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TWO NEW SPECIES OF SCIAENID FISHES (TRIBE:
SCIAENINI) FROM THE CARIBBEAN SEA AND
ADJACENT WATERS

Labbish Ning Chao and Robert Victor Miller

ABSTRACT

The genus *Sciaena*, heretofore monotypic, is characterized by the lack of mental barbels and an elongate swimbladder with no appendages. Two new species *S. trewavasae* and *S. bathytatos* are described herein. The new species differ from *S. umbra*, the type species of the genus, and from one another in the following characters: *S. umbra* has 11 + 14 vertebrae, 15-20 gill rakers, 23-26 soft dorsal rays, 9-13 inner gill rakers; *S. trewavasae* has 10 + 15 vertebrae, 19-21 gill rakers, 24-26 soft dorsal rays, 13-16 inner gill rakers; *S. bathytatos* has 11 + 14 vertebrae, 22-27 gill rakers, 21-23 soft dorsal rays, 17-20 inner gill rakers.

Atlantic sciaenids can be divided into two groups based on their otoliths. One group is characterized by an enlarged lapillus and sagitta and includes the genera *Bairdiella*, *Odontoscion*, *Ophioscion*, and *Stellifer*. The other group has only an enlarged sagitta and includes the other Atlantic American sciaenid genera, e.g., *Leiostomus*, *Micropogon*, and *Sciaenops*. *Sciaena* is included in the latter group, but at present we cannot say to which genera it is most closely related.

Two new species of sciaenid fishes were captured by the National Marine Fisheries Service R/V OREGON, during several exploratory fishing cruises from 1962 to 1966 and by UNDP/FAO Caribbean Fisheries Development Project vessel CALAMAR in 1968, in the Caribbean and adjacent waters (Table 1). They have a simple swimbladder and no mental barbel, characters diagnostic of the tribe Sciaenini (Trewavas 1962). Therefore, we classify these two new species in the genus *Sciaena* of the tribe Sciaenini. Other diagnostic characters are the relatively large eye, long pectoral fin, narrow caudal peduncle and pointed tail in adults, the number of gill rakers, fin rays, precaudal and caudal vertebrae.

These two species occur in deeper water (Table 1) than other known species of sciaenids. *Sciaena trewavasae* was mostly caught at depths of 35-120 fathoms and *Sciaena bathytatos* even deeper at 100-300 fathoms. According to opinion 988 of the International Commission of Zoological Nomenclature (1972) the only known species of *Sciaena* was the type-species *Sciaena umbra* L. (Trewavas, 1962 and personal communication). The nominal genus *Sci-*

aena was mistakenly used by many ichthyologists to include numerous species of sciaenid fishes before the type species of *Sciaena* was fixed and other genera well defined. Several specimens of *S. umbra* are compared with the new species.

METHODS

The standard methods of Hubbs and Lagler (1958) were used for all counts and measurements except that eye diameter was measured horizontally, body depth was measured at the origin of the pelvic fins and lengths of pectoral and pelvic fins were measured from the origin of the first ray to the tip of the longest ray. Pectoral length was taken from the right side and pelvic from the left. Maxillary length was measured from the juncture of the premaxillaries to the antero-ventral corner of the maxillary bone, which gave the relative size of the maximum mouth opening. The small scales perforated by the lateral-line tubule were counted as lateral scales from the upper end of the gill slit to the end of the hypurals. Transverse scales were counted from the origin of the second dorsal fin to about the vent or anal origin. Gill rakers were counted on the ex-

Table 1. Field data for *Sciaena trewavasae* and *S. bathytatos*

Station No.	Date	Locality (off coast of)	Latitude (N)	Longitude (W)	Depth (fathoms)	Gear	Temperature (F°)		No. of specimens
							bottom	surface	
<i>Sciaena trewavasae</i>									
OREGON 4466	10/17/63	Venezuela	10° 44'	66° 09'	40	40 ft†	76	81	1
4467	10/17/63	Venezuela	10° 25'	65° 42'	50	40 ft†	77	83	3
4843	5/17/64	Colombia	11° 08.5'	74° 29'	100-120	40 ft†	—	80	9
4844	5/17/64	Colombia	11° 06'	74° 30'	100	40 ft†	—	80	3
4847	5/17/64	Colombia	11° 06'	74° 29'	35-40	40 ft†	—	78	12
4856	5/19/64	Colombia	11° 08'	74° 23.8'	100	40 ft†	—	78	6
4872	5/23/64	Colombia	11° 08'	75° 14'	35	65 ft†	—	80	3
4873	5/23/64	Colombia	11° 02.8'	75° 10'	100-110	65 ft†	—	80	2
<i>Sciaena bathytatos</i>									
OREGON 3592	5/30/62	Panama	09° 13'	80° 43'	240	40 ft†	—	82	1
4465	10/17/63	Venezuela	10° 45'	66° 37'	125	40 ft†	59	83	1
4474	10/20/63	Venezuela	10° 43'	64° 29'	300	40 ft†	63	83	4
4859	5/19/64	Colombia	11° 09'	74° 26.5'	180-195	65 ft†	—	80	3
4860	5/19/64	Colombia	11° 09'	74° 26'	155-160	65 ft†	—	78	1
5028	9/22/64	Tobago	11° 30'	60° 46'	200-240	40 ft†	—	84	7
5629	9/28/65	Venezuela	10° 52'	67° 58'	155	40 ft†	59	82	2
5722	10/16/65	Colombia	09° 36'	76° 22'	280	65 ft†	50	80	2
5975*	3/17/66	Trinidad	10° 55'	61° 40'	66	Handline	—	80	6*
5976*	3/17/66	Grenadines	12° 06'	61° 45'	70	Handline	—	80	6*
CALAMAR 401	5/2/68	Trinidad	ca 11° N	61° W	38-39	—	—	—	1

* Specimens from combined stations 5975 and 5976.

