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the Limits of the Genus

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ABSTRACT: *Scorpaenodes muciparus* (Alcock) and a new species, *S. tribulosus*, are described from the Indian Ocean. These two species occur in deeper water than do the other members of the genus. The genus *Scorpaenodes* is redefined to include the following nominal genera: *Sebastopsis* Gill, *Sebastopsis* Sauvage, *Sebastella* Tanaka, *Hypomacrus* Evermann and Seale, *Metzelaaria* Jordan, *Parascorpaenodes* Smith, and *Paronescodes* Smith. The genus is characterized by the combination of 13 dorsal spines, no palatine teeth, a swimbladder, and spinous procurrent caudal rays.

INTRODUCTION

Scorpionfishes of the genus *Scorpaenodes* occur along the rocky and coral reef shores of tropical and warm temperate seas. The distribution of the species of the genus is circumtropical, but the majority of the two dozen or so species occur in the western Pacific and Indian oceans. The two species described here differ from other species by living at greater depths. Interestingly, one of the species was described by J. L. B. Smith (1957, p. 65) from a specimen taken from the stomach of a snapper collected in 110 fathoms; Smith tentatively referred the specimen to *Scorpaenodes varipinnis* but noted its unusual depth of capture, and morphological and color differences. The specimens described here show that Smith's specimen does differ from *S. varipinnis*, that it normally inhabits off-shore waters, and is in fact a specimen of *S. muciparus* (Alcock).

The availability of comparative material has allowed redefinition of the genus *Scorpaenodes*. A more comprehensive study of the species of this genus is in progress.

ACKNOWLEDGMENTS

The specimens described were collected by the United States International Indian Ocean Expedition and forwarded to me by the Smithsonian Oceanographic Sorting Center. Comparative material of other species was provided by the same source and from specimens collected by the George Vanderbilt Program, which are now a part of the California Academy of Sciences fish collection.

Several persons generously aided the study. Mr. W. I. Follett, Mrs. Lillian J. Dempster, and Miss Pearl Sonoda (Department of Ichthyology) and Dr. Earl S. Herald (Steinhart Aquarium), California Academy of Sciences, assisted in many ways. Mrs. Dempster offered suggestions on the manuscript. Dr. W. Ralph Taylor (United States National Museum) provided information on the holotype of *Thysanichthys crossotus*. Photographic prints were made by Dr. G Dallas Hanna and Mr. Maurice Giles. My wife, Lydia, aided with typing, editing, and proofreading.

METHODS

Counts and measurements follow Eschmeyer (1965, pp. 86–88). Terminology of spines follows Smith (1957), but other names used by some other authors are included in parentheses in many cases. Abbreviations of depositories of specimens are: CAS—California Academy of Sciences, San Francisco, California; USNM—United States National Museum, Washington, D. C.

Genus *Scorpaenodes* Bleeker

- Scorpaenodes* BLEEKER, 1857, p. 371 (type-species *Scorpaena polylepis* Bleeker, 1857, by monotypy; no description). MATSUBARA, 1943, pp. 274–275 (synonymy; description; Japanese species).
- Sebastopsis* GILL, 1862, p. 278, footnote (type-species *Scorpaena polylepis* Bleeker, 1857, by original designation).
- Sebastopsis* (not of Gill) SAUVAGE, 1873, p. 1 (type-species *Sebastes minutus* CUVIER in Cuvier and Valenciennes, 1829, by original designation).
- Hypomacrus* EVERMANN AND SEALE, 1907, pp. 101–102 (type-species *Hypomacrus albaiensis* Evermann and Seale, 1907, by original designation; monotypic). SMITH, 1958, p. 178 (two new species added).
- Sebastella* TANAKA, 1917, p. 10 (type-species *Sebastella littoralis* Tanaka, 1917, by monotypy).
- Metzelaaria* JORDAN, 1923, p. 209 (type-species *Scorpaena tredecimspinosus* Metzelaar, 1919, by original designation; monotypic; misspelled as “*tridecimspinosus*”).
- Parascorpaenodes* SMITH, 1957, p. 62 (type-species *Parascorpaenodes hirsustus* Smith, 1957, by original designation; monotypic).
- Paronescodes* SMITH, 1958, p. 177 (type-species *Paronescodes asperrimus* Smith, 1958, by original designation).

