

Five New Indo-Pacific Lizardfishes of the Genus *Synodus* (Aulopiformes: Synodontidae)

John E. Randall

Bishop Museum, 1525 Bernice St., Honolulu, HI 96817-2704, USA

(Accepted August 7, 2008)

John E. Randall (2009) Five new Indo-Pacific lizardfishes of the genus *Synodus* (Aulopiformes: Synodontidae). *Zoological Studies* 48(3): 402-417. The following 5 new species of lizardfishes of the genus *Synodus* are described: *S. fasciapelvicus*, 1 market specimen, Lombok, Indonesia and 2 from 26-29 m in the Philippines; *S. isolatus*, 9 specimens from Easter I. in 10-18 m, and 1 from about 250 m; *S. mundyi*, 2 specimens from 84 to about 200 m in the Hawaiian Is.; *S. pylei*, 2 specimens from 90-96 m in Fiji; and *S. sanguineus*, 1 specimen from about 100 m in Manado Bay, Sulawesi. The specimens were initially identified as *S. doaki* Russell and Cressey, type locality New Zealand. The 5 species are differentiated from *S. doaki* and one another principally by fin-ray, scale, and vertebral counts, the shape of the flap on the anterior nostril, and nuances in life color. In addition, the specimen identified as *S. doaki* from 250 m in the Gulf of Aqaba, Red Sea by Baranes and Golani (1993) is reidentified as *S. randalli* Cressey, type locality, Sudan, Red Sea.
<http://zoolstud.sinica.edu.tw/Journals/48.3/402.pdf>

Key words: *Synodus*, Synodontidae, New species, Indo-Pacific.

A revision of the Indo-Pacific species of lizardfishes of the genus *Synodus* was published by Cressey (1981) as an outgrowth of his research on parasitic copepods of Indo-Pacific synodontid fishes (Cressey and Cressey 1979). Finding different species of poecilostome copepods of the genus *Metataeniacanthus* in specimens labeled as *Synodus variegatus* (Lacepède) suggested that more than 1 species of *Synodus* was being identified as *S. variegatus*. Cressey's revision of Indo-Pacific *Synodus* proved this to be true. His paper included 21 species, 6 of which were described as new, and are still valid.

Waples and Randall (1988) reviewed the Hawaiian *Synodus*, recognizing 12 species. They regarded the species identified as *S. variegatus* by Cressey to be *S. dermatogenys* Fowler, and his *S. englemani* as the true *S. variegatus*. They described 4 species as new; however, Randall

(2007) reported their *S. amaranthus* to be a synonym of *S. dermatogenys* Fowler, and their *S. janus*, known from 1 specimen collected in 1901 with no information on depth of capture or life color, as a probable synonym of *S. falcatus* Waples and Randall.

Baranes and Golani (1993: 303, pl. 3, fig. 10) reported *Synodus doaki* from 1 specimen taken in 250 m off Eilat, Gulf of Aqaba, Red Sea). The specimen (HJ 15157, 114 mm SL) was sent on loan by the Hebrew Univ. in Jerusalem and is reidentified here as *S. randalli* Cressey, type locality Port Sudan, Red Sea, collected from 146 m. Errors in the original description and figure of *S. randalli* may have been responsible for the misidentification. The holotype of *S. randalli* (BPBM 24807, 113 mm SL), has 9 instead of 8 anal rays, 5½ instead of 4 scales below the lateral line to the anal-fin origin, and 15 instead of 13 predorsal

*To whom correspondence and reprint requests should be addressed. E-mail:jackr@hawaii.rr.com

scales. Its color photograph is shown here as figure 1.

Two paratypes of *S. doaki* (USNM 218793, 91, 92.5 mm SL) taken by trawl off the coast of Kenya at a depth of 140 m are missing from the fish collection of the Smithsonian Institution and presumed lost. They may have been *S. randalli*.

Russell in Carpenter and Niem (1999) reviewed the synodontid fishes of the Western Central Pacific. He provided a key and drawings to the 15 species of *Synodus* that occur within the region from Japan to southeastern Australia, east to the islands of Oceania.

Chen et al. (2007) described *S. taiwanensis* as a new species from 3 specimens collected from 80 m off Taiwan, bringing the total number of Indo-Pacific species of *Synodus* to 25.

Examination of specimens in the Bishop Museum's fish collection identified only as *Synodus* sp., or misidentified as *S. doaki* Russell and Cressey, revealed 5 undescribed species: one

represented by 3 specimens from the Philippines and Indonesia; one from a single specimen from Sulawesi; one from 2 specimens from Fiji; one from 2 specimens from the Hawaiian Is.; and one from 10 specimens from Easter I. The present paper provides the descriptions of these 5 new species.

Three lots of small specimens identified as *S. doaki* from Mahé, Seychelles (SAIAB 76380, 77091, and 79058) were sent on loan by the South African Institute for Aquatic Biodiversity. These were reidentified as *S. binotatus* Schultz.

MATERIALS AND METHODS

The type specimens for this study have been variously deposited at the Australian Museum, Sydney, Australia (AMS); Biodiversity Research Center, Academia Sinica, Taipei, Taiwan (ASIZP); Natural History Museum, London, UK (BMNH);



Fig. 1. Holotype of *Synodus randalli* Cressey, BPBM 24807, 113 mm SL, off Port Sudan, Red Sea. Photograph by John E. Randall.

Table 1. Fin-ray and lateral-line scale counts of new species of *Synodus*

	Dorsal rays					Anal rays		Pectoral rays			Lateral-line scales						
	11	12	13	14	15	9	10	12	13	14	54	55	56	57	58	59	60
<i>fasciapelvicus</i>	1	2				3		2	1						1	1	1
<i>isolatus</i>				6	4	5	5	2	7	1				2	3	5	
<i>mundyi</i>		2	1			2	1		2	1				1	1	1	
<i>pylei</i>				1	1	1	1		2			1	1				
<i>sanguineus</i>		1				1		1			1						

Bernice P. Bishop Museum, Honolulu, HI, USA (BPBM); Natural History Museum of Los Angeles County, CA, USA (LACM); and United States National Museum of Natural History, Washington DC, USA (USNM).

Lengths of specimens are given as standard length (SL), measured from the median anterior point of the upper lip to the base of the caudal fin (posterior end of the hypural plate); body depth is measured vertically from the origin of the pelvic fins, and from the origin of the anal fin; body width is taken at the upper base of the pectoral fins; head length (HL) from the front of the upper lip to the posterior end of the opercular membrane, and snout length from the same anterior point to the nearest bony edge of the orbit; orbit diameter is the greatest bony diameter, and interorbital width the least bony width; upper-jaw length is measured from the front of the upper lip to the posterior end of the maxilla; caudal-peduncle depth is the least depth, and caudal-peduncle length the horizontal distance between verticals at the rear base of the anal fin and the caudal-fin base. Lengths of spines and rays were measured from the point where they depart from the contour of the body; caudal-fin length is the horizontal length of the longest ray, and caudal concavity the horizontal distance between verticals at the tips of the longest and shortest caudal rays. Pectoral- and pelvic-fin lengths were measured from the most anterior point of the base of the fin to the tip of the longest ray. Tables 1 and 2 contain the meristic data for the new species of *Synodus*. Tables 3-7 present the morphometric data as percentages of SL. Proportional measurements in the text are rounded to the nearest 0.05. Data in parentheses in the descriptions with more than 1 type specimen refer to paratypes. Counts of tubed lateral-line scales do not include those on the caudal-fin base posterior to the hypural plate (the tubed scales on the caudal-fin base angle sharply downward). The uppermost scale above the lateral line to the base of the dorsal fin is often about 1/2 the size as the lower ones; it is designated a 1/2 scale (1/2). The

count of circumpeduncular scales was made in a vertical zigzag line.

Synodontid fishes lack distinctly protruding gill rakers; instead they have low but discrete patches of cteni. Waples and Randall (1988: fig. 2) recorded counts of the lower-limb gill rakers on the 1st gill arch only on the ceratobranchial, where the joint with the more anterior basibranchial (with gill rakers of diminishing size) provides a clear stopping point. The upper-limb gill-raker count for the species treated here could not be made with accuracy because the raker patches become progressively smaller anteriorly. Even with staining, the counts could not be reproduced. Therefore, only the hypobranchial count is recorded here.