† Designates 40- and 65-foot flat shrimp trawls.

ternal side of the first right gill arch including the number of "obvious" rakers (where length of raker is greater than maximum thickness, Miller 1971) and tubercles. The raker usually found at the articulation of the ceratobranchial and epibranchial was recorded as part of the lower branch count. Inner gill rakers and tubercles were also counted on the first right gill arch. Vertebral counts were determined from radiographs. The first caudal vertebra was identified by the absence of pleural ribs on the haemal process and it always has a short haemal spine just behind the elongated proximal pterygiophore of the anal fin. Gonads were dissected and 30 eggs from at least one specimen of both new species were measured with an ocular micrometer for every month that collections were available.

Morphological terminology used in describing these two new sciaenid species follows Chu, Lo and Wu (1963) and Trewavas (1964).

Genus *Sciaena* Linnaeus 1758

Sciaena umbra Linnaeus, 1758, was designated the type-species of the genus *Sciaena* Linnaeus, 1758, by the plenary power of the International Commission for Zoological Nomenclature (1972, opinion 988) and interpreted by the neotype designated by Trewavas (1966). The genus *Sciaena* may be distinguished from other genera of sciaenids by lacking a mental barbel and having a simple swimbladder (Figs. 1 and 2). The exact limits of the genus have not yet been established.

Description.—Body compressed, rather elongate with evenly arched dorsal profile at origin of dorsal fin, anterior outline rather straight above eye; snout projecting in front of upper jaw when mouth closed, three to five rostral (upper) pores on snout (Fig. 2), rostral lobes with five marginal (lower) pores, one median and two lateral pores at

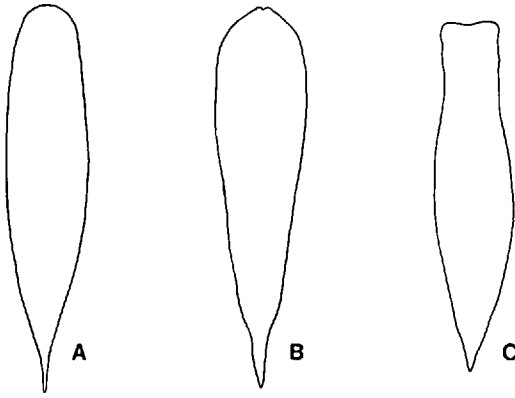


Figure 1. The shape of swimbladders in *Sciaena trewavasae* (A), *S. bathytatos* (B), and *S. umbra* (C).

either side. Five mental pores. No mental barbel on lower jaw.

Swimbladder large, oval and simple, with no appendages; anterior end blunt, with posterior tapering sharply (Fig. 1), sometimes extending to base of first anal spine. Mouth inferior, cleft horizontal or slightly oblique. Teeth villiform, in bands on both jaws; a single row of enlarged conical teeth on external edge of premaxilla. Preopercle edge with fine serrae slightly stronger at angles. First dorsal fin with 10 spines, first ray of second dorsal fin spinous; anal fin with two spines and seven rays, second spine much stronger and elongate. Caudal fin with nine superior and eight inferior main (long)

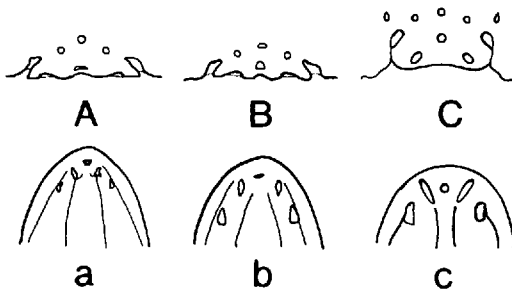


Figure 2. Diagrammatic representation of the arrangement of the rostral and marginal pores (A, B, C) and mental pores (a, b, c) of the holotypes of *Sciaena trewavasae* (A, a), *S. bathytatos* (B, b), and a specimen of *S. umbra* (C, c).

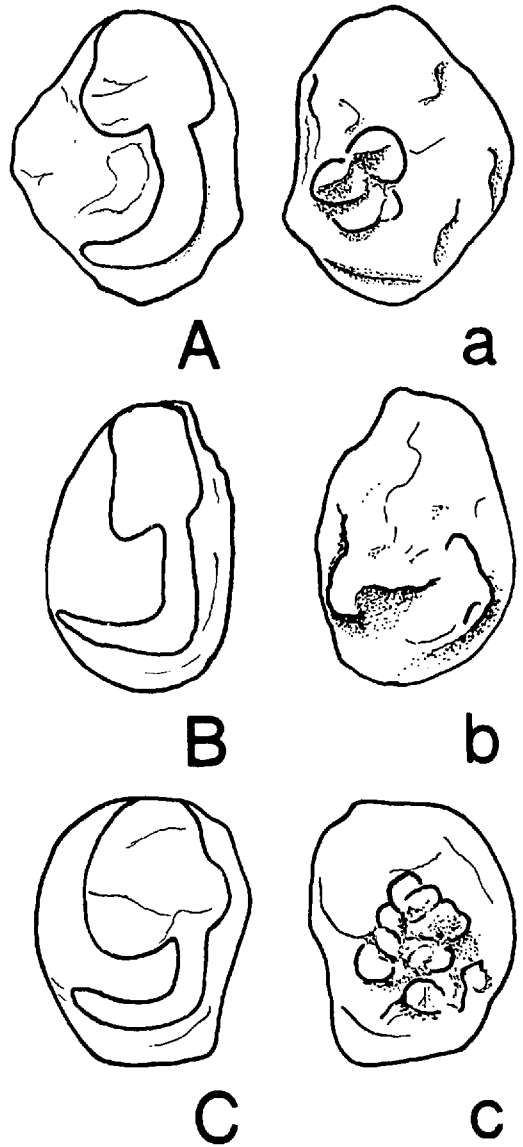


Figure 3. Diagrammatic representation of the inner (A, B, C) and external (a, b, c) surfaces of sagittae of *Sciaena trewavasae* (A, a), *S. bathytatos* (B, b), and *S. umbra* (C, c).

rays. The sagitta is the only enlarged otolith (Fig. 3) compared to some other sciaenid fishes (see relationship and biology section below). Gill rakers rather short, slender and widely spaced.