DISCUSSION OF SYNONYMY. The genus *Scorpaenodes*, as recognized above, forms a group of small, mostly shallow-water species belonging to the subfamily

Scorpaeninae. Matsubara (1943), in his treatment of the scorpaenoid fishes of Japan, established a framework, based on osteological features, of the higher classification of scorpionfishes. Matsubara included in the synonymy of *Scorpaenodes* the nominal genera *Sebastopsis* Gill, *Sebastopsis* Sauvage, and *Sebastella* Tanaka. He did not treat *Hypomacrus* and *Metzelaaria*; *Parascorpaenodes* and *Paronescodes* were described subsequently.

Species of the genus *Scorpaenodes* differ from other scorpionfishes of the subfamily Scorpaeninae (except *Hoplosebastes* Schmidt, 1929) in the combination of normally 13 dorsal spines and no palatine teeth. *Hoplosebastes* differs in having two rather than three anal spines; other differences are given by Matsubara (1943, p. 267, and following). *Thysanichthys* Jordan and Starks, 1904, (the other genus in the subfamily containing species with 13 dorsal spines) differs most noticeably in having palatine teeth.

The characters used to distinguish from *Scorpaenodes* some of the nominal genera listed in the synonymy have not proved to be of generic importance in other scorpaenid groups, but rather are species' differences. Some of the characters will distinguish groups of species, but only in one geographic area.

Species of the genus *Parascorpaenodes* were separated from *Scorpaenodes* by Smith (1957, p. 62) on the basis of having fewer scales (about 30 vertical scale rows rather than more than 35), the posterior part of the lateral line irregular, and the head more completely scaled. The scalation of the head is as complete in some other species which do not share the first two characters. The lateral line is complete (except where scales have been rubbed off) in specimens available to me, but the orientation of some of the posterior lateral line scales is slightly irregular. Species referred to the nominal genus *Hypomacrus* approach in scale size those of *Parascorpaenodes*, but scale size seems not to be a generic character.

Paronescodes was separated from *Scorpaenodes* by Smith (1958, p. 177) on the basis of more spines on the suborbital ridge, more scales on the body, and a more robust body; each of these conditions is found in some species referred to other nominal genera when the species are considered on a world basis.

The species of the nominal genus *Hypomacrus* differ in having some of the middle pectoral rays elongate and in lacking nasal spines. Elongate middle pectoral rays occur in some other species but not quite to the extent as present in the two or three species referable to *Hypomacrus*. The absence of nasal spines does not seem to be a generic difference, but corresponds to a general reduction of armature in these species. Unless other differences are found, the species previously referred to *Hypomacrus* should be considered only as a species group within *Scorpaenodes*.

The genus *Metzelaaria* was proposed by Jordan (1923, p. 209) for the western Atlantic species *tredecimspinosus* Metzelaar. This species has long been recognized as a *Scorpaenodes*.

DISTINGUISHING FEATURES. Thirteen dorsal spines, none especially elongate; procurrent rays of the caudal fin unsegmented and spinous; no palatine teeth; gas bladder present.

