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SYMPHURUS CALLOPTERUS (CYNOGLOSSIDAE, PLEURONECTIFORMES), A NEW DEEPWATER TONGUEFISH FROM THE EASTERN PACIFIC

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Abstract.—A new species of eastern Pacific tonguefish, *Symphurus callopterus,* is described from moderately deep continental shelf waters from Mexico south to northern Peru. The species is characterized by a unique interdigitation pattern (1-3-4) of dorsal pterygiophores and neural spines and the combination of a well-developed pupillary operculum, high counts (105–114 dorsal-fin rays, 91–98 anal-fin rays, 57–61 total vertebrae), and four hypurals. It is further characterized by a unique combination of pigmentation features including an unpigmented peritoneum, the presence of a dark brown or black blotch on the ventral portion of the ocular-side operculum, banding on the posterior head and along the body, and especially by the occurrence of an alternating series of distinct, black rectangular blotches and unpigmented areas on the posterior two-thirds of the dorsal fin and throughout the anal fin. Comments on overall size, size at sexual maturity, and co-occurrence with sympatric species of *Symphurus* are provided. Examination of radiographs revealed an interesting anomaly in the number of neural and/or haemal spines occurring on preural centra. Of 180 specimens examined, 27 (15%) had double neural and/or haemal spines on the first and/or second preural centra. This anomaly is shown to result most likely from the fusion of two centra.

Tonguefishes (family Cynoglossidae) are small to medium-sized, sinistral flatfishes. In the eastern Pacific, they range from southern Oregon (Eschmeyer et al. 1983) to northern Peru (Hildebrand 1946, Chirichigno 1974) and inhabit diverse sedimentary and bathymetric environments. Thirteen nominal species of *Symphurus* have been described from the eastern Pacific and there are at least four additional species to be described. Knowledge of the eastern Pacific species of this genus is inadequate, although symphurine tonguefishes comprise significant components of the benthic ichthyofauna in certain habitats (Bartels et al. 1983, 1984; Love et al. 1984). Bartels et al. (1984) found that tonguefishes, including several undescribed species (one of which was *S. callopterus*), were a numerically dominant component of the demersal fish fauna in the Gulf of Nicoya, Costa Rica.

Since the earlier, mostly regional, studies by Jordan & Evermann (1898), Meek & Hildebrand (1928) and Hildebrand (1946), there has been no published comprehensive revision of eastern Pacific *Symphurus.* The most recent, and only comprehensive, treatment of eastern Pacific tonguefishes is an unpublished dissertation by Mahadeva (1956) in which several new species were recognized. Mahadeva recognized the new species described herein based on ten specimens. Since Mahadeva's study, trawling on the continental shelf off Mexico, Central America and South America has resulted in the collection of many additional tonguefish specimens, including 292 specimens of this species. Inclusion of this new material allows us to present a more complete and expanded description of the new species.

A detailed systematic revision of eastern Pacific tonguefishes is in progress by the first author, but final results are not expected until a later date. Therefore, in order to make the name of this species available to other researchers conducting ecological and early life history studies on eastern Pacific tonguefishes, a formal description is provided at this time.

This paper is the first in a projected series of papers on symphurine tonguefishes. Revisionary studies on eastern and western Atlantic tonguefishes, based largely on Munroe (1987) are forthcoming. Additionally, results of a survey of interdigitation patterns of dorsal pterygiophores and neural spines in the genus *Symphurus* is in preparation. Completing this series will be a revision of eastern Pacific and Indo-Pacific *Symphurus.* A phylogenetic analysis of intrageneric relationships based on detailed osteological studies is also in progress and will complement these revisionary studies.

Type specimens of the new species are deposited in the following institutions: California Academy of Sciences (CAS); National Museum of Natural History (USNM); Natural History Museum of Los Angeles County (LACM); Scripps Institution of Oceanography, Marine Vertebrate Collection (SIO); University of Miami, Rosenstiel School of Marine and Atmospheric Sciences (UMML); Florida State Museum (UF); and the British Museum (Natural History) (BMNH).

Methods.—Counts and measurements were modified from Ginsburg (1951), Mahadeva (1956), Menezes & Benvegnu (1976), and Munroe (1987). Counts and measurements are outlined briefly below. Meristic data, exclusive of scale counts, were taken from radiographs.