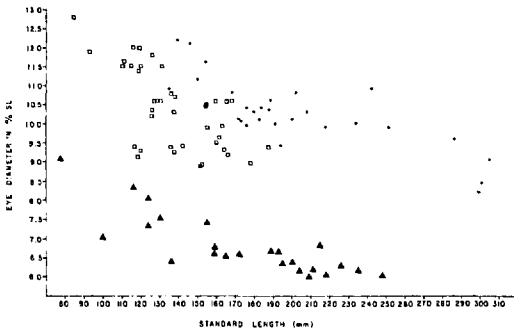


Figure 4. Eye diameter in percent of standard length by the standard lengths of *Sciaena trewavasae* (□), *S. bathytatos* (●), and *S. umbra* (▲).

Sciaena umbra Linnaeus 1758

Neotype: BMNH (British Museum of Natural History, London, England) 1893, 9.21.10.

Diagnosis.—*Sciaena umbra* may be distinguished from *S. trewavasae* and *S. bathytatos* by having black pigment on the lower part of the soft rays of the pelvic, anal and lower margin of the caudal fins, a pale peritoneum and five rostral pores. The number of inner gill rakers is less than that in *S. trewavasae* and *S. bathytatos* (Table 2). *S. umbra* also has the longest fourth or fifth dorsal spine exceeding the origin of the second dorsal. The vertebral count is the same as in *S. bathytatos*, 11 + 14 = 25. *S. umbra* has a smaller eye (Fig. 4), head (Fig. 5) and mouth (Fig. 6), and longer second anal spine (Fig. 7). The otolith, pore system and swim-

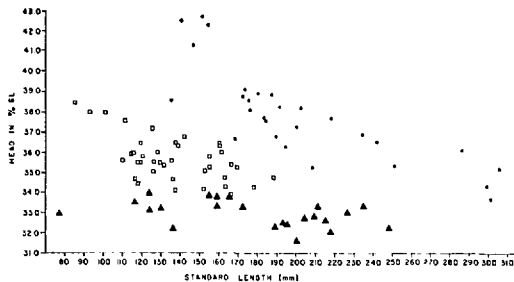


Figure 5. Head length in percent of standard length by the standard lengths of *Sciaena trewavasae* (□), *S. bathytatos* (●), and *S. umbra* (▲).

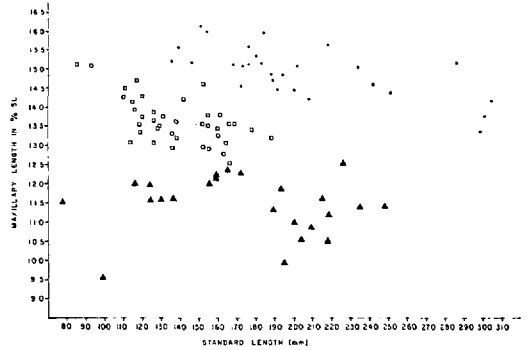


Figure 6. Maxilla length in percent of standard length by the standard lengths of *Sciaena trewavasae* (□), *S. bathytatos* (●), and *S. umbra* (▲).

bladder also differ slightly from the two new species (Figs. 1, 2, and 3).

Comments.—*Sciaena umbra* was considered monotypic until the discovery of the two new species. It is found throughout the Mediterranean, Black Sea and Sea of Azov, and along the eastern Atlantic coast from the southern coast of Portugal south to Senegal (Trewavas 1962, 1973). They mainly inhabit rocky places with weeds.

Sciaena trewavasae new species

Figure 8

Holotype: USNM (United States National Museum, Washington, D. C.) 211513; 155 mm SL, R/V OREGON station 4843; Caribbean Sea off Colombia, 11°8.5'N, 74°29'W; 100 to 120 fathoms; 40 foot flat shrimp trawl; May 17, 1964.

Paratypes: USNM 211573 (5, 119-155); OREGON

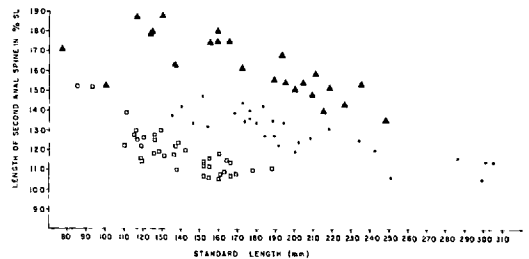


Figure 7. Length of second anal spine in percent of standard length by the standard lengths of *Sciaena trewavasae* (□), *S. bathytatos* (●), and *S. umbra* (▲).

Table 2. Counts of three species of *Sciaena*

Species	Dorsal Spines			Dorsal Soft Rays							Total					
	IX	X	XI-I	21	22	23	24	25	26	31	32	33	34	35	36	37
<i>S. trewavasae</i>	40															
<i>S. bathytatos</i>	1	27*		8	12*	8	2	31*	7	1	9	10*	8	2	31*	7
<i>S. umbra</i>	20*	5		1	13	7*	3							1	10	11* 3

Species	Pectoral Rays			Pre-caudal		Caudal		Total	
	14	15	16 17 18	10 11	14 15	14 15	25		
<i>S. trewavasae</i>	3	36*	1	9*		9*	9		
<i>S. bathytatos</i>	1	6	14*	10*	10*	10*	10		
<i>S. umbra</i>	2	13*	10	9	9	9	9		

