

Icelinus limbaughi: A New Species of Sculpin (Teleostei: Cottidae) from Southern California

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Icelinus limbaughi n. sp. is described from 36 specimens collected off the coast of California, from the Channel Islands, off San Diego, and on Cortez Bank, about 160 km off the coast of San Diego. It differs from all other species of *Icelinus* by the following combination of characters: a dorsal scale band that originates under the fourth to seventh dorsal-fin spine and terminates below the final or penultimate dorsal fin-ray, not extending onto caudal peduncle; absence of scales in the pectoral axilla; absence of cirri on dorsal-fin spines.

IN the middle 1950s and early 1960s, a number of specimens of an undetermined species of cottid were collected in southern California. Many of these specimens were taken in the La Jolla Submarine Canyon by use of the then recently developed scuba equipment. Comparisons made at that time by the first author, the late Conrad Limbaugh, and the late Carl L. Hubbs suggested that these specimens represented an undescribed species closely allied to species of the genus *Icelinus*. They noted that it had the general appearance of a deep-bodied *Artedius* but that it had two pelvic soft rays and a dorsal scale band of two rows, features characteristic of *Icelinus* (Bolin, 1944). These observations were not published, and the first author subsequently invited the second author to join him in the present study.

The genus *Icelinus* was erected by Jordan (1885) for *Artedius quadriseriatus* Lockington 1880 because of its “peculiar” squamation, preopercular armature, and characteristic body form. Following the description of numerous new genera and species of eastern Pacific sculpins (e.g., Gilbert, 1890, 1896; Evermann and Goldsborough, 1907), Bolin believed that a revision of *Icelinus* (1936a) and the Cottidae (1944, 1947) was needed. In his revision of *Icelinus*, Bolin (1936a) placed *Tarandichthys* Jordan and Evermann in Jordan 1895 in the synonymy of *Icelinus*, on the grounds that the elongation of the first dorsal spines (at least in adult males) and the presence of a scale (or scales) in the pectoral axilla were not sufficient to warrant generic separation. Bolin recognized *Tarandichthys* as a subgenus along with the subgenus *Icelinus* and the newly described subgenera *Medicelinus* and *Penicelinus*. Bolin (1936a, 1944) recognized eight species of *Icelinus*, diagnosing the genus by a number of features including an antler-like fourth (dorsalmost) preopercular spine, a pelvic fin with one spine and two soft rays, two rows of ctenoid scales extending along

the base of the dorsal fins, and gill membranes that are united and free from the isthmus. Recently, Yabe et al. (1980) and Yabe et al. (2001) described two new species of *Icelinus* from the Western Pacific, bringing the number of species in the genus to 10. This paper describes a new species from California and distinguishes it from its congeners.

MATERIALS AND METHODS

Institutional abbreviations are as listed in Leviton et al. (1985). Counts and measurements follow Hubbs and Lagler (1947) except that the last two rays of the dorsal and anal fins were considered separate. All measurements were made with vernier calipers to the nearest 0.1 mm. Vertebral and other skeletal counts were made from radiographs or cleared-and-counterstained specimens (cs). Clearing-and-double-staining for bone and cartilage follows Pothoff (1984). Measurements of cleared-and-stained paratypes were made prior to clearing and staining.

Icelinus limbaughi sp. nov.

Figure 1

Common name: Canyon Sculpin

Icelinus sp. Miller and Lea (1972):213; Peden (1984):79.

Undescribed *Icelinus* Feeney (1987):201, 204.

Material.—*Holotype*. SIO 62-628, 67.8 mm standard length (SL) male, La Jolla Submarine Canyon, California, 32°53.0'N, 117°15.0'W, 40 m depth, 4 July 1955, collected by C. Limbaugh.

