Zoological Studies **47**(5): 657-662 (2008)

Zoological Studies

Synodus orientalis, a New Lizardfish (Aulopiformes: Synodontidae) from Taiwan and Japan, with Correction of the Asian Records of *S. lobeli*

John E. Randall* and Richard L. Pyle

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

(Accepted February 13, 2008)

John E. Randall and Richard L. Pyle (2008) *Synodus orientalis*, a new lizardfish (Aulopiformes: Synodontidae) from Taiwan and Japan, with correction of the Asian records of *S. lobeli*. *Zoological Studies* **47**(5): 657-662. The lizardfish *Synodus orientalis* is described as a new species from a specimen 205.5 mm in standard length (SL) taken at a depth of 80 m off southwestern Taiwan and one 233.6 mm SL, from 140 m in the Ogasawara Is., Japan, both previously misidentified as *S. lobeli* Waples and Randall, type locality Hawaii. *Synodus orientalis* differs from *S. lobeli* in a larger size (largest of 33 specimens of *S. lobeli*, 121 mm SL, including a fully mature female, 76 mm SL), 13 instead of 10 or 11 peritoneal spots, 39 or 40 instead of 18-22 gill rakers on the ceratobranchial of the 1st gill arch, and in color. The range of *S. lobeli* is extended to the Marshall Is. and Ogasawara Is., the latter locality by 2 specimens, 68-69 mm SL, first reported as *Synodus* sp. in a checklist of the shore fishes of the Ogasawara Is. The specimens of *S. lobeli* from the 3 known localities were collected at depths of 2.5-32 m. http://zoolstud.sinica.edu.tw/Journals/47.5/657.pdf

Key words: Synodontidae, *Synodus*, New species, Taiwan, Japan.

When Cressey (1981) revised the Indo-Pacific species of the lizardfish genus *Synodus*, he described 6 species as new, all still valid. Waples and Randall (1988) reviewed the Hawaiian synodontid fishes and recognized 12 species of *Synodus*, 4 of which were described as new. However, Randall (2007) concluded that their *S. amaranthus* is a synonym of *S. dermatogenys* Fowler, and *S. janus* a probable synonym of *S. falcatus* Waples and Randall.

Synodus lobeli Waples and Randall was described from 19 specimens, 38.7-116.3 mm in standard length (SL), collected from sand at 32 m on the Kona coast of the island of Hawai'i, except for 2 specimens, 94-121 mm SL, from a Honolulu fish market. We here extend the range within the Hawaiian Is. to Maui from 4 specimens in the Bishop Museum fish collection (BPBM 32847, 41.5-50 mm SL) collected at 17 m from silty sand off Makena. The species is easily separated from the others in the Hawaiian Is., except *S. kaianus* (Günther), by having 5.5 instead of 3.5 scales above the lateral line, and the anterior palatine teeth not longer than the posterior. It differs from *S. kaianus* by having 53-55 instead of 60-64 lateral-line scales, no series of dark blotches along the lower side, and a pale instead of a black peritoneum. It is distinct in color among lizardfishes in having a narrow yellow stripe along the lateral line, with a narrow blue stripe on the upper side. A color photograph of the 116.3 mm holotype is reproduced here as figure 1.

Synodus lobeli remained a Hawaiian endemic until Senou et al. (1995) caught a ripe female specimen, 233.6 mm SL, from 140 m off Mago-jima, Ogasawara Is., Japan. They stated that it agrees well with the original description and figures of *S. lobeli*, except for a larger body size and a few head and body proportions, adding that the size difference was probably responsible for the different proportions. Chen et al. (2007) reported *S. lobeli* from Taiwan from 1 female specimen, 215

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

mm SL, collected from 80 m. Both the Japanese and Taiwanese specimens were illustrated in color.

We recently found 8 specimens of *S. lobeli* in the Bishop Museum fish collection, BPBM 29238, 38-79 mm SL, collected by the 1st author at Enewetak Atoll, Marshall Is. in 1983, that had been identified only as *Synodus* sp. The specimens were taken from a sand substratum in the lagoon at a depth of only 2.5 m. Figure 2 is a color photograph of a mature Enewetak female specimen, 76 mm SL. The meristic and morphometric data of these specimens are in the range of those of *S. lobeli*. We report the species here as the 1st record for the Marshall Is.