Species	Gill Rakers Excluding Tubercles														Total													
	Upper							Lower																				
	4	5	6	7	8	9	7	8	9	10	11	12	13	14	15	12	13	14	15	16	17	18	19	20	21	22	23	
<i>S. trewavasae</i>	4	35*	1				2	1*	11	15	7	4				2	4*	9	14	8	3							
<i>S. bathytatos</i>	3	23*	2				1	2	18*	7						1	1*	5	9	6								
<i>S. umbra</i>	1	4*	13	4	3		2	4*	11	8																		

Species	Gill Rakers Including Tubercles														Total															
	Upper							Lower																						
	5	6	7	8	9	9	9	10	11	12	13	14	15	16	17	18	19	15	16	17	18	19	20	21	22	23	24	25	26	27
<i>S. trewavasae</i>	34*	6					17	21	2																					
<i>S. bathytatos</i>	1	24*	3				1	3	20*	2	1	1																		
<i>S. umbra</i>	1*	13	7	5			4	7*	10	2	2																			

* Indicates counts of holotypes, or for *S. umbra*, counts of the neotype.

Table 2. Continued

	Inner Gill Rakers																				Total									
	Upper										Lower																			
	2	3	4	5	6	7	8	9	10	11	12	13	14	9	10	11	12	13	14	15	16	17	18	19	20					
<i>S. trewavasae</i>	1	22*							4	14*	5							1	3	14*	5									
<i>S. bathytatos</i>				15*	8				4	7	6	8	1*					2	7	5	8	1	1*							
<i>S. umbra</i>	15	10*				4	7	6	8	1*																				
	Lateral Line Scales																													
	47	48	49	50	51	52	53	54	55	58	15	16	17	18	19	20	21	22	23	24										
<i>S. trewavasae</i>	5*	7	7	3										1	4*	3	1													
<i>S. bathytatos</i>	2	4	6*	8										1	10*	3														
<i>S. umbra</i>				1	1	8	6	3	4*	1					1	2	2	7	1	1*										
	Scales In A Transverse Row																													
	17	18	19	20	21	22	23	24	25	26	27	28	29	30																
<i>S. bathytatos</i>																														
<i>S. umbra</i>	1	6*	4																											
				1	4	1	2	5	3	3	4*	1																		

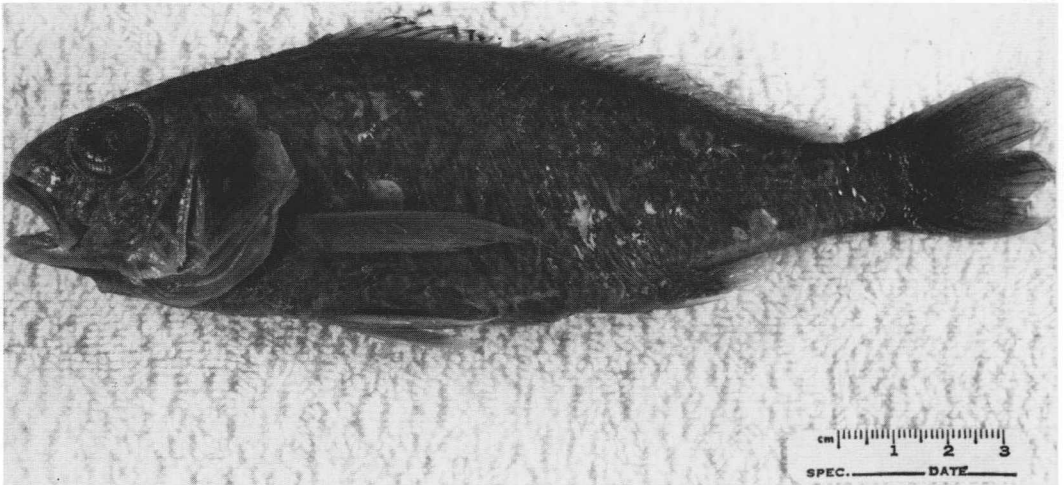


Figure 8. *Sciaena trewavasae*, new species, USNM 211513, holotype, 155 mm SL, from the Caribbean coast of Colombia, South America (photographed by K. Thornberry).

4843. USNM 211574 (3, 110-155); OREGON 4844. USNM 211575 (10, 116-166); OREGON 4847. USNM 211576 (3, 85-111); OREGON 4467. AMNH (American Museum of Natural History, N. Y.) 33469 (1, 153); OREGON 4856. ANSP (The Academy of Natural Science, Philadelphia) 126873 (2, 126-142); OREGON 4873. BMNH, London 1974.4.1.1 (2, 119-164); OREGON 4856. CAS (California Academy of Science, San Francisco) 29739 (1, 160); OREGON 4843. FMNH (Field Museum of Natural History, Chicago) 77046 (1, 127); OREGON 4466. FSM (Florida State Museum, Gainesville) 19888 (1, 161); OREGON 4847. MCZ (Museum of Comparative Zoology, Harvard University, Cambridge) 49118 (1, 178); OREGON 4847. UMML (University of Miami Marine Laboratory, Miami) 31588 (2, 136-152); OREGON 4856.

Diagnosis.—*Sciaena trewavasae* may be distinguished from *S. umbra* by the absence of black color on the pelvic, anal and lower margin of the caudal fins, by the large head and eye (Figs. 4 and 5) and three rostral pores on the snout (Fig. 2); from *S. bathytatos* by the greater number of dorsal rays, lesser number of gill rakers and 11 precaudal vertebrae (Table 2). Other characters such as snout pores, otoliths (sagitta), morphometric and meristic characters are also diagnostic, but with limitations (Tables 2 and 3, Figs. 1-7).