DESCRIPTION. Dorsal rays normally XIII, 8-9 (XII-XIV, 8-10), last soft ray double. Anal rays normally III, 5 (4-6), last soft ray double. Pectoral rays 15-20, some rays branched except in juveniles. Procurrent caudal rays unsegmented and spinous. Teeth on vomer; none on palatines. Scales on body ctenoid, sometimes cycloid ventrally; head usually scaled. Vertebrae normally 24. Occipital pit absent. Third suborbital bone absent; fourth suborbital bone present, but isolated, in species examined; fifth suborbital bone attached to sphenotic. Second suborbital bone uniform or gradually becoming wider posteriorly, firmly and broadly attached to preopercular margin. First three interneurals fitting between the second and third neural spines. Preorbital bone with three lobes (Matsubara's terminology), the second and third lobes (lying over the maxillary) usually rounded but sometimes as broad spinous points. Suborbital ridge with spinous points (sometimes only one at end); some species with additional suborbital spines below the main ridge. Preopercular bone with supplemental spine usually present; first, second, and third preopercular spines present, second sometimes reduced or absent; fourth and fifth preopercular spines present or absent. Two ridges usually present between orbits and sometimes ending in spines (coronal spines of Smith, 1957, but not of Matsubara, 1943; interorbital spines of Ginsburg, 1953). Postfrontal spines often present. Additional spines below parietal spines sometimes present. Other spines include nasal (absent in species previously referred to *Hypomacrus*), preocular, supraocular, postocular, tympanic (frontal spines of Ginsburg), parietal, nuchal (posterior parietal spines of Ginsburg), sphenotic (usually as a group of points), pterotic, upper and lower posttemporal, opercular, supracleithral, and cleithral; occasionally additional spinous points present on head. Small slit behind fourth gill arch small or absent. Gas bladder present.

Scorpaenodes muciparus (Alcock)

(Figure 1a, b; table 1.)

Sebastes muciparus ALCOCK, 1889, pp. 298-299, fig. 3 on pl. 22 (original description; type locality Bay of Bengal, 26 miles N. by E. of Gopalpur, in 45 fathoms). Alcock, 1898, pl. 18, fig. 5 (good illustration). ?WEBER, 1913, p. 491 (brief description; one from *Siboga* station 306, Solor Straits, 8°27' S., 122°54' W., in 247 meters).

?*Scorpaenodes muciparus*, DE BEAUFORT in Weber and de Beaufort, 1962, pp. 34-35 (re-description of *Siboga* specimen described by Weber).

Scorpaenodes varipinnis SMITH, 1957, p. 65 (in part; only the 50-mm. specimen taken from the stomach of a specimen of *Pristipomoides microlepis* collected in 110 fathoms off Memba and tentatively referred to *S. varipinnis*; differences in color pattern and habitat between this specimen and *S. varipinnis* discussed).

REMARKS. The specimen collected by the *Siboga* (Weber, 1913) and redescribed by de Beaufort (Weber and de Beaufort, 1962) is very doubtfully a specimen of *S. muciparus*. The descriptions of the *Siboga* specimen lack sufficient information to allow definite identification, and I am not certain if it is even a specimen referable to *Scorpaenodes*. The specimen is larger in total length than any known specimen in the genus by about 50 millimeters. Branched pectoral rays are given as 4 by de Beaufort, but the specimen should have 7 or 8 branched rays if it is *S. muciparus*. Measurements are difficult to compare because of the great difference in size between the *Siboga* specimen and the other known specimens. Neither Weber nor de Beaufort mention if the procurrent caudal rays are spinous in the *Siboga* specimen.

MATERIAL EXAMINED. All specimens are from *Anton Bruun* cruise 4B: CAS no. 24264, (1, 71.2 mm.), station 279B, West Pakistan, 24°13' N., 65°52' E., in 93 fathoms, 9 December 1963; CAS no. 24265 (2, 45.8–48.9 mm.) station 221A, off western India, 22°32' N., 68°07' E., in 31.5 fathoms, 18 November 1963; CAS no. 24266 (1, 87.4 mm.) station 264A, Gulf of Oman, 25°02' N., 56°52' E., in 159 fathoms, 2 December 1963; USNM no. 204030 (1, 72.4 mm.) station 202A, off western India, 17°25' N., 71°39' E., in 52.5 fathoms, 13 November 1963.