Interdigitation pattern (ID).—Patterns of interdigitation of proximal dorsal pterygiophores and neural spines were counted and recorded for the first three, or in unusual cases, the first four interneural spaces. The number of dorsal pterygiophores inserted into interneural spaces 1–3 was found to be diagnostic for species or groups of species of *Symphurus* (Munroe 1987). ID patterns are indicated by a pterygiophore formula such as 1-3-4. The 1-3-4 ID pattern indicates one pterygiophore inserts in interneural space one, three in interneural space two, and four in interneural space three. The first neural spine abuts directly against the cranium so there is no obvious space between it and the cranium. Therefore, the first interneural space reflected in the formula is that between the first and second neural spines.

Caudal-fin rays.—Previous authors (Ginsburg 1951, Mahadeva 1956, Menezes & Benvegnu 1976, Munroe 1987) have found that caudal-fin-ray count is extremely conservative within the genus. Previous studies have included the ultimate dorsal- and anal-fin rays in the caudal-ray counts. Because the ultimate rays of the median fins are supported by caudal elements and are aligned along the same vertical plane as the caudal-fin rays they are also included in caudal-ray counts reported here.

Anal-fin rays.—Includes all rays and is exclusive of the thick, muscular gonadal duct preceding the first anal-fin ray.

Vertebral counts.—There are consistently nine abdominal vertebrae, three without and six with haemopophyses; abdominal vertebrae counts are thus reported as (3+6). Counts of total vertebrae include the urostylar centrum (see Remarks section below). Specimens with obviously damaged vertebral skeletons, underlying support bones, or caudal fins were excluded from summaries and analyses.

Scale counts.—Accurate, repeatable scale counts are difficult to make in *Symphurus,* especially for species in which the scales are often abraded and lost during capture when specimens are trawled from any appreciable depths. Approximate counts were based on partial scale counts, counts of scale pockets, or a combination of the two. Longitudinal scale row count includes the total number of complete diagonal rows of scales along a hypothetical line starting immediately above the opercular angle to the end of the hypural; the few rows of scales along the caudal-fin base are not included and the last scale must be at least half in front of the hypural. Transverse scale count is the number of scales in a diagonal row from the base of the dorsal fin at a point directly above the posterior margin of the operculum to the base of the anal fin. Scales extending out onto the dorsal- and anal-fin rays are not included. Head scale row count includes all the oblique rows of scales on the head counted posteriorly from the first complete row of scales passing the posterior border of the lower eye; it includes the last complete row of scales immediately anterior to the mid-point emargination on the posterior border of the operculum, but the few small rows of scales present on either the dorsal or ventral fleshy lobes of the operculum are not included.

All measurements were made on the ocular surface except where noted. Measurements were taken to the nearest 0.1 mm with dial calipers (to 150 mm) or ocular micrometer. Measurements are expressed either as thousandths of standard length or thousandths of head length. Standard length: distance from tip of fleshy snout to posterior end of hypural plate. Body depth: distance across body at the anus, exclusive of fins; measured on blind side. Preanal length: tip of fleshy snout to origin of anal fin; measured on blind side. Caudal-fin length: base of articulations of middle caudal-fin rays to tip of longest middle rays. Pelvic-fin length (only blind side pelvic fin present in adults): basal articulation to distal tip of the longest ray. Pelvic to anal length: shortest horizontal distance from base of most posterior pelvic-fin ray to anal-fin origin. Head length: tip of fleshy snout to most posterior extension of upper fleshy lobe of operculum. Head width: greatest distance across head at posterior portion of operculum. Postorbital head length: posterior margin of lower eye to posterior extent of upper fleshy lobe of operculum. Upper head lobe width: distance at operculum from dorsal margin of body to dorsal origin of operculum. Lower head lobe width: distance at operculum from dorsal origin of operculum to most ventral part of operculum. Snout length: anterior rim of lower eye to tip of snout. Upper jaw length: shortest horizontal distance from bony tip of premaxilla to angle of mouth. Eye diameter: greatest horizontal diameter of the cornea of the lower eye; does not include fleshy tissue surrounding eye. Chin depth: vertical distance from angle of the mouth to most ventral aspect of the head.