Table 3. Selected diagnostic measurements of three species of *Sciaena* (in percent of standard length)

	<i>Sciaena trewavasae</i>			<i>Sciaena bathytatos</i>			<i>Sciaena umbra</i>		
	Holotype USNM 211513	Specimens N = 40 (\bar{x})		Holotype USNM 211514	Specimens N = 28 (\bar{x})		Neotype BMNH 1893, 9.21.10	Specimens N = 25 (\bar{x})	
SL (mm)	155	84.7-178		208	135-305		313	77.1-248	
Eye diameter	10.5	8.8-12.8 (10.1)		10.3	8.0-12.2 (9.9)		6.0	6.0- 8.1 (7.1)	
Maxillary length	13.8	12.3-14.6 (13.6)		14.2	13.3-16.0 (14.9)		12.3	9.9-13.8 (11.4)	
Inter-orbital width	6.7	6.0- 8.1 (6.7)		6.9	6.4- 7.8 (6.8)		6.7	6.4- 7.6 (6.9)	
Head length	35.2	33.2-38.4 (34.8)		35.3	33.7-42.7 (36.4)		33.9	30.4-34.0 (32.8)	
Body depth	30.7	28.8-32.3 (30.8)		31.7	30.7-34.5 (33.0)		33.6	30.1-35.5 (33.4)	
Pectoral length	27.2	25.5-30.6 (26.5)		27.1	25.8-29.5 (26.7)		22.6	17.6-25.9 (22.4)	
Pelvic length	20.6	17.2-23.2 (20.2)		22.2	19.2-25.5 (21.5)		22.7	20.8-31.0 (26.1)	
Least caudal peduncle depth	10.5	8.1-10.5 (9.0)		8.9	8.3-10.0 (8.9)		11.0	9.4-11.8 (10.9)	
Second anal spine	11.2	10.6-15.2 (11.7)		12.6	10.5-14.7 (12.4)		13.1	13.1-18.7 (16.0)	
Longest dorsal spine	12.2	9.9-14.3 (12.1)		12.1	11.4-15.2 (13.1)		15.7	15.7-27.4 (21.2)	

Description.—D. X, I + 24-26; A. II, 7; P. 15-17; segmented caudal 17; lateral line scales 47-50. Morphometric data and additional counts of the specimens are presented in Tables 2 and 3.

Body compressed with evenly arched back, maximum depth between origin of dorsal and origin of pelvic fins. Head moderate (Fig. 5), snout projecting slightly in front of upper jaw, with three rostral (upper) pores and five marginal (lower) pores. Rostral fold (flap) free and divided into four lobes (Fig. 2 A) by two weak inner notches and two deep outer notches for the inner and outer paired pores respectively. Mental (mandibular) pores five, relatively small (Fig. 2 A) median pore rounded, two lateral pairs slit-like. No mental barbel or process on lower jaw. Numbers of nasal papillae (lamellae) 24-34 ($n = 10$) on nasal rosette, increasing with size of fish.

Mouth moderately large, inferior, cleft slightly oblique. Upper jaw projecting in front of lower jaw, maxilla reaching anterior half of eye. All teeth on premaxilla and dentary small in villiform bands, except those of outer row of upper jaw which are enlarged and canine-like. Pharyngeal teeth small and sharp.

Eye large, situated almost entirely in anterior half of head; interorbit flat to convex, slightly narrower than eye. Passage of laterosensory canal system under dermal roofing of skull, suborbitals, preopercle, lachrymal and jaw clearly visible externally. Preopercle with serrated margin most prominent at the angle. Gill rakers short, slender, (6-7) + (13-15) = 19-21; inner gill rakers (3-4) + (10-12) = 13-16 on the first gill arch (Table 2) and similar in size. Inside of branchial chamber dark from posterior wall to inner side of opercle, shading to pale on inner margin. Pharyngeal cavity darkish gray in back of vomer, on roof, posterior surface of tongue, and on side of pharynx to pharyngeal teeth.

Body and head covered with relatively large ctenoid scales, except in front of eye and cheek where there are small cycloid scales; no scales on tip of snout. Lateral line

scales regularly arranged, continuous to end of caudal fin. One or two rows of small ctenoid scales sheathing base of soft dorsal and covering basal $\frac{1}{3}$ to $\frac{1}{2}$ of anal fin and anterior half of caudal fin. Both pectoral and pelvic fins with a scaly axillary process.

First and second parts of dorsal with a deep notch between, first dorsal without elongate filament. Pectoral fin originating directly below dorsal origin, its distal end almost reaching the line vertically above the vent. Pelvic fin originates a little behind pectoral with an elongated filamentous first soft ray, reaching below origin of second dorsal. Anal fin with first spine minute, second long and pungent, soft rays not elongated. Caudal fin slightly pointed (or double truncate) with the apex at end of lateral line.

Body cavity extends slightly beyond vent. Peritoneum black. Intestine short (54.97% of SL in specimen of 167 mm SL) with two loops; pyloric caeca 4-5 ($n = 2$), thick and elongated. Swimbladder (Fig. 1 A) simple with a blunt, rounded anterior end not extending to coelomic septum, tapered posterior end not reaching vent, and no lateral diverticulae.

Sagittae from preserved specimens show slight "erosion" along the margin. Inner surface of sagitta (Fig. 3 A) with a tadpole-shaped impression (sulcus), the head section in contact with anterior margin, the tail section grooved in J shape, curving toward the ventral margin.

Color of 40 specimens (in 40% isopropanol) uniform pale brown, slightly darker at base of median fins and inner side of paired fins, a black blotch present at axillary process of pectoral, margin of spinous dorsal and caudal slightly darkish. Opercle darkish due to black lining of branchial chamber.