DESCRIPTION. See also generic description. Measurements and counts summarized in table 1; body shape and color pattern in figure 1a, 1b.

Dorsal fin XIII, 9 (one specimen with XII, 10), last soft ray double. Anal fin III, 5, last soft ray double. Pectoral rays usually 19 (18–20), rays two or three through nine or ten branched in larger specimens; pectoral fin reaching to over anal soft rays. Spines on head well developed. Preorbital bone with second and third lobes each as a broad spinous point extending over the maxillary (third lobe with additional small points in larger specimens); suborbital ridge with one row of spinous points, one or more points on preorbital bone and three or more points on the suborbital bones. Interorbital ridges poorly developed, not ending in spines. Small spines (the postfrontal spines of Smith) near midline between tympanic spines usually absent (one spine in this area in two specimens). First preopercular spine long, second small and closer to first than to third, fourth broad, fifth absent; supplemental preopercular spine present. Upper posttemporal spine small or absent. Supracleithral spine double, upper part about one-half length of lower. Preocular, supraocular, and postocular spines well developed (supraocular spine double on left side of largest specimen). Small spine below parietal spine usually absent. Nasal spines present. Other spines as for the genus. Fourth suborbital bone isolated, bearing a few small spines (Ginsburg's postorbital spines). Tentacles and other fleshy skin appendages few. Supraocular tentacle about one-half orbit diameter in small specimens, shorter proportionally in larger specimens. A few tabs on upper part of eye, one

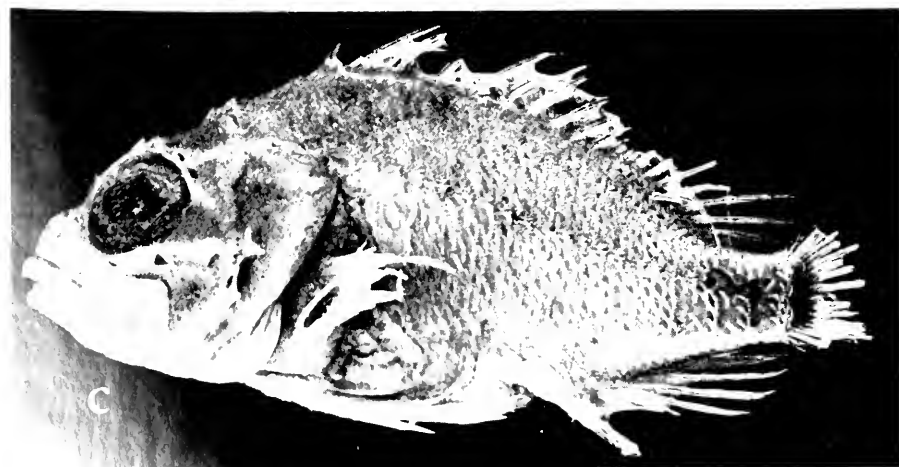
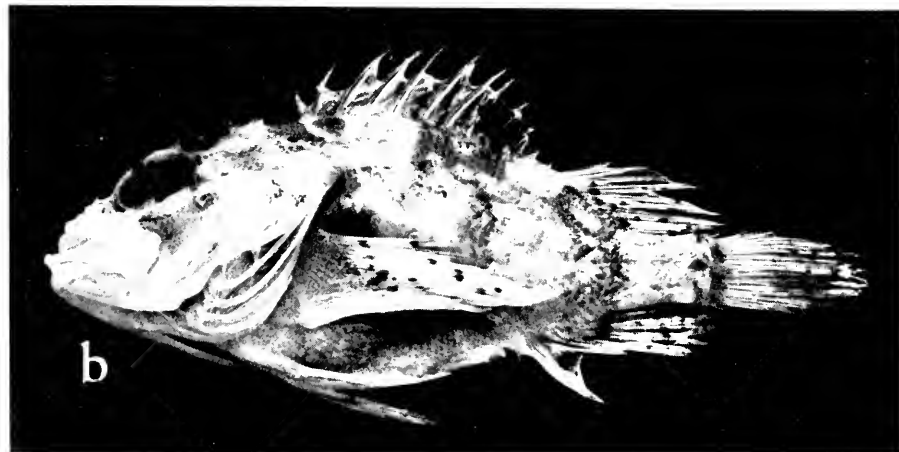
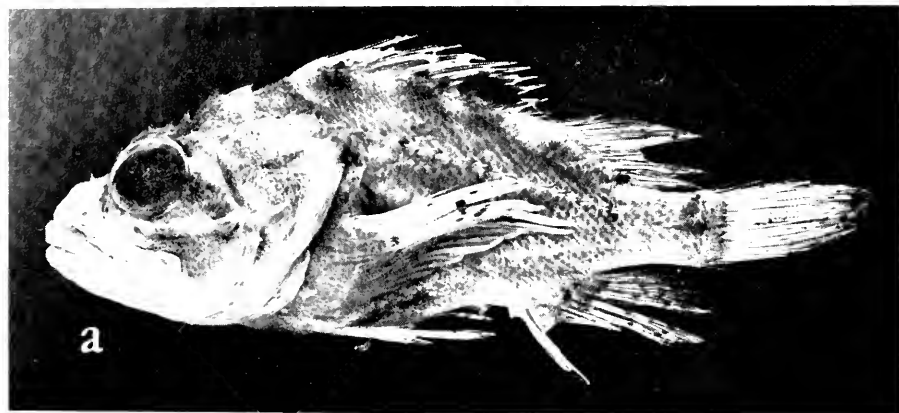