Size at maturity was estimated by macroscopic examination of the extent of posterior elongation of the ovaries (ovaries of mature females are conspicuous through the body wall when light is transmitted from beneath the specimen; in immature females, developing ovaries are best observed by dissection). Since no obvious differences in testicular size were apparent in males, estimates of maturity were based entirely on females.

Depth of capture (in feet or fathoms) was transformed to the nearest meter. If depth included a range of depths over which the nets were towed, an average depth for that particular trawl was calculated.

Symphurus callopterus, new species
Figs. 1–2

Holotype.—CAS 64023 (male, 116.9 mm SL), Peru, 05°59′S, 81°12′W to 05°58′S, 81°11′W, 65–70 m, 4 Jun 1966. Collected with 70 ft Gulf of Mexico semi-balloon trawl, R/V *Anton Bruun* Cruise 16, Station 631 B.

Paratypes.—(Measured and counted 20 specimens; 93.2–127.6 mm SL): Costa Rica.—USNM 164492, 2(93.2–96.1), 6 mi off Cabo Velas, Papagayos, 101 m, 01 Jul 1932.—UF 47590, (117.1), Puntarenas Province, Gulf of Nicoya, 317 m, 29 Jun

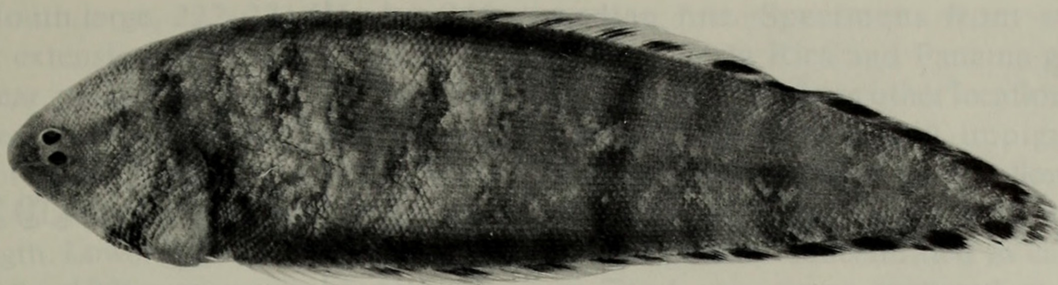

Fig. 1. *Symphurus callopterus*, n.sp., holotype, CAS 64023, male 116.9 mm SL; Peru.

1973. Panama Bay.—UMML 26069, 15(97.3–127.6), 8°00.4–00.7′N, 79°48.8–41.5′W, 78 m, 4 May 1967.—UMML 34317, 2(104.1–121.7), 7°40.3′N, 79°50.9′W; 78 m, 2 May 1967. Counts were also taken from the following 46 paratypes (88.5–145.7 mm SL): Mexico, Gulf of Tehuantepec.—SIO 63-518, 9(99.5–136.6), 15°57.5′N, 95°22.5′W, 65 m, 12 Jul 1963.—SIO 63-521, 2(96.5–105.6), 15°41′N, 96°07.5′W, 55 m, 14 Jul 1963. Costa Rica.—BMNH 1956.3.1:3–4, 2(88.5–94.5), 6 mi off Cabo Velas, Papagayos (ca. 10°22′N, 85°53′W), 101 m, 1 Jul 1932.—LACM 33827–55, 4(96.6–119.9), Gulf of Nicoya (ca. 9.5°N, 85°W), 29 Jun 1973. Panama Bay.—UMML 26069, 18(92.4–128.3), 8°00.4–00.7′N, 79°48.8–41.5′W, 78 m, 4 May 1967. Peru.—CAS 24189, 11(109.7–145.7), (same as holotype).

Diagnosis.—A medium-sized *Symphurus,* reaching 162 mm SL (most specimens 90–140 mm SL), distinguished from all other species in the genus by a unique 1-3-4 ID pattern and the following combination of characters: 105–114 dorsal-fin rays; 91–98 anal-fin rays; 57–61 (57 and 61 rare) vertebrae; 12 caudal-fin rays; 104–113 scales in a longitudinal series; head length equal to or nearly equal to head width in all but the largest specimens; a well-developed pupillary operculum; a distinct series of rectangular black blotches on the posterior three-fourths of the dorsal fin and along the entire length of the anal fin; an unpigmented peritoneum; a prominent black blotch across the lower half of the operculum; and 9–11 faint crossbars on the head and body beginning from just behind the eyes and ending just anterior to the base of the caudal fin.