Distribution.—The specimens of *Sciaena trewavasae* were taken in the southern Caribbean Sea (Table 1) between 10°43' to 11° 8.5'N and 64°29' to 75°10'W between 35 and 120 fathoms. One specimen was reportedly caught off the east coast of Florida (OREGON 5161; 29°47'N, 80°50'W; January

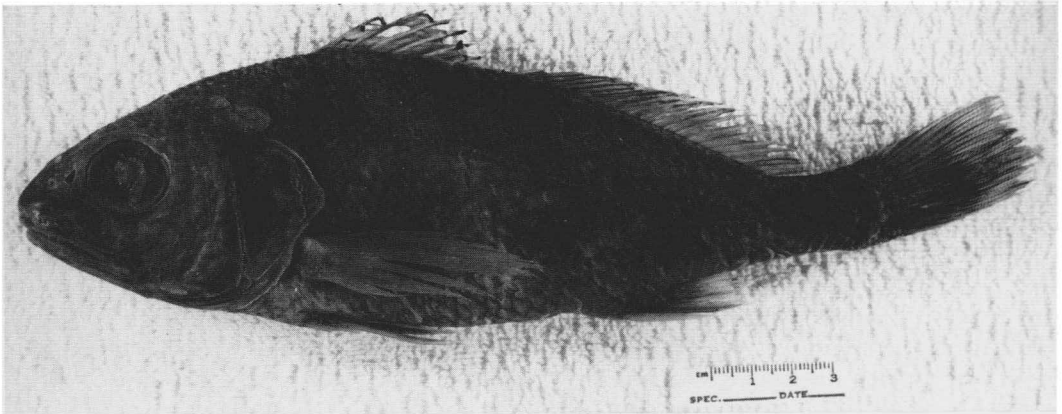


Figure 9. *Sciaena bathytatos*, new species, USNM 211514, holotype, 208 mm SL, from the Caribbean coast of Colombia, South America (photographed by K. Thornberry).

12, 1965) at a depth of 15 fathoms; this was the only fish caught by a 6-foot tumbler dredge. This locality is widely separate from the range of other specimens, and may be mislabeled from SILVER BAY station 5161 (R. B. Roe, personal communication), and therefore must be considered as a collection from an uncertain locality.

Etymology.—This species is named after Dr. Ethelwynn Trewavas, British Museum of Natural History, for her valuable contributions to the study of the Sciaenidae.

Sciaena bathytatos new species

Figure 9

Holotype: USNM 211514; 208 mm SL, R/V OREGON station 5722, Caribbean Sea off Colombia, 9°36'N, 76°22'W, 280 fathoms, 65 foot shrimp trawl; October 16, 1965.

Paratypes: USNM 211578 (1, 305); OREGON 3592. USNM 211579 (3, 140-151); OREGON 4474. USNM 211580 (1, 242); OREGON 5722. USNM 211581 (2, 299-301); OREGON 5629. AMNH 33470 (1, 234); OREGON 4859. ANSP 126874 (2, 202-251); OREGON 4859. BMNH 1974.4.1.2. (1, 188); OREGON 5028. CAS 29740 (1, 154); OREGON 4474. FMNH 77047 (1, 135); OREGON 4465. FSM 19889 (1, 176); OREGON 5028. MCZ 49119 (1, 191); OREGON 5028. UMML 31589 (1, 183); CALAMAR 401.

Diagnosis.—*Sciaena bathytatos* may be distinguished from the other two species of *Sciaena* by the greater number of gill rakers

on the first gill arch and lesser number of dorsal rays; by having 11 abdominal and 14 caudal vertebrae (Table 2) and a larger head (Fig. 5). For other diagnostic characters, see Tables 2 and 3 and Figures 1 to 7.

Description.—D. X, I + 21-23; A. II, 7; P. 15-18; segmented caudal 17; lateral line scales 47-50, trans-lateral line scales 17-19. Morphometric data and counts are presented in Tables 2 and 3.

Body compressed, with an evenly arched back, steeper in front of dorsal origin, greatest depth between origin of dorsal and pelvic fins. Head large (Fig. 5). Snout projecting slightly in front of upper jaw, with three rostral (upper) and five marginal (lower) pores. Rostral fold free and divided into four lobes (Fig. 2 B), by two weak inner and two deep outer notches for inner and outer paired pores respectively. Mental pores five, relatively large (Fig. 2 b); the median pore small with semicircular opening covered by a fleshy pad from behind. Pores of both inner and outer pairs prominent and rounded; outer pair larger than inner pair. No mental barbel present. Number of nasal papillae (lamellae), 29-41 ($n = 12$).

Mouth moderately large, inferior, cleft slightly oblique or horizontal; maxilla reaching under middle of eye. Upper and lower

jaw teeth villiform, in bands, enlarged canine-like teeth forming the external row of premaxillary teeth. Pharyngeal teeth small, villiform, with sharp median ones.

Eye large, situated at anterior half of head; interorbit convex, narrower than eye. Lateral sensory canal system under dermal roofing of skull, suborbitals, opercles, lachrymal and jaws clearly visible externally. Preopercle with serrate margin, several prominent spines at the postero-ventral angle. Gill rakers of first gill arch short and slender (7-9) + (14-19) = 22-27; inner gill rakers on the inner side of first gill arch (5-6) + (12-14) = 17-20. Inside of branchial chamber darkish brown from posterior margin to inner side of opercles; posteriorly a narrow pale region along the inner margin of branchios-tegal membrane and opercles; lining of mouth and pharyngeal cavity black, pale region only on buccal valve and surrounding the tongue on the lateral wall.

Body and most of head covered with ctenoid scales, small cycloid scales found in front of eye and cheek, no scales on tip of snout. Lateral line scales irregular and continuous to end of caudal fin. One or two rows of small ctenoid scales sheathing base of soft dorsal, anal and anterior most part of caudal fins. Both pectoral and pelvic fins with scaly axillary process.

First and second dorsal continuous with a notch between, with no elongated nor filamentous fin ray. Origin of pectoral fin in vertical line from dorsal origin, distal end of pectoral reaching below fifth to seventh soft dorsal ray, but not reaching vent. Axillary scales present beneath the pectoral origin, this process well developed in large specimens as a fleshy flap. Pelvic fin originating a little behind pectoral, posteriorly reaching about same position as end of pectoral. Anal with minute first spine and long, pungent second spine, seven soft rays, not elongated. Caudal fin double truncate, with apex at middle where lateral line ends.