TABLE 1. Counts and measurements of specimens of *Scorpaenodes muciparus* and *S. tribulosus*.

(Measurements are in millimeters; numbers in parentheses are percentages of standard length.)

	<i>Scorpaenodes muciparus</i>					<i>Scorpaenodes tribulosus</i>	
						Holotype	Paratype
Standard length	71.2	87.4	72.4	48.9	45.8	51.4	37.4
Dorsal fin rays	XII,10	XIII,9	XIII,9	XIII,9	XIII,9	XIII,8	XIII,8
Anal fin rays	III,5	III,5	III,5	III,5	III,5	III,5	III,5
Pectoral fin rays	19,20	19,18	19,19	19,19	19,19	19,19	19,19
Vertebrae	24	24	24	24	24	24	—
Gill rakers: left	6+13	6+14	6+12	6+12	6+12	5+9	5+10
right	6+11	6+13	6+13	6+12	6+12	5+8	5+10
Head length	34.8(49)	41.8(48)	37.2(51)	23.6(48)	21.5(47)	23.5(45)	17.1(45)
Snout length	8.1(11)	9.4(11)	8.0(11)	5.7(12)	4.9(11)	5.8(11)	4.3(12)
Orbit diameter	9.6(13)	11.3(13)	9.5(13)	6.8(14)	5.9(13)	7.5(15)	4.9(13)
Interorbital width	4.8(07)	5.1(06)	4.6(06)	2.9(06)	2.3(05)	3.4(07)	2.7(07)
Upper jaw length	16.7(23)	20.5(23)	16.6(23)	11.5(24)	10.2(22)	12.5(24)	8.9(24)
Predorsal-fin length	30.6(43)	36.8(42)	31.3(43)	21.6(44)	19.4(42)	23.1(45)	16.2(43)
Body depth	28.4(40)	32.3(37)	27.8(38)	20.0(41)	17.9(39)	23.2(45)	15.6(42)
Pectoral fin length	24.9(35)	32.4(37)	26.1(36)	17.6(36)	17.0(35)	—	12.6(34)
Pelvic fin length	18.1(24)	22.1(25)	18.5(26)	13.4(27)	12.5(27)	12.5(24)	10.3(28)
Caudal fin length	22.2(31)	27.8(32)	22.6(31)	15.1(31)	14.4(31)	—	11.1(30)