Counts of vertebrae include the hypural. Anderson et al. (1975) noted for Atlantic *Synodus* that the count of lateral-line scales is close to that of the number of vertebrae, with most specimens having more lateral-line scales. The species described below have the same (or ± 1) number of vertebrae as the lateral-line scale count.

All of the new species have a broad posterior pelvic process (as in fig. 1b of Cressey 1981).

Black peritoneal spots are large and obvious on larvae of species of the Synodontidae, but very small in adults, where they lie in a series of up to 14 on each side. Cutting the entire length of the peritoneal cavity is necessary for this count. This count does not seem to be as diagnostic as indicated by Cressey (1981); 10 specimens of the new species from Easter I. have peritoneal-spot counts of 1-8.

Synodus fasciapelvicus sp. nov.

(Table 3, Figs. 2, 3)

Holotype: BPBM 29790, female, 97.0 mm, Indonesia, Lombok, Tanjung Luar fish market, J.E. Randall and F. Wörner, 30 Jan. 1984.

Paratypes: USNM 391165, 65.0 mm and BPBM 22134, 56.5 mm, Philippines, Sumilon I. (east of southern end of Cebu), rubble and sand, 26-29 m, rotenone, J.E. Randall, 26 Aug. 1977.

Diagnosis: Dorsal rays 11 or 12; anal rays 9; pectoral rays 12 or 13; lateral-line scales 58-60; scales between lateral line and base of dorsal fin 4½; median predorsal scales 18; vertebrae 58 or 59; peritoneal spots 9 or 10; anterior palatine teeth of inner row much longer than posterior teeth; preopercle not scaled posterior to corner of mouth;

Table 2. Vertebrae of new species of *Synodus*

	55	56	57	58	59	60
<i>fasciapelvicus</i>				1	2	
<i>isolatus</i>					6	4
<i>mundyi</i>					1	2
<i>pylei</i>	1	1				
<i>sanguineus</i>	1					

membranous posterior flap of anterior nostril triangular, with a slightly attenuate tip, reaching to above posterior nostril when laid back; body depth 6.6-7.35 in SL; pectoral fins reaching a line connecting dorsal- and pelvic-fin origins, fin length 2.4-2.6 in HL; color in alcohol pale yellowish with 9 irregular light brown circles along lateral line, each linked narrowly to an irregular, slightly oblique, brown bar to lower side of body; tip of dorsal part of snout with a pair of small brown spots; color when fresh light orangish brown dorsally, white ventrally, dark markings a mixture of orange and dark brownish red; pelvic fins crossed by 6 dark orangish brown bands twice as broad as white interspaces.

Description: Dorsal rays 12 (11 or 12), branched except for first 2, the last branched to base; anal rays 9, unbranched except the last, branched to base; pectoral rays 13, holotype with

12 on other side (12), upper 2 and lowermost unbranched; pelvic rays 8, rays with a slender posterior branch, except first and last; principal caudal rays 19, upper and lower unbranched; upper and lower procurent caudal rays about 17; lateral-line scales 58, 59 on right side (59 or 60), not including 3 tubed scales curving ventrally on caudal-fin base; scales between lateral line and dorsal fin $4\frac{1}{2}$; scales below lateral line to origin of anal fin $7\frac{1}{2}$; median predorsal scales 18; circumpeduncular scales 19; lower-limb gill rakers on basibranchial 15 (17 or 18); vertebrae 59 (58 or 59); peritoneal spots 10 (9).

Body slender, depth at pelvic-fin origin 7.2 (6.6-7.35) in SL; body width 6.95 (6.9-7.2) in SL; HL 3.25 (3.25-3.35) in SL; snout length 4.3 (4.2-4.25) in HL; orbit diameter 5.75 (4.3-4.95) in HL; interorbital space a broad V-shaped concavity when viewed anteriorly, least bony width 10.0

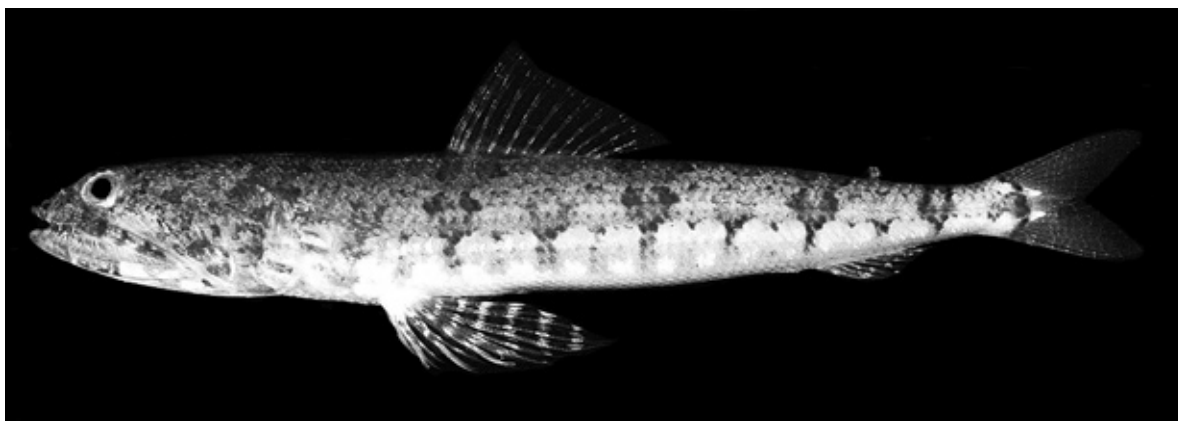


Fig. 2. Holotype of *Synodus fasciapelvicus* sp. nov., BPBM 29790, 97 mm SL, Lombok, Indonesia, market specimen. Photograph by John E. Randall.

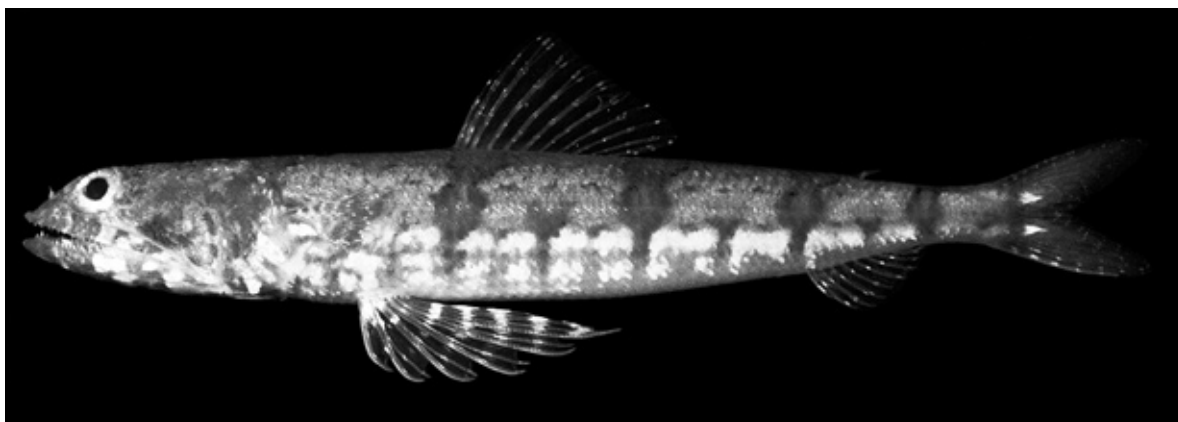


Fig. 3. Paratype of *Synodus fasciapelvicus* sp. nov., USNM 391165, 65 mm SL, Sumilon I., Philippines, 26-29 m. Photograph by John E. Randall.

(10.2-12.4) in HL; caudal-peduncle depth 5.4 (5.05-5.3) in HL; caudal-peduncle length 3.3 (2.95-3.15) in HL.

Mouth terminal and slightly oblique, forming an angle of about 15° to horizontal axis of body; mouth very large, extending more posterior to eye than anterior, upper-jaw length 1.5 (1.55-1.6) in HL; teeth in jaws needle-like, the largest arrow-tipped, about equal in length to pupil diameter, and angling medially and anteriorly, except for a few teeth at front of jaws; teeth of upper jaw in 2 closely set rows, those of outer row fixed, about ½ length of inner teeth, and largely covered by lip; teeth of inner row inwardly depressible; teeth in lower jaw in 3 closely set rows, becoming progressively smaller laterally, all inwardly depressible, outer row hidden by lip; palatine teeth in 2 or 3 rows, becoming progressively longer medially, angling medially and posteriorly; anterior 5-7 teeth of inner row of palatine teeth very long, 3rd-6th about twice as long as posterior teeth; bands of palatine teeth

converging anteriorly, tips of longer anterior teeth touching when depressed; about 35 posteriorly depressible teeth in 4 irregular rows on anterior part of tongue, followed by numerous very small teeth.