Paratypes.—La Jolla Submarine Canyon, 32°53.0'N, 117°15.0'W. All specimens collected by C. Limbaugh unless otherwise noted: SIO 54-112, 18 (56–82 mm SL), 40–46 m, 13 August 1954, collected by SIO party with rotenone. SIO

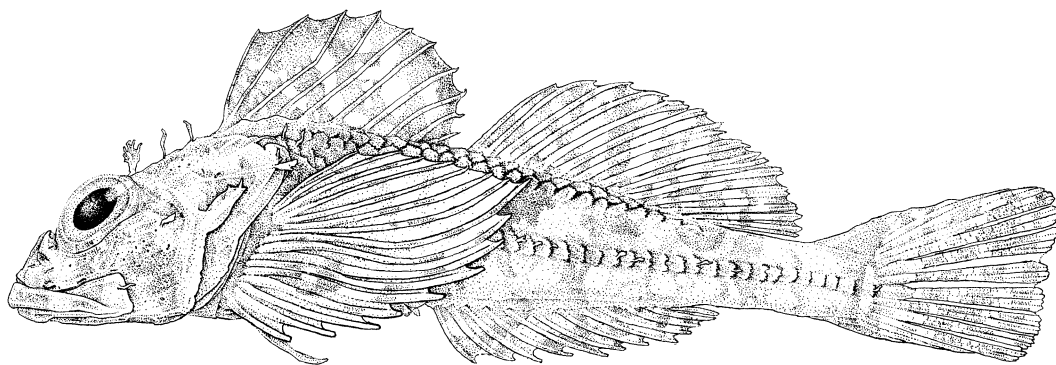


Fig. 1. Illustration of the holotype of *Icelinus limbaughii*, SIO 62-628, a 67.8 mm SL male.

58-508, 72.0 mm SL, approximately 30 m, 27 July 1954. SIO 58-509, 2 (52.3–60.9 mm SL), 37–43 m, 29 July 1954, AMNH 233608 (formerly SIO 58-510), 2 (46.2–60.9 mm SL, (1 specimen cs), 37 m, 30 July, 1954. SIO 62-632, 65.6 mm SL, 40 m, 23 July 1954. CAS 218345 (formerly SIO 62-634), 71.1 mm SL, 40 m, 1955. SIO 62-635, 63.6 mm SL, 40 m, 20 November 1954. USNM 374474 (formerly SIO 62-636), 65.1 mm SL, 43 m, 3 August 1955, collected by C. Limbaugh and R. Parks. SIO 62-673, 76.0 mm SL (cs), 40 m, 14 November 1954.

Channel Islands, California. Collected by C. L. Hubbs and party on R/V ORCA with a pipe dredge: SIO 51-247, 60.6 mm SL, Anacapa Passage 34°00.5'N, 119°28.3'W, 55–57 m, 30 June 1951. SIO 51-252, 62.5 mm SL, Anacapa Island, south of west end of West Island, 34°00.2'N, 119°27.3'W, 53–58 m, 2 July, 1951. SIO 51-253, 2 (46.5–65.4 mm SL), Anacapa Passage 34°01.3'N, 119°28.3'W, 62–66 m, 2 July 1951.

Other locations in southern California: SIO 63-239-55A, 54.2 mm SL, Cortez Bank, 32°30.2'N, 119°13.7'W, 86 m, 16 May 1963, collected by F. Berry, D. Dockins, and party on R/V BLACK DOUGLAS by otter trawl. SIO 63-1024-55B, 78.8 mm SL, Point Loma, 32°41.0'N, 117°14.0'W, 20–26 m, 14 November 1963, collected by R. Rosenblatt and party using Chemfish™. SIO 74-164, 75.9 mm SL, off San Diego, 33°52.0'N, 118°33.2'W, 73 m, 29 March 1974, collected by T. Matsui and party on R/V ALEXANDER AGASSIZ by otter trawl.

Differential diagnosis.—*Icelinus limbaughii* differs from all congeners by the following combination of characters: (1) dorsal scale band originates under fourth to seventh dorsal-fin spine and terminates under penultimate or last dorsal-fin ray, not extending onto caudal peduncle; (2) axilla of pectoral naked; (3) no cirri on dorsal-fin spines. The first character state differs

from that of *Icelinus oculatus*, *Icelinus pietschi*, *Icelinus japonicus*, and *Icelinus fimbriatus*, in which the dorsal scale band originates under the first or second dorsal-fin spine, and differs from that of *I. borealis*, *I. fimbriatus*, *Icelinus japonicus*, and *Icelinus quadriseriatus*, in which the dorsal scale band extends onto the caudal peduncle. The second character state differs from that of *Icelinus cavifrons*, *Icelinus filamentosus*, and *Icelinus tenuis*, in which there are one or more scales in the pectoral axilla. The third character state differs from that of *Icelinus burchami*, *I. fimbriatus*, and *I. oculatus*, in which there are cirri on the dorsal-fin spines. In addition to these characters that diagnose *I. limbaughii*, it can further be recognized by its single common opening of the anterior terminal mandibular pore, lack of nasal cirri, nonelongate dorsal-fin spines, and lack of parietal spines.