Body cavity extends beyond vent. Peritoneum black, intestine short (56.6% of SL in specimen of 175 mm SL) with two

loops; pyloric caeca 10 (n = 2) thick and elongated. Swimbladder simple (Fig. 1 B), anterior end rounded, posterior end tapering to reach origin of first anal spine.

Sagittae from preserved specimens elliptical, external surface (Fig. 3 B) with crest-like projection in middle; posterior half heavier and thicker than anterior half. Ventral surface with tadpole-shaped impression (Fig. 3 B); head section reaching anterior margin, tail section in J shape, bending sharply toward outer margin and tapered at end.

Color of 28 preserved specimens (in 40% isopropanol), uniform light brown body with triangular dark blotch on axillary process of pectoral base. Dorsal and caudal margin slightly darkish. Opercle dark due to black inner lining of branchial chamber. Dorsal side generally darker than ventral.

Distribution.—Specimens of *Sciaena bathytatos* were collected in the southern Caribbean Sea between 9°13' and 11°30'N and 61°40' and 80°43'W, and between 100 and 300 fathoms (Table 1), except for two collections near Trinidad from 54 and 66 fathoms.

Etymology.—The name *bathytatos* is from the Greek for deepest because this species of *Sciaena* was caught at a greater depth than any other known sciaenid.

KEY TO THE SPECIES OF THE GENUS *SCIAENA*

- 1a. Longest spine of the first dorsal fin extends beyond the origin of the second dorsal fin. Pelvic and anal rays black. Caudal with black inferior margin. Peritoneum pale. Total gill rakers 9-13; vertebrae 11 + 14 = 25 *S. umbra* L.
- 1b. Longest spine of the first dorsal fin does not reach the origin of the second dorsal fin. All fins pale in color. Peritoneum black.
- 2a. Dorsal rays 24-26; total gill rakers (with tubercles) 19-21; inner gill rakers 13-16; vertebrae 10 + 15 = 25 *S. trewavasae* Chao and Miller.
- 2b. Dorsal rays 21-23; total gill rakers (with tubercles) 22-27; inner gill rakers 17-20; vertebrae 11 + 14 = 25 *S. bathytatos* Chao and Miller.

RELATIONSHIPS AND BIOLOGY

The current concepts of sciaenid classification are largely based on the morphology of snout (rostral) and mental (mandibular) pores and/or barbels, otoliths (sagittae) and the swimbladder (Chu, Lo and Wu, 1963; Trewavas 1962, 1964; Robins and Tabb, 1965; and Gilbert, 1966). Among the species of *Sciaena*, *S. trewavasae* and *S. bathytatos* have the most similar swimbladders (Fig. 1) and pore systems (Fig. 2). The overall shape of otoliths (Fig. 3) in *S. trewavasae* and *S. umbra* are broader than that of *S. bathytatos*. The head portion of the tadpole-shaped impression (sulcus) on the inner surface of the sagitta of *S. trewavasae* is most similar to *S. umbra*. But the sharp curve of the tail section of the sulcus of *S. bathytatos* is most similar to that of *S. umbra*; they also have the same precaudal vertebrae count (Table 2). Morphometrically, *S. trewavasae* and *S. bathytatos* are more similar to each other than to *S. umbra* (Figs. 4, 5, and 7; Table 3).

One of us (Chao) is studying other available specimens of Western Atlantic sciaenids and has found that Atlantic sciaenids can readily be divided into two groups based on their otoliths. A group with both the lapillus and the sagitta enlarged includes *Bairdiella*, *Odontoscion*, *Ophioscion*, and *Stellifer*. The other group with only the sagitta enlarged includes *Cynoscion*, *Equetus*, *Larimus*, *Leiostomus*, *Menticirrhus*, *Micropogon*, *Pogonias*, *Sciaena*, *Sciaenops*, and *Umbrina*. In the latter group, *Cynoscion* and *Menticirrhus* have rather elongated sagittae. Among the rest of the genera in the group, *Equetus*, *Leiostomus*, *Larimus fasciatus* and the North American endemic freshwater drum, *Aplodinotus* also have a simple swimbladder, and no mental barbel, characters of the tribe Sciaenini (Trewavas, 1962). In contrast, the tadpole-shaped sulca on the sagittae vary among these four genera (Fig. 10). *Equetus* and *Leiostomus* are similar to *Sciaena* (Fig. 3) in which the anterior end of the sulcus reaches the anterior margin of the sagitta. *Larimus* and *Aplodinotus* differ

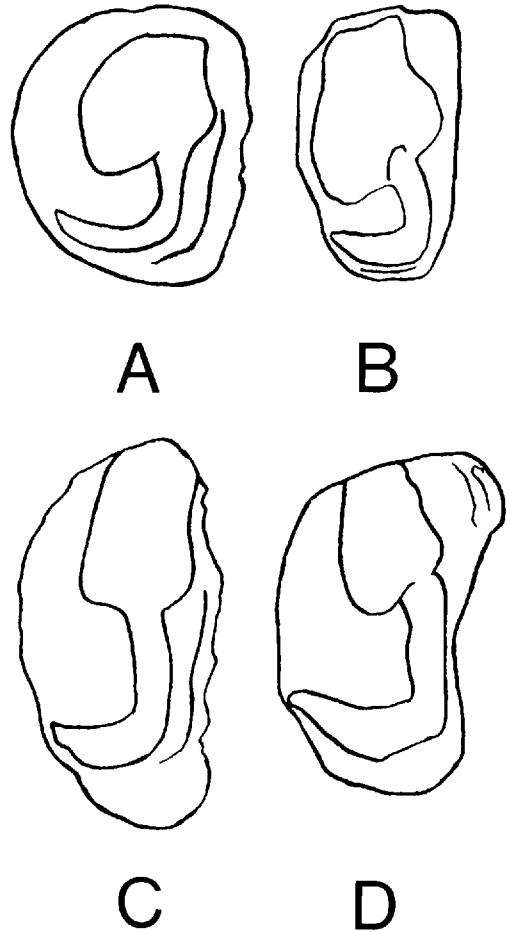


Figure 10. Inner surface of the right sagittae of *Aplodinotus grunniens* (A), *Larimus fasciatus* (B), *Leiostomus xanthurus* (C), and *Equetus umbrosus* (D).

in that the anterior end of the sulcus does not reach the anterior edge of the sagitta. The utility of swimbladder and otolith structure to the study of systematics of Western Atlantic sciaenids will be developed in a future paper. At present we can not state to which genus *Sciaena* is most closely related.