Anterior nostril on a line from upper edge of orbit to tip of snout, 1/2 way to base of upper lip; membranous posterior flap of anterior nostril nearly an equilateral triangle with slightly concave sides, pointed tip reaching to above posterior nostril when laid back; posterior nostril nearly round, with only a slight rim at front, directly behind anterior nostril, internarial distance about equal to posterior nostril diameter.

Predorsal scales extending forward to a vertical 1 orbit diameter behind eye; postorbital scales on head above upper lip becoming progressively smaller posteriorly, not extending beyond a vertical at end of maxilla; a row of 7 scales anteriorly on opercle, each crossed by a sensory canal with 2 or 3 pores, the 1st in preopercular canal; remaining scales on opercle large and embedded, except for a few small scales dorsally; no scales on dorsal, anal, or paired fins; a broad central zone of scales basally on caudal fin, ending in a pair of very large pointed scales, 1 in each lobe, nearly reaching margin of fork of fin; a triangular scaly process of about 11 scales midventrally at base of pelvic fins.

Predorsal length equal to distance from dorsal-fin origin to rear base of adipose fin, 2.35 (2.3-2.35) in SL; dorsal-fin base 1.9 in HL; 2nd dorsal ray longest, 2.1 (1.9-1.95) in HL; anal-fin base 3.4 (3.3-3.4) in HL; 3rd anal ray longest, 4.1 (3.9-4.0) in HL; caudal fin forked, lobes pointed, longest rays broken on holotype (1.6-1.65 in HL); caudal concavity (3.4-3.7 in HL); pectoral fins just reaching a line connecting origins of dorsal and pelvic fins, fin rounded when spread, 2.6 (2.4-2.5) in HL; 6th pelvic ray longest, 1.2 (1.15-1.2) in HL.

Color in alcohol (pattern nearly faded): Pale yellowish with 9 irregular light brown circles along lateral line, each linked narrowly to an irregular, slightly oblique, brown bar extending to dorsal edge; dorsal part of head with faint transverse rows of small brown blotches; tip of dorsal part of snout with a pair of small brown spots at base of upper lip; a broad brown bar below eye, crossing lips and ventral part of head; fainter bars across anterior and posterior part of lips and ventrally on head; oblique dark bars of dorsal and pelvic fins in fresh specimens no longer apparent in preservative.

Color of holotype when fresh shown in figure 2, and that of 65 mm paratype in figure 3.

Table 3. Proportional measurements of type specimens of *Synodus fasciapelvicus* as percentages of the standard length

	Holotype	Paratypes	
	BPBM 29790	BPBM 22134	USNM 391165
Sex	female	?	male
Standard length (mm)	97.0	56.5	65.0
Body depth (P ₂ origin)	14.1	13.6	15.0
Body depth (A origin)	9.3	9.6	9.9
Body width	14.4	14.5	13.9
Head length	30.9	29.7	30.7
Snout length	7.2	7.1	7.1
Orbit diameter	5.4	6.9	6.2
Interorbital width	2.8	2.4	3.0
Upper-jaw length	20.2	18.3	19.7
Caudal-peduncle depth	5.7	5.6	6.1
Caudal-peduncle length	9.3	10.1	9.8
Predorsal-fin length	42.7	42.9	42.7
Preanal-fin length	79.7	78.5	79.2
Preadipose-fin length	83.0	82.4	83.0
Prepelvic-fin length	35.1	34.9	35.1
Dorsal-fin base	16.1	15.5	16.0
Longest dorsal ray	14.9	15.6	15.8
Anal-fin base	9.1	9.0	9.1
Longest anal ray	7.5	7.6	7.7
Caudal-fin length	broken	18.8	18.4
Caudal concavity	-	8.8	8.3
Pectoral-fin length	11.8	12.4	12.4
Pelvic-fin length	25.5	26.3	26.1

Etymology: This species is named *S. fasciapelvicus* from the Latin for the broad dark cross bands on the pelvic fins in fresh specimens, noteworthy in the pigment being on the membranes as well as rays.

Remarks: This species would be identified as *S. doaki* Russell and Cressey in the key of Cressey (1981) based on the pectoral-fin length relative to the origins of the dorsal and pelvic fin. It is easily distinguished from *S. doaki* in having 11 or 12 instead of 13-15 dorsal rays, lacking scales on the preopercle posterior to the end of the maxilla, and in having a short triangular flap on the anterior nostril instead of a long slender one.

The holotype was a market specimen, so the habitat is unknown. The 2 paratypes from Sumilon I. in the Philippines were collected from a rubble and sand bottom in 26-29 m.

***Synodus isolatus* sp. nov.**

(Table 4, Figs. 4, 5)

Synodus doaki (non Russell and Cressey) Randall, Cea and Meléndez 2005: 44 (Easter I.).

Holotype: BPBM 39162, female, 241 mm, Easter I., west side, off Motu Tautara, 10 m, spear, J.E. Randall, 6 Feb. 1985.

Paratypes: AMS I.44590-001, 114 mm, Easter I., west coast, off south end of Hanga Roa, rock and sand bottom, 12 m, rotenone, J.E. Randall and G.R. Allen, 10 Feb. 1969; BPBM 39163, 117 mm, same data as for holotype except depth 12 m; BPBM 39232, 2: 129-153 mm, Easter I., west coast, off Tahai, sand patch in reef, 18 m, rotenone, J.E. Randall and A. Cea Egaña, 15 Feb. 1985; ASIZP 69356, 202 mm; BMNH, 145 mm; LACM 56782-1, 140 mm; and USNM 392613, 252 mm, all with same data as for BPBM 39232; BPBM 31052, 226 mm, Easter I., west side, about 250 m (depth of 100 fathoms estimated by fisherman),

Table 4. Proportional measurements of type specimens of *Synodus isolatus* as percentages of the standard length

	Holotype			Paratypes				
	BPBM 39162	BPBM 39163	BPBM 39232	LACM 56782-1	BPBM 39232	ASIZP 69356	BPBM 31052	USNM 392613
Sex	female	?	?	male	male	male	female	female
Standard length (mm)	241	117	129	140	153	202	226	252
Body depth (P ₂ origin)	13.7	14.7	13.7	13.4	14.4	14.6	14.7	15.1
Body depth (A origin)	9.8	10.2	10.0	10.1	9.7	10.4	10.4	10.9
Body width	15.3	14.8	14.3	15.0	14.1	16.5	15.1	16.3
Head length	30.4	29.7	30.1	28.5	29.5	28.4	28.9	30.5
Snout length	8.0	7.9	7.7	7.5	7.9	7.5	7.6	8.0
Orbit diameter	4.7	6.0	5.9	5.5	5.3	4.9	4.9	4.8
Interorbital width	3.7	2.9	3.1	3.0	3.3	3.5	3.8	3.6
Upper-jaw length	20.0	19.8	19.6	18.5	19.7	18.6	19.0	20.6
Caudal-peduncle depth	5.9	6.0	5.8	6.0	5.8	5.9	5.7	5.6
Caudal-peduncle length	11.4	11.7	12.2	12.3	11.6	11.5	11.0	11.3
Predorsal length	41.4	41.3	40.7	40.1	41.6	39.8	41.4	41.7
Preanal length	79.8	77.2	77.3	77.7	77.9	78.3	79.0	80.8
Preadipose length	82.5	80.6	80.2	80.6	80.5	81.6	82.8	84.4
Prepelvic length	37.4	35.0	37.0	34.8	35.2	36.2	36.8	37.2
Dorsal-fin base	20.6	20.2	20.8	20.7	17.6	19.8	18.6	19.3
Longest dorsal ray	12.3	15.2	14.7	14.3	14.0	13.3	13.2	12.5
Anal-fin base	9.6	10.5	10.0	9.5	9.8	9.4	9.7	9.8
Longest anal ray	9.2	9.3	9.0	8.9	9.0	9.1	9.2	9.3
Caudal-fin length	15.6	16.9	broken	broken	16.1	16.2	16.0	15.9
Caudal concavity	6.0	7.5	-	-	6.5	7.4	6.3	6.1
Pectoral-fin length	12.8	13.7	13.3	12.8	13.1	13.4	12.8	12.6
Pelvic-fin length	24.9	27.7	27.6	26.4	26.1	26.2	25.2	25.8

hook and line, R. Ika for J.E. Randall, 13 Feb. 1986.