Description.—Frequency distributions of meristic data are given in Table 1. ID pattern typically 1-3-4 (123 of 191 specimens), less frequently 1-4-3 (23/191), rarely 1-3-3-3 or 1-4-4. Caudal-fin rays 12 (160 of 165), rarely 11 or 13. Dorsal-fin rays 105-114, usually 109–113, $\bar{x}$ = 110.8. Anal-fin rays 91–98, usually 93–97, $\bar{x}$ = 94.7. Pelvic-fin rays 4. Total vertebrae 57–61, usually 58–60, rarely 57 or 61, $\bar{x}$ = 58.9; abdominal vertebrae 9 (3+6). Hypurals 4. Longitudinal scale rows 97–114, usually 100–111. Scale rows on head posterior to lower orbit 20–26, usually 22–24. Transverse scales 35–45, usually 37–41.

Body relatively deep, proportionately deeper in larger specimens, 233–296 SL, $\bar{x}$ = 248; with greatest depth in anterior third of body; body width gradually tapering posteriorly giving body lanceolate shape. Preanal length 216–265 SL, $\bar{x}$ = 236; slightly less than body depth. Head relatively wide (216–278 SL, $\bar{x}$ = 237), nearly equal to body depth in specimens smaller than 150 mm SL, proportionately smaller than body depth in specimens larger than 150 mm SL. Head length nearly equal to head width (218–261 SL, $\bar{x}$ = 236). Postorbital length 146–189, $\bar{x}$ = 163. Lower head lobe (117–158 SL, $\bar{x}$ = 139) slightly larger than upper head lobe (101–136 SL, $\bar{x}$ = 118). Snout relatively short, 171–203 HL, $\bar{x}$ = 185; covered with small ctenoid scales. Dermal papillae well-developed on blind side of snout. Anterior nostril relatively short, not reaching anterior margin of eye when extended poste-

Table 1.—Frequency distribution of meristics for *Symphurus callopterus.* (Asterisks indicate counts for holotype.)

Dorsal-fin rays	105	106	107	108	109	110*	111	112	113	114								
Frequency	1	—	1	8	21	50	44	27	22	5								
Anal-fin rays	91	92	93*	94	95	96	97	98										
Frequency	4	4	25	49	49	33	12	4										
Caudal fin rays	9	10	11	12*	13													
Frequency	1	—	1	160	3													
Hypurals	4*	5																
Frequency	122	1																
Total vertebrae	57	58	59	60*	61													
Frequency	2	43	103	31	1													
Longitudinal scale rows	97	98	99	100	101	102	103	104	105	106*	107	108	109	110	111	112	113	114
Frequency	2	2	1	7	6	11	15	7	9	16	9	8	5	3	5	1	2	1
Lateral scale rows	35	36	37	38	39	40*	41	42	43	44	45							
Frequency	1	—	11	17	20	28	14	5	1	—	1							
Scale rows on head	20	21	22	23*	24	25	26											
Frequency	1	1	31	42	36	7	1											

	Pattern	Frequency	%
Interdigitation Pattern	1-3-4-2*	123	64
	1-4-3-2	27	14
	1-3-3-3	10	5
	1-4-4-2	10	5
	1-4-3-3	7	4
	1-3-4-3	6	3
	1-3-3-2	5	3
	1-3-4-2-3	1	0.5
	1-2-4-2	1	0.5
	2-3-4-2	1	0.5