Description.—Description of holotype followed parenthetically by that of paratypes, if different from holotype. Counts and measurements are given in Table 1. Body robust, slightly compressed, not elongate. Head large and depressed; mouth of moderate size; maxillary extending to a vertical from posterior margin of pupil; snout moderately steep; lower jaw slightly shorter than upper jaw; small conical teeth present in bands on jaws, vomer, and palatine; nasal spine roughly in line with profile of snout; eye moderate; interorbital space narrow and flat (flat or very slightly concave); top of head gently concave between low fronto-parietal ridges; no spines (occasionally bumps or ridges in paratypes) behind upper posterior margin of orbit on neurocranium or on posttemporal; four preopercular spines, fourth (dorsalmost) spine antler-like, 4.8 (4.4–7.2) in head length, with a bifid (simple to bifid) tip and four (four or five) barbs along its upper margin; no spinous point on subopercle; opercular flap extending be-

TABLE 1. PROPORTIONAL MEASUREMENTS AND COUNTS OF HOLOTYPE AND PARATYPES OF *Icelinus limbaughi*. Average is mean \pm 1 SD for proportional measurements and mode; mean \pm 1 SD for counts.

| | Holotype | # of Paratypes Examined | Range of Paratypes | Average |
|---|------------------|-------------------------------|-----------------------|--------------------|
| Standard length (mm) | 67.8 | 35 | 46.2–81.7 | |
| Proportional measurements in standard length unless otherwise noted | | | | |
| Body depth at pelvic-fin origin | 23.3 | 33 | 18–22.9 | 20.8 \pm 1.3 |
| Head length | 36.9 | 34 | 34.6–40.3 | 38.3 \pm 1.4 |
| Snout length | 10 | 33 | 9.2–13 | 10 \pm 0.8 |
| Length of upper jaw | 17.3 | 34 | 13–19.3 | 16 \pm 1.4 |
| Length of mandible | 14.7 | 32 | 11–14.6 | 13 \pm 0.9 |
| Snout to spinous dorsal-fin origin | 31.6 | 32 | 29.7–37.7 | 32.9 \pm 1.7 |
| Snout to anal-fin origin | 49.4 | 33 | 49.7–58.4 | 52.3 \pm 1.9 |
| Snout to pelvic-fin origin | 27.6 | 33 | 26.4–33.5 | 29.1 \pm 1.7 |
| Snout to anus | 46.8 | 32 | 45.1–54.8 | 48.0 \pm 1.9 |
| Longest dorsal-fin spine | 17.4 | 31 | 11–17.8 | 15 \pm 1.5 |
| Longest dorsal-fin ray | 18 | 33 | 14–20 | 18 \pm 1.7 |
| Longest anal-fin ray | 12 | 32 | 9.1–14 | 11 \pm 1.0 |
| Longest pectoral-fin ray | 29.2 | 33 | 24.4–31.9 | 28.2 \pm 1.8 |
| Longest pelvic-fin ray | 12 | 34 | 9.4–13.6 | 11.2 \pm 1.1 |
| Spinous dorsal-fin base length | 24.6 | 33 | 20.0–27.4 | 23.7 \pm 1.8 |
| Soft dorsal-fin base length | 33.6 | 33 | 28.0–35.0 | 31.6 \pm 1.9 |
| Anal-fin base length | 24.8 | 33 | 22.8–31.0 | 26.8 \pm 1.8 |
| Pectoral-fin base length | 13 | 33 | 11–16.5 | 14 \pm 1.2 |
| Caudal peduncle length | 15.2 | 33 | 11–18.8 | 15 \pm 2.1 |
| Interorbital width in head length | 5.2 | 34 | 3.4–8.2 | 5.0 \pm 0.9 |
| Orbit length in head length | 30 | 33 | 23–31.2 | 27 \pm 2.5 |
| Postorbital length in head length | 45.6 | 32 | 44–57.6 | 52 \pm 3.3 |
| Counts | | | | |
| Dorsal-fin spines | 10 | 35 | 9–10 | 10; 9.8 \pm 0.4 |
| Dorsal-fin soft rays | 15 | 35 | 13–15 | 14; 14.2 \pm 0.6 |
| Anal-fin rays | 12 | 35 | 8–12 | 11; 11.3 \pm 0.8 |
| Pectoral-fin rays | 16 | 35 | 15–17 | 16; 16.0 \pm 0.3 |
| Pelvic-fin spines | 1 | 35 | 1 | 1; 1 \pm 0.0 |
| Pelvic-fin soft rays | 2 | 35 | 2 | 2; 2 \pm 0.0 |
| Branched caudal-fin rays | 9 | 34 | 8–9 | 9; 8.6 \pm 0.5 |
| Lateral-line scales | 36 + 1L, 37 + 1R | 33 | 30–38 | 36; 35.7 \pm 1.6 |
| Scales in uppermost dorsal scale row | 24 | 35 | 19–24 | 21; 21.5 \pm 1.1 |
| Vertebrae–precaudal | 10 | 35 | 9–11 | 10; 9.9 \pm 0.6 |
| Vertebrae–caudal | 25 | 35 | 22–25 | 24; 23.6 \pm 0.9 |