Diagnosis: Dorsal rays 14 or 15; anal rays 9 or 10; pectoral rays 12-14; lateral-line scales

57-59; scales between lateral line and base of dorsal fin $4\frac{1}{2}$ or 5; median predorsal scales 15 or 16; vertebrae 59 or 60; predorsal vertebrae 15 or 15.5; peritoneal spots 1-8; 3 anterior palatine

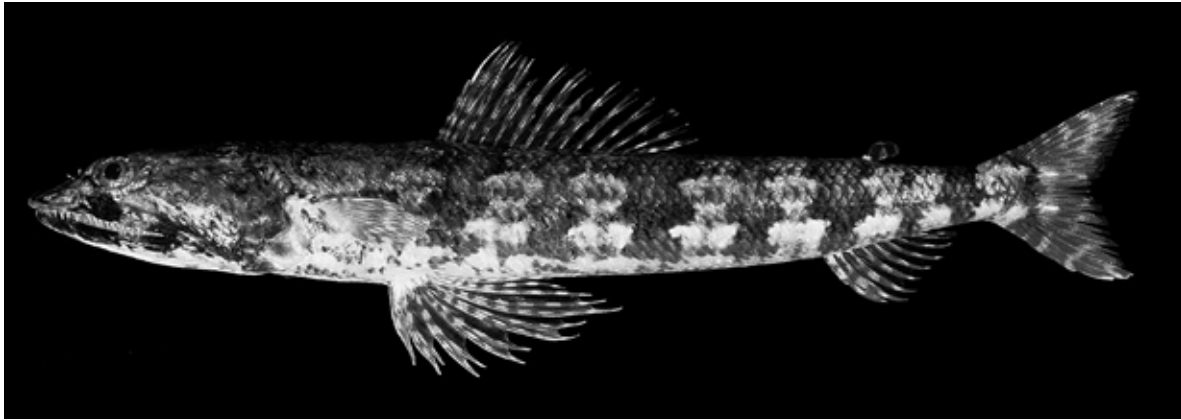


Fig. 4. Holotype of *Synodus isolatus* sp. nov., BPBM 39162, 241 mm SL, Easter I., 10 m. Photograph by John E. Randall.

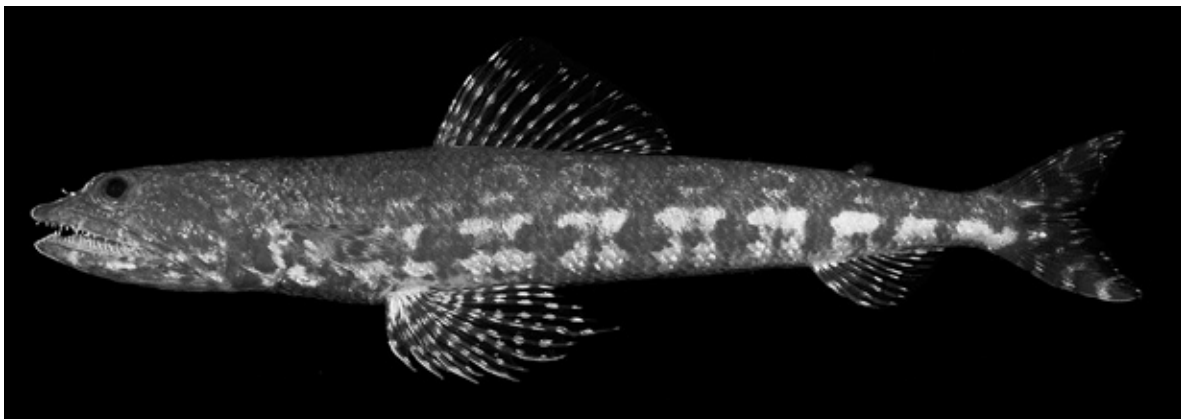


Fig. 5. Paratype of *Synodus isolatus* sp. nov., BPBM 31052, 226 mm SL, Easter I., 275 m. Photograph by John E. Randall.



Fig. 6. Paratype of *Synodus doaki*, BPBM 14655, 151.5 mm SL, Ball's Pyramid, Lord Howe I., 31 m. Photograph by John E. Randall.

teeth of inner row distinctly longer than posterior teeth; preopercle fully scaled; posterior flap of anterior nostril leaf-like and short, just reaching or extending slightly beyond rear edge of posterior nostril when laid back; body depth 6.6-7.45 in SL; pectoral fins reaching well posterior to a line connecting dorsal- and pelvic-fin origins, fin length 2.1-2.4 in HL; color in alcohol pale brown with 8 dark-edged brown bars on body, each with 3 constrictions, 2 above and 1 below lateral line; even-numbered bars darker; 2 irregular dark brown bars across lips, larger 1 below eye, the other just before corner of mouth; a pair of very small black spots dorsally at tip of snout, each followed by a dark brown line, the 2 lines merging posteriorly on snout; adipose fin with 2 dark brown spots; remaining fins pale, anterior dorsal-fin rays with faint dark spots; color when fresh orangish brown dorsally, white ventrally; white spaces between dark bars on body just above lateral line with a horizontal row of 2-4 small dark brown blotches, 1 per scale; white spaces below lateral line with 2 small interconnected vertically aligned reddish orange blotches; dorsal, anal, and caudal fins with rows of red spots on rays; 2 broad black bands across lips; caudal-fin lobes with irregular red cross bands; color in alcohol of paratype from deep water nearly uniformly pale, its color when fresh with same dark markings as shallow-water individuals, but orangish red.

Description: Dorsal rays 15 (14 or 15), branched except first 2, the last branched to base; anal rays 9 (9 or 10), unbranched, except the last branched to base; pectoral rays 13 (12-14), upper 2 and lower 1 or 2 unbranched; pelvic rays 8, 2nd-7th with a slender posterior branch; principal caudal rays 19, upper and lower ones unbranched; upper procurrent caudal rays 17 (16); lower procurrent caudal rays 14; lateral-line scales 58 (57-59), not including 3 tubed scales curving ventrally on caudal-fin base; scales between lateral line and dorsal fin 4½; scales below lateral line to origin of anal fin 5½; median predorsal scales 15 (15 or 16); circumpeduncular scales 15; lower-limb gill rakers on basibranchial 24 (23-26); vertebrae 59 (59 or 60); predorsal vertebrae 15 (15 or 15.5); peritoneal spots 8 (1-7).

Body slender, depth at pelvic-fin origin 7.3 (6.6-7.45) in SL; body width 6.55 (6.1-7.1) in SL; HL 3.3 (3.3-3.5) in SL; snout length 3.8 (3.75-3.9) in HL; orbit diameter 6.5 (4.95-6.4) in HL; interorbital space a broad V-shaped concavity when viewed anteriorly, least bony width 8.2 (7.6-10.2) in HL; caudal-peduncle depth 5.15

(4.8-5.45) in HL; caudal-peduncle length 2.7 (2.65) in HL.

Mouth inferior and very slightly oblique, forming an angle of about 5° to horizontal axis of body; mouth large, upper-jaw length 1.5 (1.5-1.55) in HL; teeth in jaws needle-like, the largest arrow-tipped and about 1/2 orbit diameter; teeth in jaws angling medially and anteriorly, except for a few anteriorly; teeth of upper jaw in 2 closely set rows, those of outer row fixed, about 1/2 length of inner teeth, and covered by lip; teeth of inner row inwardly depressible; teeth in lower jaw in 3 closely set rows, becoming progressively smaller laterally, all inwardly depressible, outer row hidden by lip; palatine teeth in 3 or 4 rows; 3 or 4 anterior teeth of inner row elongate, longest about twice length of posterior teeth; bands of palatine teeth converging anteriorly, tips of longer anterior teeth overlapping when depressed; 4 irregular rows of about 40 posteriorly depressible teeth on anterior part of tongue, followed by numerous very small teeth.

Anterior nostril on level with lower edge of pupil, 1/3 distance from edge of orbit to tip of snout; posterior flap of anterior nostril leaf-like, expanded part in holotype as broad as long (narrower in most paratypes), not reaching beyond posterior nostril (or reaching at most slightly beyond in paratypes) when laid back; posterior nostril narrowly elliptical, without a rim, slightly medial to anterior nostril; internarial distance equal to (or slightly less than) greatest posterior nostril diameter.