Suspicion concerning the identification of specimens from Japan and Taiwan as *S. lobeli* was aroused because of their much larger size, the greater depth at which they were collected, and some difference in the fresh coloration (which, however, could possibly be related to their larger size and deeper habitat). Fin-ray, scale, and vertebral counts are the same as those for *S. lobeli*, with the possible exception of the dorsal-ray count. The specimen from Japan and the one from Taiwan each has 12 dorsal rays; 23 specimens of *S. lobeli* have 11 dorsal rays, and 10 have 12 rays. We agree with Senou et al. (1995) that morphometric differences could be the result of the different size of the specimens under comparison. We found a difference in the number of peritoneal spots, 10 or 11 in *S. lobeli*, compared to 13 for the specimens from Japan and Taiwan; however, this count, which entails opening the entire peritoneal cavity, can be more variable than indicated by Cressey (1981). The number of gill rakers on the ceratobranchial part of the lower limb of the 1st gill arch (following Waples and Randall, 1988: 180, fig. 2) proved to be significantly different: 18-22 for *S. lobeli* and 39 and 40 for the single specimens from Taiwan and Japan, respectively. We determined that the gill-raker count does not increase with growth in other species of *Synodus* represented by a wide range in size. We concluded that the specimens from Japan and Taiwan represent a new species, which is described below.

Randall et al. (1997: 80, pl. 2E) reported 2 specimens, BPBM 35326, 68-69 mm SL, as *Synodus* sp., from Minami-shima, south coast of Chichi-jima, Ogasawara Is. in 1992; they were speared by the 1st author at a depth of 15 m from an open sand bottom where the sandlance *Ammodytoides kimurai* was also collected. The specimens were believed to represent an undescribed species, but the morphometric and meristic data (with correction of the pectoral-ray count to 12, the predorsal-scale count to 17, and the peritoneal spots to 11) correspond to those of *S. lobeli*. Also, the fresh coloration is very similar (Fig. 3). We conclude that these 2 small specimens represent the first valid record of *S. lobeli* for Japan.

MATERIALS AND METHODS

Specimens for this study are from the Research Center for Biodiversity, Academia Sinica, Taipei, Taiwan (ASIZP); Bernice P. Bishop Museum, Honolulu, HI (BPBM); and the Kanagawa Prefectural Museum of Natural History, Odawara, Japan (KPM-NI).

Lengths of specimens are given as 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 was measured vertically from the origin of the pelvic fins, and from the origin of the anal fin; body width was 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 was 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. Morphometric data of table 1 are given as percentages of SL. Proportional measurements in the text are rounded to the nearest 0.05.

Counts of tubed lateral-line scales do not include those posterior to the hypural plate (the tubed scales on the caudal-fin base angle downward). Counts of vertebrae include the hypural plate.

Synodontid fishes do not have distinct 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 of the 1st gill arch only on the ceratobranchial part of the lower limb of the 1st gill arch where the joint with the hypobranchial provides a clear stopping point. The rakers on the hypobranchial become so small anteriorly that they cannot be accurately counted, and the count of the rakers on upper limb (epibranchial) lack useful variability among species of *Synodus*.

Data in parentheses in the description refer to the paratype, if different from the holotype.

***Synodus orientalis* sp. nov.**
(Figs. 4, 5; Table 1)

Synodus lobeli (non Waples and Randall) Senou et al. 1995: 93, fig. 1 (Mago-jima, Ogasawara Is., Japan).

Synodus lobeli (non Waples and Randall) Chen et al. 2007: 152, fig. 4 (off Hobihu, Taiwan).

Holotype: ASIZP 64387, ♀, 205.5 mm, southwestern Taiwan off Hobihu, 80 m, 14 Apr. 2004.

Paratype: KPM-NI 00079 (formerly YCM-P 27845), female, 233.6 mm, off west side of Mago-jima, Ogasawara Is., 140 m, K. Sasaki, June 1994.

Diagnosis: Dorsal rays 12; anal rays 9; pectoral rays 12; lateral-line scales 53-55; scales above lateral line to base of dorsal fin 3.5; median predorsal scales 17; lower-limb gill rakers on ceratobranchial 39 or 40; vertebrae 53 or 54; peritoneal spots 13; anterior palatine teeth not longer than posterior teeth; scales on cheek extending to posterior edge of preopercle; membranous posterior flap of anterior nostril a slender triangle, pointed tip reaching above middle of posterior nostril when laid back; body depth at origin of pelvic fins 6.8-6.85 in SL; pectoral fins not reaching a line connecting dorsal- and pelvic-fin origins, fin length 2.25-2.35 in HL; posterior pelvic process broad; color in alcohol pale yellowish gray on upper 1/2 of body, nearly white below; scales dorsally on body with dusky edges; color when fresh bluish gray with dull reddish orange stripes following longitudinal scale rows on dorsal 1/2 of body.