yond upper end of gill opening; branchiostegal membranes broadly united, free from isthmus; branchiostegal rays six; anterior nostrils in well-developed tubes, posterior nostrils slightly larger and with slightly elevated rims; anterior pores of the mandibular latero-sensory canal opening in a common median pit.

Body scaleless except for lateral-line scales and dorsal scale band; lateral-line scales ctenoid, forming a descending arch over the opercular flap, continuing in a gradually descending straight line (straight line to slightly arched) to body midline under fourth dorsal-fin ray (third to fifth) then proceeding horizontally along midline for the posterior third of the body, end-

ing at caudal-fin base; a dorsal scale band, two scale rows deep, extending along the dorsal profile from fifth (fourth to seventh) dorsal-fin spine to last (penultimate to last) dorsal-fin ray; no scales in pectoral axilla; maxillary cirri small and simple; no nasal or orbital cirri; postorbital cirri ribbon-like and slightly expanded at tip; slender cirri on middle and at posterior end of fronto-parietal ridge; no cirri on preopercular spines; slightly expanded cirri on base of opercular flaps; slender cirri on cheek above sub-orbital stay, one or two slender cirri on many lateral-line scale margins; genital papilla developed as a small but stout penis.

First dorsal fin without filamentous spines, its

origin slightly in advance of upper end of gill opening; dorsal fin, when erect, forming a nearly oblong margin, anterior and posterior margins of first dorsal fin nearly vertical, fourth (fourth to sixth) spine longest; second dorsal fin separated from first by a short interspace; origin of second dorsal fin above third (second to fourth) anal-fin ray; second dorsal fin, when erect, rounded anteriorly, abruptly rounded posteriorly, the main distal profile forming a gently descending convex curve, the fifth (fourth to sixth) ray longest; origin of anal fin below dorsal interspace (below last dorsal-fin spine to below first dorsal-fin ray); no anal spines, longest ray fourth (fourth to fifth), last ray entirely free from peduncle; anal fin, when erect, similar in shape to second dorsal fin, but somewhat lower. Pectoral-fin base slightly in advance of midpoint between snout and anterior margin of anal-fin origin. Pelvic-fin base midway between snout and anal-fin origin, pelvic-fins extending about one-third of distance to anal-fin origin. Anus just anterior to anal-fin origin. Caudal fin truncate; epurals three.

Color in alcohol.—General ground color yellow to light brown, dorsal surface more pigmented than area below lateral-line scales; ventral surface pale; four (three to four) irregular dark brown bars, two (one or two) underneath each dorsal fin; first bar under spinous dorsal fin widest and triangular in shape; an additional dark band across base of caudal fin; branchiostegal membrane pale yellow to light; lips and snout dark brown with upper lip crossed by numerous yellow bars; dorsal, caudal, anal, and pectoral fins yellowish to light brown with dark brown barring; anal fin markings darker than other fins; pelvic fins uniformly yellowish to light brown.