riorly. Mouth large, 222–271 HL, $\bar{x}$ = 245; posterior extension of maxilla reaches usually to rear margin of lower eye, less frequently extending posteriorly only to rear margin of pupil of lower eye. Chin depth 179–272 HL, $\bar{x}$ = 207; slightly larger than snout length. Lower eye relatively small, 79–118 HL, $\bar{x}$ = 103; eyes usually slightly subequal in position with upper slightly in advance of lower eye. Anterior and medial surfaces of eyes partially covered with 3–5 rows of small ctenoid scales; 1–3 small ctenoid scales in narrow interorbital region. Pupillary operculum triangular and well-developed. Length of dorsal-fin base 941–955 SL, $\bar{x}$ = 948. Dorsal-fin origin far forward; dorsal fin usually reaches anteriorly to a point directly above anterior margin of migrating eye, less frequently to anterior margin of pupil and in a few specimens, only to middle of migrating eye; predorsal length 46–59 SL, $\bar{x}$ = 52. Length of anal-fin base 736–821 SL, $\bar{x}$ = 760. Blind sides of dorsal and anal fins without scales; 3–5 rows of small scales present on ocular-side bases of dorsal- and anal-fin rays. Pelvic fin with 4 rays; relatively short, 38–63 SL, $\bar{x}$ = 55; longest pelvic-fin ray reaches to first anal-fin ray. Caudal fin relatively short, 75–94 SL, $\bar{x}$ = 83.

Teeth well-developed on blind side jaws. Teeth on ocular side of premaxilla slender, in single row, usually covering only anterior half or three-fourths of jaw; extending posteriorly to point directly below base of anterior nostril. Teeth on ocular side dentary in single row, usually only extending along anterior three-fourths of dentary, sometimes along entire dentary, or only anterior half.

Pigmentation.—Specimens in alcohol with a chocolate brown ground color with series of 9–11 faint crossbars of variable width (usually 4–8 scale rows wide) from behind nape to base of caudal fin (holotype with 12 bars); and 10–19 well-defined, rectangular, or sometimes slightly oval, black blotches alternating with very light areas on median fins. Specimens from southern Mexico, Costa Rica and Panama generally darker than those from other locations. Blind side typically uniformly unpigmented, probably creamy white in life. Some individuals of both sexes also have darkly pigmented patches concentrated in caudal region and sometimes scattered at various places along bases of dorsal- and anal-fins along posterior half of blind side of body.

Head usually with two faint crossbars. Anterior bar about 3–4 scales in width, barely reaching ventral portion of head, and located posteriorly (about 4–5 scales width) to eyes. Well-defined posterior bar about 6–8 scales wide, crossing opercular region, and extending ventrally slightly onto blind side of head; sometimes somewhat faint and diffuse dorsally. Inner lining of eyed-side operculum only lightly pigmented, most often only sprinkled with melanophores; blind-side opercular lining usually unpigmented. Isthmus mostly unpigmented except for small patch of melanophores on dorsal surface.

Posterior two-thirds of dorsal fin and entire length of anal fin bear clearly-defined blotches, not extending to either tips or bases of rays. Blotches on both fins start approximately equidistant from snout; anteriormost blotches typically lighter than posterior ones; each blotch usually covers about 5–7 rays. Lighter areas between blotches cover about 3–5 rays and are stippled with tiny melanophores producing a faint duskiness barely discernible to naked eye. Median fins on blind side without melanophores. Number of black blotches on dorsal fin varies between 10–19. Anterior to point above anal-fin origin, dorsal fin without distinct blotches. Anal-fin blotches usually parallel in position to dorsal-fin blotches and with similar intensity of pigmentation; usually between 12–15 (one specimen had 8, and another 19 blotches). Holotype with 14 blotches on dorsal and 11 on anal fin. Most posterior portions of median fins heavily pigmented in melanistic

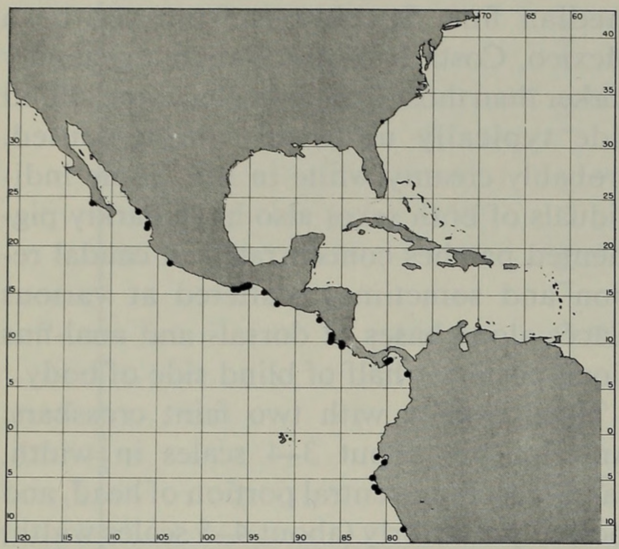

Fig. 2. Geographic distribution of *Symphurus callopterus* based on available study material. Dots indicating collection localities may represent more than one occurrence and more than a single specimen from each locality.

specimens, obscuring blotches to naked eye (but still perceptible under magnification).