Predorsal scales extending forward to a vertical about an orbit diameter behind posterior edge of orbit; preopercle fully scaled, with 7 (6 or 7) nearly vertical, curving rows of scales, becoming progressively smaller posteriorly; opercle with an anterior row of 7 scales, each crossed by a sensory canal containing pores, the anterior pore in preopercular canal; remaining scales on opercle large and embedded except for a few small scales dorsally; no scales on dorsal, anal, or paired fins; a broad central zone of scales basally on caudal fin, dividing to a pointed part in each lobe, ending in a large elongate scale reaching within 1/2 orbit diameter of margin of fork of fin; a triangular scaly process of 11 scales midventrally at base of pelvic fins.

Predorsal length shorter than length from dorsal-fin origin to origin of adipose fin in holotype and largest paratypes (reaching beyond origin of adipose fin in smaller paratypes), 2.4 (2.4-2.5) in SL; dorsal-fin base 1.5 (1.45-1.65) in HL; 3rd dorsal ray longest, 2nd and 4th subequal, 2.5 (1.95-2.45) in HL; anal-fin base 3.15 (2.85-3.1)

in HL; 3rd anal ray longest, 3.3 (3.1-3.35) in HL; caudal fin forked, with pointed lobes, longest ray 1.95 (1.75-1.9) in HL; caudal concavity 5.1 (4.0-5.0) in HL; pectoral fins reaching well posterior to a line connecting origins of dorsal and pelvic fins, rounded when spread, 2.4 (2.1-2.4) in HL; 5th pelvic ray longest, 1.2 (1.05-1.2) in HL.

Color of holotype in alcohol pale brown with 8 dark-edged brown bars on body that extend ventrally to level of base of pelvic fins, each bar with 3 constrictions, 2 above and 1 below lateral line; even-numbered bars darker; 2 irregular dark brown bands across lips, the largest below eye, the other just before corner of mouth; a pair of very small black spots dorsally at tip of snout, each followed by a dark brown line, the 2 merging posteriorly on snout; a 2nd fainter pair of very small dark spots on front of snout lateral to 1st pair, each followed by a line that forms 3 branches before anterior nostril, upper branch encircling nostrils; dorsal, anal, and pelvic fins with translucent yellowish membranes and pale yellowish rays, first 4 rays faintly showing a series of 4 or 5 dusky spots; caudal fin colored like body on basal scaled part, remainder of fin yellowish; adipose fin with 2 dark brown spots, proximal spot twice as large as distal one.

Color of holotype when fresh shown in figure 4. Color of a 226 mm paratype collected from about 275 m portrayed in figure 5.

Etymology: This lizardfish is named *S. isolatus* sp. nov. in reference to the type locality of Easter I., the most isolated island of the Indo-Pacific region.

Remarks: Easter I., the easternmost outpost of the Indo-Pacific region, has the most impoverished shore-fish fauna of this vast region with only 129 species. Of these, 28 have been reported only from the island (and nearby islet of Sala-y-Gómez). This 21.7% rate of endemic shore fishes is 2nd only to the 25% of shore-fish endemism of the Hawaiian Is. within the Indo-Pacific region (Randall et al., 2005). With the description of *S. isolatus* formerly identified as *S. doaki* Russell and Cressey by Randall et al., the percentage of endemic fishes is increased to 23.5%.

Synodus isolatus is very similar in general morphology and color pattern to *S. doaki*, as may be seen by comparing the deeper-water color form of *S. isolatus* sp. nov. of figure 5 with the color photograph of the paratype of *S. doaki* of figure 6. *Synodus isolatus* differs from *S. doaki* in having 9 or 10 anal rays, compared to 8 or 9 (usually 8);

4½ or 5 scales between the lateral line and dorsal fin, compared to 3½; 57-59 lateral-line scales, compared to 55-58; 59 or 60 vertebrae, compared to 55-58; 1-8 peritoneal spots, compared to 11 or 12; and a short and relatively broad flap of the anterior nostril, compared to a long slender one for *S. doaki*.

One might expect the 226 mm paratype of *S. isolatus* from about 250 m to represent a different species from the 9 specimens collected in 10-18 m. However, no morphological differences could be found. Measurements of this specimen are shown in the 7th column of table 4; the meristic data are well within the range for the species. Its red coloration (Fig. 5) is sometimes seen in other species of fishes in the deeper part of their depth range (when they occur from near shore to as much as 250 m).

As noted by DiSalvo et al. (1988) and Randall et al. (2005), the low number of shore fishes at Easter I. appears to be a factor in the unusually broad depth ranges of some of the species. For example, *Chrysiptera rapanui*, one of 3 damselfishes of Easter I., and *Pascua caudilinea*, one of 5 gobies, are common from tide pools to at least 40 m. Competition is lacking at the island in these 2 families that are represented by many species in other Indo-Pacific localities. If more species of these 2 families were present at Easter I., they would be expected to restrict the damselfish and goby to narrower depth zones. Only 2 species of *Synodus* are known from Easter I. (the other being *S. capricornis* Cressey and Randall). By contrast, the Hawaiian Is. have 11 species of *Synodus*.

***Synodus mundyi* sp. nov.**

(Table 5, Fig. 7)

Synodus doaki (non Russell and Cressey) Waples and Randall 1988: 191, fig. 1, pl. 1C (Hawaiian Is.); Mundy 2005: 200 (Hawaiian Is.); Randall 2007: 110, lower figure (Hawaiian Is.).

Holotype: BPBM 28623, 68 mm, Hawaiian Is., Kaiwi Channel, Penguin Bank, 84 m, rotenone, HURL submarine dive 82-109, S. Ralston, 15 Sept. 1982.

Paratype: USNM 392810, 140 mm, Hawaiian Is., northwest of O'ahu, 21°39'N, 158°6'W, 180-200 m, trawl, *Townsend Cromwell* Cruise 61, Station 26, 17 Oct. 1972.

Diagnosis: Dorsal rays 13; anal rays 9 or 10;

pectoral rays 13 or 14; lateral-line scales 59 or 60; scales between lateral line and base of dorsal fin 3½; vertebrae 60; predorsal vertebrae 16 or 17; peritoneal spots 14; 3 anterior palatine teeth of inner row distinctly longer than posterior teeth; preopercle fully scaled; posterior flap of anterior nostril slender and tapering, extending more than 2 posterior-nostril diameters beyond nostrils when laid back; body depth 7.2-7.35 in SL; pectoral fins reaching posterior to a line connecting dorsal- and pelvic-fin origins, fin length 2.15-2.25 in HL; color in alcohol pale yellowish; color when fresh white, with 8 light red bars on body, each with 3 constrictions (uppermost obscure in direct side view), even-numbered bars much more evident; broad parts of each red bar with a pale yellow spot; space between 2nd constricted area of each bar with a pale bluish arc with a width nearly that of pupil.

Description: Dorsal rays 13, branched except first 2, last branched to base; anal rays 9 (10), unbranched, except last, branched to base;

pectoral rays 14 (13), upper 2 and lower 1 or 2 unbranched; pelvic rays 8, 2nd-7th branched; principal caudal rays 19, upper and lower ones unbranched; upper procurent caudal rays 18 (17); lower procurent caudal rays 17; lateral-line scales 59 (60), not including 3 tubed scales curving ventrally on caudal-fin base; scales between lateral line and dorsal fin 3½; scales below lateral line to origin of anal fin 5½; median predorsal scales 16; circumpeduncular scales 15; lower-limb gill rakers on basibranchial 23 (22); vertebrae 59 (60); predorsal vertebrae 16 (17); peritoneal spots 14.

Body slender, depth at pelvic-fin origin 7.35 (7.2) in SL; body width 8.2 (7.4) in SL; HL 3.5 (3.4) in SL; snout length 3.9 (3.95) in HL; orbit diameter 3.9 (4.55) in HL; interorbital space a broad V-shaped concavity when viewed anteriorly, least bony width 9.8 (9.0) in HL; caudal-peduncle depth 4.9 (5.1) in HL; caudal-peduncle length 2.95 in HL.