larger than the others. Dorsal and anal fin spines relatively long; length third dorsal spine 13–16 percent S.L., penultimate spine 5–8 percent, last spine 11–13 percent. Second anal spine longer than third, both ending at about the same point or second extending beyond third when depressed. Scales on flanks ctenoid; vertical scale rows about 50; lateral line scales about 23 plus 2 on caudal fin (many scales rubbed off in available specimens). Bases of fins with a few scales. Scales on chest and pectoral base cycloid. Dorsal parts of head scaled; underside of head unscaled or with cycloid scales. Gill rakers including rudiments 18–20; upper arch with 6 short spiny rakers; lower arch with 9–10 rakers on ceratohyal and 2–5 flat rudiments on hypohyal. Small slit present behind fourth gill arch. Color pattern as in figure 1a, 1b. The dark pigment in smaller specimens most intense on pectoral fin and as a spot on the spinous dorsal fin.

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FIGURE 1a. *Scorpaenodes muciparus*, CAS no. 24266, 71.2 mm. S.L., off West Pakistan, 24°13' N., 65°52' E., in 93 fathoms; 1b. *Scorpaenodes muciparus*, CAS no. 24265, 48.9 mm. S.L., off western India, 22°32' N., 68°07' E., in 31.5 fathoms; 1c. *Scorpaenodes tribulosus*, CAS no. 24267, holotype, 51.4 mm. S.L., off Kenya, 02°42' S., 40°53' E., in 77 fathoms.

COMPARISONS. Most species of the genus are reef inhabitants occurring in very shallow water, but the present species and *Scorpaenodes tribulosus* appear to be exceptions. *Scorpaenodes muciparus* has been taken in depths from 31–159 fathoms and *S. tribulosus* from 77 and 40 to 96 fathoms. *Scorpaenodes tredecim-spinosus* from the western Atlantic has been collected from as deep as 50 fathoms, but it usually occurs in depths from 10–20 fathoms. Other species of the genus are shore forms which rarely descend below about 10 fathoms.

Groups of species of *Scorpaenodes* differ from *S. muciparus* in lacking a spot on the spinous dorsal fin, having shorter dorsal spines, having extra spines below the suborbital ridge, having spines on the interorbital ridges, lacking nasal spines, having fewer scales, and having eight rather than nine soft dorsal rays. Most of the shallow-living species are characteristically brightly colored.

The specimen tentatively referred to *S. varipinnis* by Smith (1957, p. 65) is a specimen of *S. muciparus*. *Scorpaenodes muciparus* differs from *S. varipinnis* in having normally nine rather than eight soft dorsal rays, more spines on the suborbital ridge (usually one on preorbital and three or more on suborbitals versus one plus two), and smaller scales. The color pattern and depth of capture of Smith's specimen also agree with *S. muciparus*. *Scorpaenodes muciparus* is compared with *S. tribulosus* under the account of *S. tribulosus*.

DISTRIBUTION. *Scorpaenodes muciparus* is known from the type collected in the Bay of Bengal and from the five specimens described here which were collected in the Gulf of Oman and in the Arabian Sea off western India and West Pakistan. The specimen reported on by Smith (1957, p. 65) was taken off Memba, Mozambique. Depths of capture range from 31 to 159 fathoms.

Scorpaenodes tribulosus Eschmeyer, new species.

(Figure 1c; table 1.)

HOLOTYPE. CAS no. 24267, a specimen 51.4 mm. in standard length, *Anton Bruun* cruise 8, station 420A, off Kenya, 02°42'S., 40°53'E., in 77 fathoms, field no. LK 64-101, 6 November 1964.

PARATYPE. USNM no. 204031 (1, 37.4 mm.) *Anton Bruun* cruise 9, station 463, off Somali Republic, 11°24'N., 51°35'E., in 40–96 fathoms, 17 December 1964.

DESCRIPTION. See also generic description. Measurements and counts summarized in table 1; body shape and color pattern in figure 1c.