Caudal fin generally with two ill-defined blotches, one on the base and the other at distal tip, with lighter space between. Caudal-fin blotches may be faded and diffuse giving entire caudal uniformly dark coloration. In some specimens of both sexes, blind side of caudal fin darkly pigmented.

Size and sexual maturity.—Sexual maturity occurs at a large size relative to other *Symphurus* species. Of 53 females, 52, ranging in size from 90.8–162 mm SL, were mature with elongate, gravid ovaries. The smallest of these measured 90.8, 93.0, 97.3 and 97.9 mm SL. The only immature female examined was slightly smaller (87.3 mm SL) with ovaries just undergoing posterior elongation. The 66 males were only slightly smaller than the females (76.5–151 mm SL).

Etymology.—*Callopterus* meaning "pretty fin" (Greek *kallos,* beauty; and *pterygion,* fin, a diminutive form of *pteron,* wing); in reference to the striking black blotches on the median fins in an otherwise mundanely pigmented group of fishes.

Distribution.—Throughout the tropical eastern Pacific (Fig. 2) from Mazatlan and southern Baja California, Mexico, to northern Peru (10°36′S).

Symphurus callopterus occurs primarily in moderate depths (18–317 m; SIO 63-522 and UF 47590, respectively) throughout its geographic range. The bathymetric center of abundance, based on both frequency of capture and numerical abundance, occurs on the continental shelf between 60–110 m. Over 85% (244 of 285) of the specimens studied were collected at these depths. Capture of this species at depths less than 60 m is unusual; only five specimens were collected between 40–60 m and only three specimens were taken shallower than 40 m (18 and 20 m). *Symphurus callopterus* has been collected rarely at depths greater than 110 m; only 10 of 285 specimens (4%) were collected deeper than 110 m with the deepest occurrences reported for single specimens being 146, 196, 206 and 317 m.

Geographical variation.—No latitudinal variation in meristic characters was observed in specimens collected between the northern and southern parts of the geographic range.

Remarks.—Two haemal and/or neural spines occurred on the first preural (PU 1) or the second preural centra (PU 2) in 27 of 180 (15%) specimens examined. Two hypotheses may explain the high frequency of doubling of spines in these centra: 1) PU 1 or PU 2 frequently possess double neural and/or haemal spines, or 2) double spines result from fusion of two caudal vertebrae. The data support the latter hypothesis. In some specimens with two spines on PU 1, that centrum was slightly longer than normal, suggesting that it might be the result of fusion of two centra. Additionally, when two-spined preural centra were counted as a single vertebra (Table 2), specimens with these centra had, as a group, one fewer vertebra than the normal specimens ($\bar{x}$ = 58.0 for double-spined specimens; $\bar{x}$ = 58.9 for

Table 2.—Number of vertebrae in *Symphurus callopterus*. *T*-test comparing specimens possessing double neural and/or haemal spines on the PU 1 or PU 2 to those with single spines.

PU 1/PU 2 spines	Number of vertebrae 57	58	59	60	61	n	$\bar{x}$	SD	t	P
Double (counted as one centrum)	4	19	4	0	0	27	58.0	0.56	6.30	<0.000
Single (normal condition)	2	39	84	27	1	153	58.9	0.71		
Double (counted as two centra)	0	4	19	4	0	27	59.0	0.56	0.63	>0.90
Single (normal condition)	2	39	84	27	1	153	58.9	0.71		

normal specimens; t = 6.30; $P < 0.000$). However, when two-spined centra were counted as two vertebrae, there were no significant differences in total vertebrae between the two groups ($\bar{x} = 59.0$ for double-spined group versus 58.9 for "normal" group; t = 0.63, $P > 0.90$). Because the data support the hypothesis that double spines are the result of vertebral fusion, vertebrae bearing them were counted as two.