Table 1. Proportional measurements of type specimens of *Synodus orientalis* as percentages of the standard length

	Holotype	Paratype
	ASIZP 64387	KPM-NI 00079
Sex	female	female
Standard length (mm)	205.5	233.6
Body depth (P_2 origin)	14.6	14.7
Body depth (A origin)	9.0	10.4
Body width	13.9	14.2
Head length	27.4	27.3
Snout length	6.8	6.6
Orbit diameter	4.5	4.0
Interorbital width	2.8	2.6
Upper-jaw length	17.1	17.2
Caudal-peduncle depth	4.9	5.1
Caudal-peduncle length	11.9	11.8
Predorsal-fin length	42.3	42.2
Preanal-fin length	79.1	78.5
Preadipose-fin length	81.5	83.0
Prepelvic-fin length	35.4	35.0
Dorsal-fin base	13.0	13.2
Longest dorsal ray	14.4	broken
Anal-fin base	8.6	8.9
Longest anal ray	7.3	7.1
Caudal-fin length	15.8	15.4
Caudal concavity	8.1	7.9
Pectoral-fin length	12.2	11.7
Pelvic-fin length	23.2	23.4

Description: Dorsal rays 12, branched except first 2, last branched to base; anal rays 9, unbranched except last, branched to base; pectoral rays 13, upper 2 and lowermost unbranched; pelvic rays 8, branched except last; principal caudal rays 19, uppermost and lowermost unbranched; upper procurrent caudal rays 15 (16); lower procurrent caudal rays 14 (15); lateral-line scales 53 (55), not including 3 tubed scales curving ventrally on caudal-fin base; scales between lateral line and dorsal fin 3.5; scales below lateral line to origin of anal fin 4 (4.5); median predorsal scales 17; circumpeduncular scales 15; lower-limb gill rakers on ceratobranchial 39 (40); vertebrae 53 (54); predorsal vertebrae 15.5 (16); peritoneal spots 13.

Body depth at origin of pelvic fins 6.85 (6.8) in SL; body width 7.2 (7.05) in SL; HL 3.8 in SL; tip of snout firm; snout length 4.05 (4.45) in HL; orbit diameter 6.1 (6.85) in HL; interorbital space deeply concave, least width 9.8 (9.5) in HL; caudal-peduncle depth 5.6 (5.35) in HL; caudal-peduncle length 2.3 in HL.

Mouth slightly inferior and slightly oblique, forming an angle of about 15° to horizontal axis of body; mouth large, upper-jaw length 1.6 in HL; teeth in jaws needle-like, largest about equal in length to pupil diameter, angling medially, those of lower jaw also angling anteriorly, except for about 7 teeth at front of jaw that are inclined posteriorly; teeth in jaws inwardly depressible except some

Fig. 1. Holotype of *Synodus lobeli*, BPBM 29293, 116.3 mm standard length, Hawai'i (J.E. Randall).

Fig. 2. *Synodus lobeli*, BPBM 29238, 76 mm standard length, Enewetak, Marshall Is. (J.E. Randall).

Fig. 3. *Synodus lobeli*, BPBM 35326, 68 mm standard length, Chichi-jima, Ogasawara Is., Japan (J.E. Randall).

Fig. 4. Holotype of *Synodus orientalis*, ASIZP 64387, 205.5 mm standard length, Taiwan (J.P. Chen).

Fig. 5. Paratype of *Synodus orientalis*, KPM-NI 00079, 233.6 mm standard length, Mago-jima, Ogasawara Is., Japan (M. Hayashi).

of outer row in upper jaw that are fixed; teeth of upper jaw in 2 closely set rows, those of outer row about 1/2 length of inner teeth, and largely covered by lip; teeth in lower jaw in 3 closely set rows, progressively smaller laterally, lateral row hidden by lip; palatine teeth in 3 rows, progressively longer medially, angling inwardly and posteriorly; anterior teeth not distinctly longer than posterior teeth; bands of palatine teeth converging anteriorly; tips of front teeth overlapping when depressed; free part of tongue with about 40 recurved, posteriorly depressible teeth in 4 or 5 longitudinal rows; remainder of tongue with another set of about 40 slightly smaller teeth, separated by a gap from teeth on free part of tongue.