Color in life.—Abstracted from notes made from SIO 62-632 by Carl L. Hubbs after specimen had been in formalin for about half of a day. A large, triangular, golden brown area under first dorsal fin, extending from its origin to seventh ray, with a black irregular edge posteriorly and a trace of a fine black bar on the body between fifth and sixth dorsal-fin spines. Two rather well-developed bands posterior to dark triangular area, quite dark but with some red-brown pigment, extend from base of dorsal fin toward lateral line. A dark bar across base of caudal fin, with a light spot at its midpoint, and small circular blue marks on dorsal margin. Head finely and irregularly marked with olive, purplish-brown and reddish-brown; considerable yellow around mandible and upper jaw; lips pale yellow,

crossed with purple blotches and bands. Several irregular extensions of golden brown, broken up by white spots, run from lateral-line scales downward into lighter ventral area. Spinous dorsal-fin with deep round red-orange blotch at posterior end and a large, marginal, deep purple blotch between first three spines. Second dorsal-fin has several interrupted brown bars with color concentrated on rays; extreme tips of rays cream colored. Caudal fin with five olive spots on upper edge, and red spots marginally below; main part of fin bearing irregular purplish-brown bars. Anal fin marked with bright yellow, both on rays and membranes; most rays have one or two purple-brown blotches. Pelvic fins white with black spot on medial third. Pectoral fins with irregular brown bars distally, and an irregular medial brown-black blotch. Nasal tubes pale yellow distally and deeply speckled with purple; postorbital cirri dark purple.

Distribution.—Most specimens of *I. limbaughi* have been collected in the La Jolla Submarine Canyon at San Diego, but additional specimens have been collected off San Diego, at Cortez Bank, in the Anacapa Passage, and at Anacapa Island. The specimens were taken between 20 m and 86 m, with most from around 40 m.

Etymology.—We take great pleasure in naming this species for the late Conrad Limbaugh, former diving officer at SIO, who collected most of the specimens, and trained RHR in scuba diving. Limbaugh's pioneering efforts in scientific diving during the early days of scuba paved the way for the modern techniques of collection, manipulation, and observation of underwater marine life for scientific study.

Discussion.—Peden (1984:79) provided a key to the known species of *Icelinus* that included *I. limbaughi* as "*Icelinus* sp." and all currently recognized species except for the recently described *I. pietschi* from the Kuril Archipelago. As was noted by Yabe et al. (2001), *I. pietschi* can be distinguished from all other species of *Icelinus* by its lack of orbital, parietal, and posttemporal spines and by a dorsal scale band originating under the first or second dorsal spine and terminating before the posterior end of the second dorsal fin.

In addition to the 10 other valid species of *Icelinus*, there are three additional nominal species and one apparent nomen nudum. *Icelinus strabo* was described by Starks (1896) from Puget Sound. However, in his checklist of fishes from around San Juan Islands, Starks (1911) listed *I.*

borealis as the only species of *Icelinus* from the Sound. Hubbs (1928) formally placed *I. strabo* in the synonymy of *I. borealis*, and Bolin (1934, 1936a) argued that Starks' listing of only *I. borealis* was indicative of Starks's belief that *I. borealis* and *I. strabo* were synonymous. Gilbert (1915) described *Icelinus fuscescens* from Santa Barbara Island. Hubbs (1928) placed this species in the synonymy of *I. burchami* and this action was followed by Bolin (1936a, 1944). However, Peden, (1981, 1984) more recently recognized *I. fuscescens* as a subspecies of *I. burchami*. *Icelinus limbaughii* is clearly distinct from these nominal species on the same grounds because its separation from their valid counterparts. A third nominal species, *Icelinus australis*, was described by Eigenmann and Eigenmann (1889) from Cortez Bank, a known locality for *I. limbaughii*. *Icelinus australis* was described from two small half-digested specimens taken from the stomach contents of a "rock cod" (genus *Sebastes*). In their original description Eigenmann and Eigenmann opined that these specimens could be young *Icelinus quadriseriatus*, which is also known to occur on Cortez Bank. *Icelinus australis* has been treated as a species of *Icelus* (e.g., Jordan et al., 1930) but without justification. Bolin (1936a), stated that the syntype he examined at the USNM was in such a "hopeless condition that I doubt that it can ever be satisfactorily identified," and continued that "It is probable that the specimen does not belong to the genus *Icelinus*..." One of us (WLS) has examined that syntype and concurs. Starks (1896:552) compared his putative new species, *I. strabo*, to "*Icelinus microps*." No known specimen or species description exists for *I. microps*, and it is clear that Starks was not describing it as a new species; thus, this name appears to be a nomen nudum despite Bolin's (1936a) attribution of the name to Starks and his listing it as a synonym of *I. borealis*.