Co-occurring Symphurus species.—In the shallower portions of its bathymetric range along the coast of Mexico and Central America (at least as far south as Panama), *S. callopterus* has been collected with *S. gorgonae* Chabanaud and *S. atramentatus* Jordan & Bollman; at greater depths in this region, *S. callopterus* is partially syntopic with an undescribed species.

Comparisons.—Other tonguefishes with counts comparable to those of *S. callopterus* are *S. maldivensis* Chabanaud, *S. marmoratus* Fowler and *S. strictus* Gilbert from the Indo-West Pacific including Hawaii, *S. microlepis* Garman from the eastern Pacific, *S. ligulatus* (Cocco) from the eastern Atlantic, and *S. jenynsi* Evermann & Kendall and *S. nebulosus* (Goode & Bean) from the western Atlantic. *Symphurus callopterus* differs from *S. microlepis* principally in ID pattern (1-3-4 versus 1-3-2) and pigmentation (peritoneum unpigmented and dorsal and anal fins with blotches in *S. callopterus* versus dark black peritoneum and unpigmented fins in *S. microlepis*). *Symphurus callopterus* differs from the other species in ID pattern and number of caudal-fin rays (1-3-4, 12 versus 1-2-2 and 14, respectively, in *S. strictus, S. marmoratus, S. ligulatus* and *S. nebulosus*; 1-4-3 and 10 in *S. jenynsi*; 1-2-2 and unknown number of caudal-fin rays in *S. maldivensis*), as well as in features of its pigmentation (peritoneum unpigmented in *S. callopterus* versus darkly pigmented in all of the above species, except *S. jenynsi*; median fins highly ornate with alternating series of blotches and unpigmented areas in *S. callopterus* versus uniformly pigmented fins in the other species).

Other species of *Symphurus* with similar pigmentation on the median fins are *S. atramentatus* Jordan & Bollman, and an undescribed species from the eastern Pacific, as well as *S. diomedeanus* (Goode & Bean) from the western Atlantic. *Symphurus callopterus* differs from them in its extremely high number of dorsal- and anal-fin rays and vertebrae and in the larger number of blotches on the fins. In addition, in *S. callopterus,* head length is nearly equal to head width in all except the largest adults, whereas in the other species, head length is usually less than head width. Throughout its range, *S. callopterus* is occasionally collected with an undescribed species that has a similar body shape and pigmentation pattern. *Symphurus callopterus* differs from this undescribed species in several major features including ID pattern (1-3-4 versus 1-3-2), hypural number (4 versus 5), presence of a well-developed pupillary operculum versus its absence, pigmentation of the peritoneum (unpigmented versus dark black showing through the abdominal wall), and modal differences in meristic characters.

Material Examined

Counts were taken from the following 138 non-type specimens (71.0–162 mm SL): Mexico.—UCLA W61-198, 2(116.0–131.8), Sinaloa, 3–4 miles southwest of Mazatlan (ca. 23.5°N, 106°50′W), 29 Oct 1961.—CAS 4785–4786, 2(93.0–101.9), Michoacan, South of Punta San Telmo off Michoacan coast (ca. 18.3°N, 103°40′W), 19 Jul 1932.—UCLA W56–80, (104.1), Oaxaca, off Port Angeles Light (ca. 15.5°N, 96°40′W), 14 Jul 1932. Guatemala:—SIO 73–265, 14(71.0–90.0), 13°55.6–53.5′N, 92°02.5′W, 101 m, 13 Apr 1973. Nicaragua.—SIO 73-279, 3(107.4–116.1), 12°09–11.5′N, 87°32–35.5′W, 113 m, 17 Apr 1973. Costa Rica.—CAS 5304, (94.2), off Cabo Velas (ca. 10°22′N, 85°53′W), 101 m, 1 Jul 1932.—CAS 11710, (119.3), 6 mi off Cabo Velas (ca. 10°22′N, 85°53′W), 101 m, 1 Jul 1932.—LACM 33590–2, 3(105.0–130.0), 9 mi from Isla Herraderra, 17 May 1973.—LACM 33827-11, (124.4), Gulf of Nicoya, central Puntarenas (ca. 9.5°N, 85°W), 29 Jun 1973.—SIO 79-5, 42(76.6–116.8), Gulf of Papagayo, 10°42.4′N, 85°55′W, 88 m, 02 Apr 1978. Panama Bay.—UMML 26003, 11(76.5–117.6), 7°49.3–49.8′N, 80°00–00.7′W, 46 m, 2 May 1967.—UMML 34318, 30(85.8–133.8), 7°40.3′N, 79° 50.9′W, 78 m, 2 May 1967. Colombia.—UMML 34319, (124.5), 4°00′N, 77°30′W, 92 m, 17 Sep 1961. Ecuador.—CAS 24195, 3(140.6–162), 2°29′S, 80°59′W, 93 m, 11 Sep 1966.—CAS 24198, (131.2), 3°35′S, 78°35′W, 79 m, 16 Sep 1966. Peru.—CAS 24188, 10(114.9–140.1), 5°59′S, 81°12′W, 100 m, 4 Jun 1966.—CAS 24190, (112.2), 6°20′S, 81°01′W, 146 m, 4 Jun 1966.—CAS 24191, 3(131.3–151.3), 6°21′S, 80°56′W, 100 m, 5 Jun 1966.—CAS 24957, (129.2), 6°21′S, 80°59′W, 140 m, 4 Jun 1966.—CAS 24192, 2(122.2–139.2), 6°24′S, 80°44′W, 20 m, 5 Jun 1966.—CAS 24194, 2(111.3–132.6), 4°55′S, 81°19′W, 70 m, 8 Sep 1966.—UCLA W58–395, 3(106.5–123.5), 10°36′S, 77°54′W, 16 Oct 1958.