Dorsal fin XIII, 8, last soft ray double. Anal fin III, 5, last soft ray double. Pectoral rays 19, some rays branched (rays broken distally in holotype; paratype with rays 3–9 or 10 branched, second rays broken; probably rays 2 through 9 or 10 usually branched in specimens of this size); pectoral fin reaching to level of first anal spine. Spines on head fragile. Preorbital bone with second lobe as a broad rounded shelf and third lobe broad with two small points in

holotype and one point in paratype; several small spinous points on preorbital bone in front of eye. Suborbital ridge with 6–8 poorly defined spinous points in holotype and 4 in paratype. (Much variability is expected in suborbital spination; the usual condition is probably one spine on the preorbital in line with three on the suborbitals; the condition in the holotype represents a splitting of some of these.) A strong ridge on anterior margin of pore between first and second suborbital bones. Interorbital ridges poorly developed, ending in small upright spines (coronal spines of Smith) in holotype and absent in paratype (variable in other species also). No postfrontal spines near midline between the tympanic spines (usually variable in other species). Preopercular spines fairly small; supplemental and five preopercular spines present; second preopercular spine slightly smaller than first or third and closer to first. Upper posttemporal spine small or absent. Supracleithral spine double, upper part about one-half length of lower part. Spine below parietal spine absent. Nasal spines present. Fourth suborbital bone isolated, with low spinous points (post-orbital spines of Ginsburg). Other spines as for the genus. Skin appendages poorly developed. Supraocular tentacle less than one-half orbit diameter. Dorsal and anal fin spines relatively long; length third dorsal spine 17 percent S.L. (paratype), penultimate 4 percent (paratype), last spine broken in both specimens. Second anal spine about equal to or slightly longer than third, second extending beyond third when depressed. Scales on body strongly ctenoid. Vertical scale rows about 45 (some scales rubbed off in available specimens). Bases of fins with ctenoid scales. All of head, including nape, interorbital area, edge of eye, jaws, and underside of head with small ctenoid scales. Scales on chest and pectoral-fin base mostly ctenoid. Gill rakers including rudiments 14–15; upper arch with 5 rakers; lower arch with 9 rakers on ceratohyal and 0–1 rudiment on hypohyal. Small slit present behind fourth gill arch. Body shape and color pattern as in figure 1c. Holotype mostly pallid, with a few dark specks on membranes between posterior dorsal spines. Paratype pallid except for dark spot between dorsal spines 8–11. A minute dusky tentacle at left nuchal spine in paratype. Head pores better developed than in other species of the genus, especially those pores associated with the preorbital bone, between the preorbital and first suborbital bone, and between first and second suborbital bones.

COMPARISONS. This species is characterized by the presence of extremely rough scales caused by numerous long ctenii, especially on the scales about the head. *Scorpaenodes parvipinnis* (Garrett, 1863) (= *Paronescodes asperrimus* Smith, 1958) also has strongly ctenoid scales, but the ctenii of scales in *S. tribulosus* are longer, and the degree of scalation on the underside of the head and on the maxillaries is stronger in *S. tribulosus*. The head pores appear to be proportionally larger in *S. tribulosus* than in other species of *Scorpaenodes* (larger pores are usually found in the deeper-living species of each genus). *Scorpaenodes tribulosus* agrees with *S. muciparus* in living in deeper water than other species

of the genus. *Scorpaenodes tribulosus* is most easily distinguished from *S. muciparus* in usually having 8 rather than 9 soft dorsal rays, and in having the under-side of the head covered with ctenoid scales rather than being naked or covered with cycloid scales.

DISTRIBUTION. The species is known from the two type specimens from off northwest Africa at Kenya and the Somali Republic in 77 and between 40–96 fathoms respectively.

NAME. The species is named "*tribulosus*," the Latin word for thorny, alluding to the strongly ctenoid scales.