Icelinus limbaughii represents the 11th valid species in the genus and the ninth eastern Pacific species. All nine eastern Pacific species except for the northern sculpin, *I. borealis*, have distributions that overlap that of *I. limbaughii*. Despite the larger number of eastern Pacific species, most authors have argued that *Icelinus* is most closely related to the western Pacific *Stlengis* (e.g., Bolin, 1936b; Yabe, 1985). Bolin (1936b) argued that the genera were related based on similarities in the structure of their fourth preopercular spine, their reduced number of pelvic rays, and the structure of their scales. Yabe (1985) used the reduced number of pelvic rays (two) and the reduction of the endopterygoid (metapterygoid not touching

endopterygoid) as synapomorphies uniting these two genera. *Icelinus* may have evolved in the Western Pacific and diversified in the Eastern Pacific. However, without a species-level phylogeny, such a hypothesis cannot be tested.

Icelinus limbaughii cannot be assigned to any of the subgenera of *Icelinus* defined by Bolin (1936a). The recently described *I. pietschi* and *I. japonicus* also cannot be accommodated in his scheme. Considering this, the utility of Bolin's subgenera is doubtful, and they are here treated as synonymous with *Icelinus*. At present, and without the introduction of new characters, a further discussion of possible intrageneric relationships would be of little value.

Additional material (Icelinus).—Comparative material examined, included the following ("cs" indicates cleared and stained, "r" indicates radiographed.): *Icelinus australis* USNM 41917, 1 (syntype) r. *Icelinus borealis* AMNH 2638, 32, r. CAS 102292, 1 (paralectotype), r. CAS 105045, 1 (syntype of *Icelinus strabo*), r. SIO 63-595, 2, r. SIO 76-299, 5, r. SIO 76-300, 1, cs. SIO 77-12, 2, r. USNM 53037, 6 (paralectotypes). *Icelinus burchami* SIO 97-123, 1, r. SIO 97-130, 2, r. SIO 97-132, 2, r. SIO 97-135, 2, r. USNM 57822, 1 (holotype). USNM 75812, 1 (holotype of *Icelinus fuscescens*). *Icelinus cavifrons* CAS 128111, 1 (syntype), r. SIO 48-217, 1, r. SIO 48-30, 3, r. SIO H48-306, 1, cs. SIO H51-260, 1, r. SIO 52-102, 6, r. SIO 62-381, 1, r. SIO 62-631, 1, r. USNM 44405, 2 (syntypes). *Icelinus filamentosus* CAS 100118, 1 (syntype), r. SIO 51-252-55A, 1, r. SIO 83-64, 3, r. SIO 83-68, 1, r. SIO 83-69, 3, r. SIO 83-82, 1, cs. SIO 98-24, 1, r. USNM 44407, 1 (syntype). *Icelinus fimbriatus* SIO 94-130, 2, r. cs. SIO 97-130, 1, r. USNM 43087, 1 (syntype). *Icelinus japonicus* HUMZ 77562, 1 (paratype), r. *Icelinus oculatus* CAS 051404, 1, r. CAS 100080, 1 (holotype), r. CAS 102559, 1, r. SIO 97-59, 1, r. SIO 97-126, 1, r. *Icelinus pietschi* HUMZ 151944, 1 (paratype), r. *Icelinus quadriseriatus* SIO 60-468-55A, 8, r. SIO 60-471, 14, r. SIO 84-91, 2, cs. SIO 85-139, 5, r. USNM 23503, 2 (syntypes). *Icelinus tenuis* CAS 128110, 1 (syntype), r. SIO 66-4-55A, 2, r. SIO 83-15, 3, r. SIO 83-86, 1, r. SIO 85-58, 1, r. USNM 43086, 1 (syntype).

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