The unique characters of these two new species of *Sciaena* are associated with their deep water habitat. *S. trewavasae* and *S. bathytatos* have large eyes compared with *S. umbra* (Fig. 4) which is a typical coastal estuarine species. Larger mouths are also

Table 4. The ovary condition and the egg size in two species of *Sciaena* from the Caribbean Sea and adjacent waters

Date*	Species	SL (mm) & No. of specimens	Description	Diameter of 30 oocytes (mm) from one specimen
January, 1965	<i>S. trewavasae</i>	188 (1)	Developing: oocytes visible	0.33-0.66 (\bar{x} = 0.587) OREGON 5161, 188 mm SL
March, 1966	<i>S. bathytatos</i>	168-200 (6)	Resting: oocytes not visible	
May, 1964	<i>S. trewavasae</i>	110-178 (35)	Ripening: different stages of oocytes present, many eggs opaque with chorion membrane and an oil droplet	0.33-1.11 (\bar{x} = 0.704) OREGON 4847, 167 mm SL
	<i>S. bathytatos</i>	203-305 (5)	Resting: oocytes not visible	
September & October, 1963, 1964 & 1965	<i>S. trewavasae</i>	85-127 (4)	Resting: oocytes not visible	
	<i>S. bathytatos</i>	135-301 (16)	Developing: oocytes visible	0.22-0.66 (\bar{x} = 0.445) OREGON 5028, 194 mm SL

* Monthly data were pooled, also see Table 1 for detail.

found in these deep water forms (Fig. 6). The lack of overlap of the gill raker counts may also suggest differences in food habits. They may feed in mid-water or off the bottom rather than on or in the bottom. Both *S. trewavasae* and *S. bathytatos* were taken in the same area but the depths of capture (Table 1) indicate a depth segregation between them.

The occurrence of oocytes and size of the eggs (Table 4) indicate that both *S. trewavasae* and *S. bathytatos* spawn once a year. The ovaries of *S. trewavasae* appeared ready for spawning in May but *S. bathytatos* probably would not be ready until January. In both species the gonads start to mature at about 100-150 mm SL. The different depth distributions, separate spawning seasons and different feeding apparatus may play an important role in reproductive isolation and niche segregation between these two sympatric sciaenid fishes.

SUMMARY

Two new species of Sciaenid fishes, *Sciaena trewavasae* and *S. bathytatos* from the Caribbean and adjacent seas are described and compared with the monotypic eastern Atlantic *S. umbra* Linnaeus. They

are characterized by the lack of mental barbels and an elongated swimbladder with no appendages. The two new species differ from *S. umbra* and from one another in the following characters: *S. umbra* has 11 + 14 vertebrae, 15-20 gill rakers, 23-26 soft dorsal rays, 9-13 inner gill rakers; *S. trewavasae*, has 10 + 15 vertebrae, 19-21 gill rakers, 24-26 soft dorsal rays, 13-16 inner gill rakers; *S. bathytatos* has 11 + 14 vertebrae, 22-27 gill rakers, 21-23 soft dorsal rays, 17-20 inner gill rakers. *S. umbra* inhabits rocky shore waters of the Mediterranean, Black Sea and Sea of Azov, and along the eastern Atlantic coast from the southern coast of Portugal south to Senegal. *S. trewavasae* and *S. bathytatos* are sympatric and distributed along the Caribbean coast of South America at depths of 35 to 120 fathoms and 100 to 300 fathoms, respectively. Both new species spawn once a year at different seasons.

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Study Material

Sciaena trewavasae and *S. bathytatos* were collected by the National Marine Fisheries Service, R/V OREGON and UNDP/FAO Caribbean Fisheries Development Project Vessel CALAMAR. The field data of each collection are listed in Table 1. Other than the designated type specimens, the following specimens were studied: *Sciaena trewavasae*: USNM 211577, 1 specimen, OREGON 5161; VIMS 03149, 3, OREGON 4872; VIMS 03151, 1, OREGON 4843; VIMS 03154, 1, OREGON 4856. *Sciaena bathytatos*: USNM 211582, 5, OREGON 5975 and 5976; VIMS 03150, 1, OREGON 5975 and 5976; VIMS 03152, 1, OREGON 4860; VIMS 03153, 4, OREGON 5028. *Sciaena umbra*: AMNH 2940, 1, Naples Market, Italy, 1909; AMNH 1843, 1, Naples Market, Italy, 1909; FMNH 63109, 1, Straits of Messina, Italy, 1960; MCZ 26486, 1, Trieste, Italy, October 1864; MCZ 21674, 1, Trieste, Italy, 1886; MCZ 10803, 1, Trieste, Italy, 1886; MCZ 21739, 1, Nice, France, 1873; MCZ 26544, 1, Sevastopol, Russia, Dec. 24, 1855; USNM 37280, 1, Sevastopol, Russia, September 1885; USNM 48343, 2, Bay of Naples, Italy, June 1897; USNM 212005, 2, St. George Bay, River of Lebanon, August 1964; USNM 212006, 1, Sidi Raiss, Gulf of Tunis, 36°45'N, 10°30'E, July 1962.