Mouth inferior and very slightly oblique, forming an angle of about 10° to horizontal axis of body; mouth large, upper-jaw length 1.55 in HL; teeth in jaws needle-like, largest nearly equal to pupil diameter, angling medially and anteriorly, except for a few teeth at front of jaws; teeth of upper jaw in 2 closely set rows, those of outer row fixed, about 1/2 length of inner teeth, and covered by lip; teeth of inner row inwardly depressible; teeth in lower jaw in 3 closely set rows, becoming progressively smaller laterally, all inwardly depressible, outer row hidden by lip; palatine teeth in 3 or 4 rows; 3 anterior teeth of inner row elongate, longest nearly twice as long as posterior palatine teeth; bands of palatine teeth converging anteriorly, tips of longer anterior teeth overlapping when depressed; 5 rows of a total of about 45 posteriorly depressible teeth on anterior part of tongue, followed by numerous very small teeth.

Anterior nostril before middle of eye, nearly 1/2 distance from edge of orbit to base of upper lip; posterior flap of anterior nostril a long, slender, tapering flap with a thin middle rod, reaching more than 2 posterior nostril diameters beyond nostrils when laid back (flap more leaf-like in paratype, with irregular edges); posterior nostril elliptical, with little or no rim, nearly directly behind anterior nostril; internarial distance about equal to greatest posterior nostril diameter.

Predorsal scales extending forward to a vertical about 3/4 orbit diameter behind posterior edge of orbit; preopercle fully scaled, with 7 nearly vertical, curving rows of scales, becoming smaller posteriorly; opercle with 7 scales anteriorly, each crossed by a sensory canal beginning with a pore

Table 5. Proportional measurements of type specimens of *Synodus mundyi* as percentages of the standard length

	Holotype	Paratype
	BPBM 28623	USNM 392810
Sex	?	male
Standard length (mm)	68	140
Body depth (P ₂ origin)	13.6	13.9
Body depth (A origin)	9.2	9.8
Body width	12.2	13.5
Head length	28.4	29.6
Snout length	7.3	7.5
Orbit diameter	7.3	6.5
Interorbital width	2.9	3.3
Upper-jaw length	18.3	18.9
Caudal-peduncle depth	5.8	5.8
Caudal-peduncle length	9.6	10.0
Predorsal-fin length	40.3	40.8
Preanal-fin length	78.3	78.3
Preadipose-fin length	82.7	81.3
Prepelvic-fin length	34.9	35.8
Dorsal-fin base	17.6	16.8
Longest dorsal ray	16.2	15.7
Anal-fin base	9.6	9.6
Longest anal ray	7.5	7.9
Caudal-fin length	16.1	15.0
Caudal concavity	7.5	7.1
Pectoral-fin length	13.2	13.2
Pelvic-fin length	23.8	22.8

of preopercular canal and ending with a 2nd pore; remaining scales of opercle large and embedded, except for a few small dorsal scales; no scales on dorsal, anal, or paired fins; a broad central zone of scales basally on caudal fin, dividing into a pointed part in each lobe, ending in a large elongate scale reaching within 1/2 orbit diameter of fork of fin; a triangular scaly process of 12 scales midventrally at base of pelvic fins.

Predorsal length shorter than length from dorsal-fin origin to origin of adipose fin 2.4 (2.4-2.5) in SL; dorsal-fin base 1.65 (1.75) in HL; 2nd dorsal ray longest, but 3rd nearly equal, 1.75 (1.85) in HL; anal-fin base 2.95 (3.1) in HL; 3rd anal ray longest, 3.8 (3.75) in HL; caudal fin forked, with pointed lobes, longest ray 1.75 (1.95) in HL; caudal concavity 3.8 (4.15) in HL; pectoral fins reaching well posterior to a line connecting origins of dorsal and pelvic fins, rounded when spread, 2.15 (2.25) in HL; 6th pelvic ray longest, 1.2 (1.3) in HL.

Color of holotype in alcohol pale yellowish.

Color when fresh as in figure 7.

Etymology: This species is named in honor of Bruce C. Mundy in recognition of his extensive systematic research on the Hawaiian fish fauna.

Remarks: Waples and Randall (1988: 191) listed 4 specimens of *S. doaki* from the Hawaiian Is. They wrote: "These four specimens vary considerably with respect to several counts and measurements." Two are from Maro Reef in the northwestern Hawaiian Is: BPBM 21057, 235 mm, was included by Russell and Cressey as a paratype of *S. doaki*; the other, BPBM 31994, 124 mm, is in very poor condition. Waples and Randall illustrated in color what they believed to be BPBM 24758 from O'ahu as plate 3, figure C, giving the length as 135 mm SL. However, BPBM 24758 (now the paratype of *S. mundyi* of USNM 392810) measures 140 mm SL, and it was not photographed. The photographed specimen has not been found; it was apparently never cataloged at the Bishop Museum.



Fig. 7. Holotype of *Synodus mundyi* sp. nov., BPBM 28623, 68 mm, Penguin Bank, Hawaiian Is. Photograph by John E. Randall.



Fig. 8. Holotype of *Synodus pylei* sp. nov., BPBM 39913, 80.5 mm SL, Viti Levu, Fiji, 90 m. Photograph by Richard L. Pyle.

None of the 4 extant Hawaiian specimens is *S. doaki*. They have 9 or 10 anal rays (reported as 8 or 9, usually 8, for *S. doaki*) and 58-60 lateral-line scales and vertebrae (55-58 for *S. doaki*). Unexpectedly, the 2 Maro Reef specimens appear to be a different species from the 2 specimens collected in the main Hawaiian Is. They have 14 or 15 dorsal rays instead of 13, 58 instead of 59 or 60 lateral-line scales and vertebrae, 3 instead of 14 peritoneal spots, and a shorter and broader flap on the anterior nostril. Their description is deferred at the present time in the hope of obtaining additional specimens.

***Synodus pylei* sp. nov**

(Table 6, Fig. 8)

Holotype: BPBM 39913, male, 80.5 mm, Fiji, Viti Levu, off Suva Harbor, directly off bow of old shipwreck on top of reef, 18°9'51.18"S, 178°24'1.2"E, base of vertical reef drop-off, 90 m, rotenone, R.L. Pyle and J. Dituri, 31 Jan. 2002.

Paratype: USNM 391166, male, 81.0 mm, Fiji, Viti Levu, off Suva Harbor, south end of "Fish Patch" reef, 18°9'36.6"S, 178°22'57.6"E, sandy slope with rubble and small outcrops, 93-99 m, rotenone, R.L. Pyle and D.F. Pence, 5 Feb. 2002.

Diagnosis: Dorsal rays 14 or 15; anal rays 9 or 10; pectoral rays 13; lateral-line scales 55 or 56; scales between lateral line and base of dorsal fin 4½; median predorsal scales 15; vertebrae 55 or 56; predorsal vertebrae 14; peritoneal spots 5 or 6; 3 anterior palatine teeth of inner row distinctly longer than posterior teeth; preopercle fully scaled; membranous posterior flap of anterior nostril long and thin, narrowing to a filamentous tip reaching well beyond posterior nostril when laid back; body depth 6.45-6.55 in SL; pectoral fins reaching posterior to a line connecting dorsal- and pelvic-fin origins, fin length 2.1-2.15 in HL; color in alcohol pale yellowish; color when fresh pale pink with 8 light orangish red bars on body that narrow ventrally, even-numbered bars darker; dorsal and pelvic fins faintly banded with light red and white.

Description: Dorsal rays 15 (14), branched except for first 2, the last branched to base; anal rays 10 (9), first 5 unbranched, the last branched to base; pectoral rays 13, upper 2 and lowermost 1 unbranched; pelvic rays 8, rays with a slender posterior branch, except for 1st and last; principal caudal rays 19, upper and lower ones unbranched; upper procurent caudal rays 17 (16); lower

procurent caudal rays 14; lateral-line scales 58, 59 on right side (59 or 60), not including 3 tubed scales curving ventrally on caudal-fin base; scales between lateral line and dorsal fin 4½; scales below lateral line to origin of anal fin 5½; median predorsal scales 18; circumpeduncular scales 12; lower-limb gill rakers on basibranchial 18 (20); vertebrae 56 (55); predorsal vertebrae 14; peritoneal spots 10 (9).

Body slender, depth at pelvic-fin origin 6.65 (6.45) in SL; body width 7.0 (6.9) in SL; HL 3.4 in SL; snout length 3.55 (3.5) in HL; orbit diameter 4.35 (4.25) in HL; interorbital space a broad V-shaped concavity when viewed anteriorly, least bony width 9.9 (9.5) in HL; caudal-peduncle depth 5.0 (5.1) in HL; caudal-peduncle length 2.6 (2.65) in HL.