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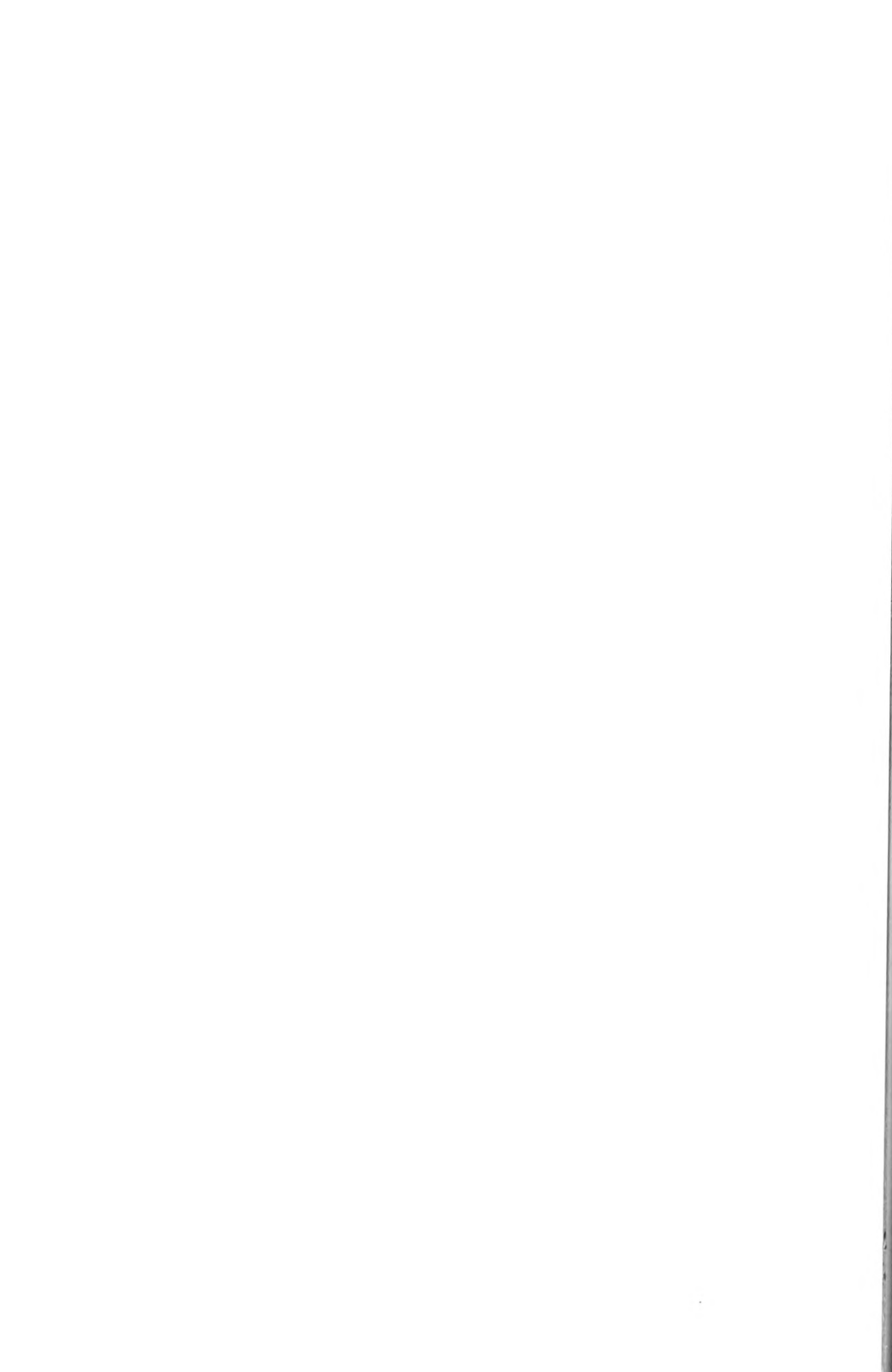
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