Additional material examined but not counted or measured (97 specimens; 52.2–143.1 mm SL): Mexico.—SIO 64-878, 2(55.9–58.7), Baja California, 24°18.9–19.0′N, 111°47.6–48.6′W, 78 m, 13 Nov 1964.—SIO 62-75, (52.2), Sinaloa, 22°15′N, 106°03′W, 55 m, 25 Aug 1961.—SIO 62-76, 23 (73.1–116.0), 22°13′N, 106°10′W, 79 m, 25 Aug 1961.—SIO 73-230, (89.9), 21°59′N, 106°20′W, 102 m, 30 Mar 1973.—SIO 73-232, 8(82.8–103.6), 21°57–56′N, 106°10–11′W, 52 m, 31 Mar 1973. Mexico, Gulf of Tehuantepec.—SIO 63–504, (113.0), 15°57.5′N, 95°00′W, 61 m; 8 Jul 1963.—SIO 65-165, (62.0), 15°55′N, 95°24′W, 102 m, 6-7 Jun 1965.—SIO 63-525, (104.2), 15°52′N, 95°43′W, 55 m, 15 Jul 1963.—SIO 63-522, (89.5), 15°44′N, 96°06.5′W, 18 m, 15 Jul 1963.—SIO 63-523, 2(70.5–89.1), 15°41′N, 96°07.5′W, 55 m, 15 Jul 1963.—SIO 63-513, (96.5), 15°07.5′N, 93°25′W, 102 m, 10 Jul 1963. Guatemala.—SIO 73-265, 4(81.0–92.0), 13°55.6–53.5′N, 92°02.5′W, 100 m, 13 Apr 1973. Costa Rica.—CAS 20965, (82.5), 6 mi off Cabo Velas (ca. 10°22′N, 85°53′W), 101 m, 1 Jul 1932.—CAS 43880, (114.5), Cabo Blanco (ca. 9.5°N, 85°W), 206 m, 9 Mar 1974.—CAS 44140, (111.6), Gulf of Nicoya (ca. 9.5°N, 85°W), 83 m, 14 Mar 1974.—SIO 73-281, (103.1), 10°50.2–53.2′N, 86°20.0–24.3′W, 196 m, 18 Apr 1973.—SIO 73-296, 26(83–126.5), 9°37.4–37.7′N, 84°49.0–51.8′W, 87 m, 22 Apr 1973. Gulf of Panama.—CAS 24958, 2(115.5–117.2), 8°11′N, 79°36′W, 88 m, 23 Jul 1967.—CAS 24959, 3(127.5–143.1), 6°34′N, 77°21′20″W, 60 m, 21 Apr 1967. Colombia.—CAS 24960, 6(121.5–132.0), 6°44′N, 77°33′30″W, 82 m, 10 Aug 1967.

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