Mouth slightly inferior and slightly oblique, forming an angle of about 8° to horizontal axis of body; mouth large, upper-jaw length 1.6 (1.55) in HL; teeth in jaws needle-like, largest arrow-

Table 6. Proportional measurements of type specimens of *Synodus pylei* as percentages of the standard length

	Holotype	Paratype
	BPBM 39913	USNM 391166
Sex	male	male
Standard length (mm)	80.5	81.0
Body depth (P ₂ origin)	15.0	15.5
Body depth (A origin)	10.5	10.6
Body width	14.3	14.5
Head length	29.6	29.4
Snout length	8.3	8.4
Orbit diameter	6.8	6.9
Interorbital width	3.0	3.1
Upper-jaw length	18.8	18.9
Caudal-peduncle depth	5.9	5.8
Caudal-peduncle length	11.3	11.1
Predorsal-fin length	40.5	40.0
Preanal-fin length	78.3	77.2
Preadipose-fin length	81.3	81.5
Prepelvic-fin length	36.7	36.5
Dorsal-fin base	19.6	19.8
Longest dorsal ray	15.9	16.2
Anal-fin base	9.5	9.3
Longest anal ray	9.4	9.4
Caudal-fin length	17.5	17.7
Caudal concavity	8.4	8.6
Pectoral-fin length	13.7	13.8
Pelvic-fin length	22.6	23.0

tipped, about equal in length to pupil diameter, and angling medially and anteriorly, except for a few teeth at front of jaws; teeth of upper jaw in 2 closely set rows, those of outer row fixed, about 1/2 length of inner teeth, and covered by lip; teeth of inner row inwardly depressible; teeth in lower jaw in 3 closely set rows, becoming progressively smaller laterally, all inwardly depressible, outer row hidden by lip; palatine teeth in 2 or 3 rows, becoming progressively longer medially, angling medially and posteriorly; 3 or 4 anterior teeth elongate, longest about twice as long as posterior palatine teeth; bands of palatine teeth converging anteriorly, tips of longer anterior teeth overlapping when depressed; about 30 posteriorly depressible teeth in 4 irregular rows on anterior part of tongue, followed by numerous very small teeth.

Anterior nostril before center of eye, 2/5 distance from edge of orbit to tip of snout; membranous posterior flap of anterior nostril very long and slender, tapering to a filament, reaching well beyond posterior nostril when laid back, its length nearly equal to pupil diameter; posterior nostril nearly round, with only a slight rim at front, slightly median to anterior nostril, internarial distance a little smaller than posterior nostril diameter.

Predorsal scales extending forward to a vertical 2/3 orbit diameter behind posterior edge of orbit; preopercle with 7 nearly vertical, curving rows of scales to posterior edge, those of posterior row 1/3 to 1/2 size of anterior scales; opercle with an anterior row of 7 scales, each crossed by a sensory canal beginning with a preopercular pore and ending with a pore; remaining scales of opercle variable in size, the largest posterior and embedded; no scales on dorsal, anal, or paired fins; a broad central zone of scales basally on caudal fin, ending in a very large scale on each lobe nearly reaching margin of fork of fin; a triangular scaly process of about 11 scales midventrally at base of pelvic fins.

Predorsal length equal to distance from dorsal-fin origin to origin of adipose fin, 2.5 in SL; dorsal-fin base 1.5 in HL; 2nd and 3rd dorsal rays longest, 1.85 (1.8) in HL; anal-fin base 3.1 (3.15) in HL; 3rd anal ray longest, 3.15 in HL; caudal fin forked, with pointed lobes, longest ray 1.7 (1.65) in HL; caudal concavity 3.5 (3.4) in HL; pectoral fins reaching posterior to a line connecting origins of dorsal and pelvic fins, fin rounded when spread, 2.15 (2.1) in HL; 5th pelvic ray longest, 1.3 in HL.

Color in alcohol uniformly pale yellowish, fins with translucent membranes and pale yellowish

rays. Color when fresh as in figure 8.

Etymology: This species is named in honor of Richard L. Pyle, who collected the type specimens and provided the color photograph of the holotype.

Remarks: Specimens of this species were first identified as *S. doaki* Russell and Cressey, 1979. It differs from *S. doaki* in having 4½ scales instead of 3½ between the lateral line and dorsal fin, the pectoral fins extending well beyond a line connecting the origins of the dorsal and pelvic fins, compared to not or reaching slightly beyond the dorsal-pelvic line; 9 or 10 anal rays, compared to 8 or 9 for *S. doaki*; 5 or 6 peritoneal spots, instead of 11 or 12; a very long, slender, tapering nasal flap, compared to a shorter, more leaf-like flap in *S. doaki*; and in color. The irregular light orangish red bars on the body of *P. pylei* sp. nov. are broader than the pale interspaces, as can be seen by comparing figure 8 of the holotype of *S. pylei* sp. nov. with figure 6, a photograph of the paratype of *S. doaki* (BPBM 14655, 151.5 mm) from Ball's Pyramid, Lord Howe I.

Type specimens of *S. doaki* from South

Table 7. Proportional measurements of holotype of *Synodus sanguineus* as percentages of the standard length

	BPBM 29790
Sex	female
Standard length (mm)	116.0
Body depth (P ₂ origin)	15.2
Body depth (A origin)	10.2
Body width	15.5
Head length	31.0
Snout length	7.9
Orbit diameter	7.0
Interorbital width	2.6
Upper-jaw length	19.8
Caudal-peduncle depth	6.2
Caudal-peduncle length	9.5
Predorsal-fin length	42.6
Preanal-fin length	78.5
Preadipose-fin length	84.0
Prepelvic-fin length	37.5
Dorsal-fin base	17.7
Longest dorsal ray	16.6
Anal-fin base	9.7
Longest anal ray	8.6
Caudal-fin length	17.3
Caudal concavity	6.3
Pectoral-fin length	13.9
Pelvic-fin length	22.8

Pacific localities were collected in the depth range of 9-35 m. The 2 type specimens of *S. pylei* sp. nov. from Viti Levu are from 90-96 m. The very extensive fish collections from Fiji contain no specimens of *S. doaki*.

The stomach of the paratype of *S. pylei* contained a partially digested specimen of the genus *Symphysanodon*, about 40 mm SL (hence half the SL of the lizardfish). It was probably an earlier victim of the rotenone.

***Synodus sanguineus* sp. nov.**

(Table 7, Fig. 9)

Holotype: BPBM 26683, female, 116 mm, Indonesia, Sulawesi, Manado Bay, about 100 m, local fisherman for J.E. Randall, 3 Sept. 1978.

Diagnosis: Dorsal rays 12; anal rays 9; pectoral rays 13; lateral-line scales 54; scales above lateral-line to base of dorsal fin $3\frac{1}{2}$; median predorsal scales 15; vertebrae 54; 3 anterior palatine teeth of inner row distinctly longer than posterior palatine teeth; preopercle scaled to posterior margin, all scales large; membranous posterior flap of anterior nostril slender and leaf-like, reaching well beyond posterior nostril when laid back; body depth 6.6 in SL; eye moderately large, 4.45 in HL; pectoral fins extending posterior to a line connecting dorsal- and pelvic-fin origins, fin length 2.2 in HL; color in alcohol pale yellowish with only traces of dark pigment in blotches along lateral line; fresh coloration red on dorsal 1/2 of body, white ventrally, with V-shaped darker red bars extending 1/2 way into white ventral space, each with 3 constrictions; a vertical series of

orangish red blotches in each interspace between red bars, ventralmost in white area between tips of red bars; median and pelvic fins with red cross bands.

Description: Dorsal rays 13, branched except first 2, the last branched to base; anal rays 9, only the last branched to base; pectoral rays 13, upper 2 and lower 2 unbranched; pelvic rays 8, rays with a slender posterior branch, except first and last 2; principal caudal rays 19; upper procurrent caudal rays 16; lower procurrent caudal rays 14; lateral-line scales 54, not including 3 tubed scales angling ventrally on caudal-fin base; scales between lateral line and dorsal fin $3\frac{1}{2}$; scales below lateral line to origin of anal fin $5\frac{1}{2}$; median predorsal scales 15; circumpeduncular scales 14; lower-limb gill rakers on basibranchial 20; vertebrae 55; peritoneal spots 13, of which 3 are double spots.