Nostrils on a line from upper edge of orbit to front of upper lip; anterior nostril 2/3 orbit diameter before anterior edge of orbit, with a low fleshy rim and a slender triangular posterior flap that reaches above middle of posterior nostril when laid back; posterior nostril ovate, without a rim; internarial distance equal to outer anterior nostril diameter.

Median predorsal scales extending forward to within 1.3 orbit diameter of posterior edge of orbit; finely branching sensory canals extending about an orbit diameter posterior to eye, followed by 5 curving rows of scales to posterior edge of preopercle; opercle and subopercle with a curving vertical row of 7 scales adjacent to preopercular edge, each scale with finely branching series of tiny sensory pores; 2nd row of 3 scales, and a single embedded scale in 3rd row; no scales on dorsal, anal, or paired fins; a triangular patch of scales basally on each caudal-fin lobe; caudal-base scales progressively more pointed posteriorly; enlarged last scale nearly reaching margin at fork of fin; 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 in SL; dorsal-fin base 2.1 (2.05) in HL; 2nd dorsal ray longest, 1.9 (broken on paratype) in HL; anal-fin base 3.2 (3.1) in HL; 3rd anal ray longest, 3.75 (3.85) in HL; caudal fin forked, lobes pointed, longest ray 1.75 in HL; caudal concavity 3.4 (3.45) in HL; pectoral fins not reaching a line connecting origins of dorsal and pelvic fins; pectoral fins asymmetrically rounded when spread, 2.25 (2.35) in HL; 6th and 7th pelvic rays longest, 1.2 (1.15) in HL; posterior pelvic process broad (as in fig. 1b of Cressey 1981).

Color of holotype in alcohol pale yellowish gray on dorsal 1/2 of body, scale edges darker gray; ventral 1/2 of body nearly white; head dusky dorsally, pigment extending ventrally on snout and in a broad zone ventral and posterior to eye; dusky pigment also extending obliquely downward from occiput onto dorsal part of opercle; fins translucent with pale yellowish rays. Color of paratype in alcohol similar to holotype, differing mainly in lacking dark edges on scales dorsally on body.

Etymology: The specific name *orientalis*, from the Latin for east, was selected in reference to the localities of Taiwan and Japan.

Remarks: As mentioned, both the holotype and paratype were initially identified in the literature as *S. lobeli*. They have the same fin-ray, scale, and vertebral counts as *S. lobeli* and readily key to this species in Waples and Randall (1988). The few morphometric differences, such as a smaller eye and broader interorbital space, were assumed to be due to the much larger size of these 2 specimens. Only after we examined a total of 35 specimens of *S. lobeli*, none longer than 121 mm SL (including a fully ripe female of 76 mm SL), did we consider the possibility that the Taiwanese and Japanese specimens represented an undescribed species.

Synodus orientalis sp. nov. also has the same fin-ray, scale, and vertebral counts as *S. fuscus* Tanaka from Japan, as well as the fully scaled cheek and short pectoral fins. It differs from *S. orientalis* in having long anterior palatine teeth, 9 or 10 peritoneal spots, and about 9 dusky bars dorsally on the body, judging from the illustration of *S. fuscus* in Cressey (1981: fig. 11) and in Masuda et al. (1984: pl. 61, fig. I).

Acknowledgments: We are most grateful to J. P. Chen for providing the color photograph of the holotype of *Synodus orientalis*, Y.C. Liao for the loan of the specimen, and to Hiroshi Senou for providing the paratype and its color photograph. Thanks are also due Loreen R. O'Hara and Arnold Y. Suzumoto of the Bishop Museum for x-rays and curatorial assistance.

REFERENCES

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). Smithsonian Contrib. Zool. **342:** iii + 53 pp.

Masuda H, K Amaoka, C Araga, T Uyeno, T Yoshino (eds.) 1984. The fishes of the Japanese Archipelago. Tokyo:

Tokai Univ. Press, Vol. 1 (text: xxii + 437 pp.) and Vol. 2 (plates).

Randall JE. 2007. Reef and shore fishes of the Hawaiian Islands. Honolulu, HI: Sea Grant Program of the Univ. of Hawai'i, xiv + 546 pp.

Randall JE, H Ida, K Kato, RL Pyle, JL Earle. 1997. Annotated checklist of the inshore fishes of the Ogasawara Islands. Natl. Sci. Mus. Monog. **11:** 1-74.

Senou H, Y Morita, K Arai. 1995. Two new records of lizardfishes (Pisces: Synodontidae) from Japan. Jpn. J. Ichthyol. **42:** 93-95.

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.