger and stouter than other arms 6

6. Arms very long and slender, asymmetrical in length; mantle small; animals small to medium; gills 11; ligula index 1.8-2.5; eggs not known ..... *O. defilippi* Verany
6. Arms not conspicuously long and slender; arms symmetrical or nearly so in length 7

7. Arms stout, moderately short; animals medium to large; gills 7-11; ligula index under 2.5; eggs small, 3 mm or less ..... *O. vulgaris* Cuvier

7. Arms short; animals small; gills 5-7; ligula index 4-7; eggs moderately large, 5-10 mm ..... *O. joubini* (Robson)

SUMARIO

Octopus maya, UNA ESPECIE NUEVA DE PULPO DE LA BAHÍA DE CAMPECHE

Con base en 9 ejemplares de octópodos, colectados en la Bahía de Campeche, México, se describe una especie nueva de pulpo de aguas someras, *Octopus maya,* de la región occidental del Océano Atlántico. Es de talla grande (longitud del manto en los ejemplares examinados: 48.0-116.0 mm en las hembras y 77.0-119.0 mm en los machos) y huevos grandes (17 mm de longitud y 4.5 mm de ancho). Siendo el carácter más distintivo de esta especie, la presencia en todos los ejemplares de ambos sexos de una mancha oscura u ocelo situado bajo los ojos, y entre éstos y la base del segundo y tercer brazos, haciéndose menos aparente en los adultos. Este último carácter es discutido comparativamente con especies que también poseen ocelos, tales como *Octopus hummelincki* Adam, 1936, también del Atlántico; *O. bimaculatus* Verrill, 1883 y *O. bimaculoides* Pickford and McConnaughey, 1949 de la porción este del Océano Pacífico y *O. cyaneus* Gray, 1849 de la región del Indo-Pacífico; apoyándose para diferenciar éstos de *O. maya* en el sistema de medición seguido por Pickford (1945) y Pickford y McConnaughey (1949).

Este trabajo es ilustrado con dibujos y cuadros, adicionándose una clave de campo para la identificación de *Octopus* de aguas someras del Atlántico Tropical occidental.

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