Body slender, depth at pelvic-fin origin 6.6 in SL; body width 6.45 in SL; HL 3.2 in SL; dorsal profile of snout strongly concave; snout length 3.9 in HL; eye moderately large, orbit diameter 4.45 in HL; interorbital space a broad V-shaped concavity when viewed anteriorly, least bony width 11.9 in HL; caudal-peduncle depth 5.0 in HL; caudal-peduncle length 3.25 in HL.

Mouth terminal and slightly oblique, forming an angle of about 10° to horizontal axis of body; mouth large, extending about 2/3 orbit diameter posterior to eye; upper-jaw length 1.6 in HL; teeth in jaws needle-like, strongly arrow-tipped, angling inwardly, those of inner row longest, up to 2/3 pupil diameter in length; teeth in jaws also angling anteriorly, except those on about anterior 1/4 of jaw, erect or angling posteriorly; teeth in upper jaw in 2 closely set rows, outer one fixed, inner one much longer and inwardly



Fig. 9. Holotype of *Synodus sanguineus* sp. nov., BPBM 26683, 116 mm SL, Sulawesi, about 100 m. Photograph by John E. Randall.

depressible; teeth in lower jaw in 3 closely set rows, all inwardly depressible, those of outer row short and hidden by lip; palatine teeth in 3 rows, becoming progressively longer medially, angling inwardly and posteriorly, all depressible inwardly; first 3 palatine teeth of inner row longer than posterior teeth, middle tooth about twice as long as posterior teeth; bands of palatine teeth converging anteriorly, tips of longest teeth overlapping when depressed; about 20 inwardly depressible teeth in 4 longitudinal rows on anterior part of tongue, followed by numerous very small teeth.

Anterior nostril in front of center of eye, about 1/2 distance from fleshy anterior edge of orbit to base of upper lip; membranous posterior flap of anterior nostril slender, leaf-like, and long, reaching more than a nostril diameter beyond posterior nostril when laid back; posterior nostril ovate, directly behind anterior nostril, internarial distance slightly less than posterior nostril diameter.

Predorsal scales extending forward to a vertical line 1 orbit diameter behind eye; preopercle fully scaled, with 7 nearly vertical, curving rows of scales, those of posterior row about 1/2 size of anterior scales; a row of 7 scales anteriorly on opercle, each crossed by a sensory canal with 2 pores, anterior 1 in preopercular canal, the other posterior; remaining scales on opercle larger and embedded, except some small ones dorsally; no scales on dorsal, anal, or paired fins; a broad central zone of scales basally on caudal fin, ending in a pair of large pointed scales, 1 in each lobe, reaching to within 1/2 pupil diameter of margin at fork of fin; a triangular scaly process of about 10 scales midventrally at base of pelvic fins.

Predorsal length 2.35 in SL, equal to distance from dorsal-fin origin to rear base of adipose fin; dorsal-fin base 1.75 in HL; 2nd dorsal ray longest, 1.85 in HL; anal-fin base 3.2 in HL; 2nd and 3rd anal rays longest, 3.6 in HL; caudal fin forked, with pointed lobes, fin length 1.8 in HL; caudal concavity 4.9 in HL; pectoral fins reaching posterior to a line connecting origins of dorsal and pelvic fins, fin rounded when spread, 2.2 in HL; 6th pelvic ray longest, 1.35 in HL.

Color in alcohol pale yellowish with very faint dusky blotches along lateral line; 5 faint dusky bars across lips and mandibles, the most evident below orbit; fins unmarked. Color when fresh as in figure 9.

Etymology: This species is named *S. sanguineus* sp. nov. from the Latin for blood red, in reference to the predominantly deep red color.

Remarks: *Synodus sanguineus* is most

similar to *S. doaki* Russell and Cressey. It is separated by having 12 dorsal rays compared to 13-15 (usually 14) for *S. doaki*, 54 lateral-line scales compared to 55-58, and in having a larger eye (orbit diameter 7.0% SL, compared to about 5.7% for *S. doaki* of the same size). The vertebral count of 55 is at the low end of the range of 55-58 for *S. doaki*. Although there is much similarity in the fresh coloration of the 2 species, the red bars of *S. doaki* extend farther ventrally, and those below and just posterior to the dorsal fin have 4 constrictions, compared to 3 for *S. sanguineus*.

In the key to *Synodus* provided by Cressey (1981), the final couplet leading to *S. doaki* reads: "Pectoral fin just to a line from origin of pelvic to origin of dorsal fin". However, the pectoral fins of the paratype of *S. doaki* from Ball's Pyramid, Lord Howe I. (BPBM 14655, 151 mm) and the paratype from One Tree I., Great Barrier Reef (AMS I.18351-001, 84 mm) extend distinctly posterior to that line. The pectoral fins of *S. sanguineus* sp. nov., at 13.9% SL, are still a little longer than these 2 paratypes of *S. doaki* (13.1%-13.6% SL).

Synodus sanguineus sp. nov. keys to *S. binotatus* Schultz in Cressey (1981), but it does not share the 2nd character in the key of 0-3 peritoneal spots (10 in *S. sanguineus* sp. nov.). In addition, it differs from *S. binotatus* in having a much larger eye (7.0% SL compared to about 4.6% for *S. binotatus* sp. nov. of the same size), a longer nasal flap, and in color (that of *S. binotatus* more horizontally linear).

Acknowledgments: I thank R.L. Pyle for providing the specimens and color photograph of the new species of *Synodus* from Fiji, D. Golani of the Hebrew University for the Red Sea specimen reported as *S. doaki*, M.A. McGrouther of the Australian Museum for the loan of the paratype of *S. doaki* from the Great Barrier Reef, and L.R. O'Hara and A.Y. Suzumoto for curatorial assistance and x-rays.

REFERENCES

- Anderson WW, JW Gehringer, FW Berry. 1966. Family Synodontidae: Lizardfishes. *In* Fishes of the Western North Atlantic. Mem. Sears Found. Mar. Res. 1: 30-102.
- Anderson WW, JW Gehringer, FH Berry. 1975. The correlation between numbers of vertebrae and lateral-line scales in western Atlantic lizardfishes (Synodontidae). Fish. Bull. 73: 202-206.
- Baranes A, D Golani. 1993. An annotated list of deep-sea fishes collected in the northern Red Sea, Gulf of Aqaba.

- Isr. J. Zool. **39**: 299-336.
- Carpenter KE, VH Niem, eds. 1999. The living marine resources of the western Central Pacific. Vol. 3. Batoid fishes, chimaeras and bony fishes, part 1 (Elopidae to Linophrynidae). Rome: Food and Agriculture Organization of the United Nations.
- Chen JP, HC Ho, KT Shao. 2007. A new lizardfish (Aulopiformes: Synodontidae) from Taiwan with descriptions of three new records. Zool. Stud. **46**: 148-154.
- Cressey R. 1981. Revision of Indo-west Pacific lizardfishes of the genus *Synodus* (Pisces: Synodontidae). Smithson. Contrib. Zool. **342**: iii + 53 pp.
- Cressey R, HB Cressey. 1979. The parasitic copepods of Indo-West Pacific lizardfishes (Synodontidae). Washington DC: Smithsonian. Contrib. Zool. **296**: 1-296.
- DiSalvo LH, JE Randall, A Cea. 1988. Ecological reconnaissance of the Easter Island sublittoral marine environment. Natl. Geogr. Res. **4**: 451-473.
- Mundy BC. 2005. Checklist of the fishes of the Hawaiian Archipelago. Bishop Mus. Bull. Zool. **6**: 1-704.
- Randall JE. 2007. Reef and shore fishes of the Hawaiian Islands. Honolulu, HI: Sea Grant Program of the Univ. of Hawai'i.
- Randall JE, AE Cea, RC Meléndez. 2005. Checklist of shore and epipelagic fishes of Easter Island, with twelve new records. Bol. Mus. Nac. Hist. Nat. Chile **54**: 41-55.
- Russell BC, R Cressey. 1979. Three new species of Indo-West Pacific lizardfish (Synodontidae). Proc. Biol. Soc. Wash. **92**: 166-175.
- Waples RS, JE Randall. 1988. A revision of the Hawaiian lizardfishes of the genus *Synodus*, with descriptions of four new species. Pac. Sci. **42**: 178-213.