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A New Maximum Length for the Bluebanded Ronquil, *Rathbunella hypoplecta* (Zoarcoidei: Bathymasteridae)

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Abstract.—Throughout 2019, multiple large *Rathbunella* specimens were collected from recreational hook and line fishermen off San Diego County, California, USA. The individuals were larger than the previously reported maximum size for *Rathbunella* and exhibited a dark coloration known but not usually depicted for the genus. Herein, we provide morphological and molecular evidence that these specimens are Bluebanded Ronquils, *Rathbunella hypoplecta*, and we increase the maximum size of the species to 242 mm standard length. We provide descriptions of the specimens and the dark-phase coloration and demonstrate that dark and light-phase individuals are not genetically different.

The bathymasterid genus *Rathbunella* Jordan and Evermann, 1896 is a relatively common demersal zoarcoid genus comprising two species found on the northeastern Pacific coast from Marin, California to San Carlos, Baja California (Love and Passarelli 2020). Of the two species, *Rathbunella alleni* Gilbert, 1904 is distributed along the full range, but is most common in central California from depths of 2–146 m, whereas *R. hypoplecta* (Gilbert, 1890) is known from Point Conception, California to Santo Tomás, Baja California from depths of 9–136 m (Stevenson and Matarese 2005; Love and Passarelli 2020). The two species have been confused with some authors considering *R. alleni* as a synonym of *R. hypoplecta* (Eschmeyer and Herald 1983); however, Stevenson and Matarese (2005) redescribed the species and identified a suite of characters supporting its validity and distinction from *R. hypoplecta*. *Rathbunella alleni* differs in having rougher scales, lacking an accessory preopercular pore, having males with large canines and having a blue stripe through the anal fin rather than blue bands and is generally considered to be rarer than *R. hypoplecta* (Miller and Lea 1972). *Rathbunella hypoplecta* is the larger of the two species, generally reported to reach a maximum size of 216 mm total length (TL) with *R. alleni* around 161 mm standard length (SL) (Love and Passarelli 2020).

During 2019, California Department of Fish and Wildlife (CDFW) personnel collected five *Rathbunella* specimens ranging from 248–277 mm TL (unpreserved) off San Diego County, California, USA, that are larger than the previously reported maximum length for the genus. Specimens were collected on hook and line by recreational anglers and recovered by CDFW personnel sampling from fishing operations. Additional material was observed but not retained from locations throughout San Diego County, CA. Historically, there has been some confusion on the maximum size of *R. hypoplecta*. Barnhart (1936) reported a

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Table 1. Morphometrics for newly collected *Rathbunella hypoplecta* specimens and those reported by Stevenson and Matarese (2005). Cephalic measurements are reported as percentage head length, all others are percentage standard length (SL). Means are in parentheses.

	New specimens	Steven and Matarese (2005) specimens
	<i>n</i> = 5	<i>n</i> = 11
Unpreserved Total Length	248–277	-
Preserved Total Length	245–276	-
Preserved SL	209–242	116–175
Head length	20.5–22.7 (21.5)	20.4–23.7 (21.6)
Snout length	24.4–27.6 (26.3)	16.5–27.0 (22.5)
Upper jaw length	36.1–40.7 (38.8)	29.6–38.6 (33.3)
Eye diameter	18.6–20.7 (19.8)	18.9–24.9 (22.5)
Interorbital width	14.0–17.1 (15.9)	10.8–15.4 (13.3)
Body depth at dorsal-fin origin	14.4–15.6 (14.8)	13.3–15.2 (14.3)
Body depth at anus	15.2–17.6 (16.2)	15.0–17.4 (16.0)
Caudal peduncle depth	6.9–7.4 (7.1)	7.2–8.6 (7.8)
Dorsal-fin length	76.2–79.9 (79.0)	76.8–80.8 (78.5)
Anal-fin length	54.1–57.5 (55.9)	51.3–57.9 (55.0)
Pectoral-fin length	16.3–17.9 (16.8)	15.7–18.8 (17.2)
Pelvic-fin length	10.5–12.1 (11.1)	10.2–13.1 (11.6)
Predorsal length	16.4–19.0 (17.3)	18.0–20.3 (18.9)
Preanal length	40.5–41.9 (41.0)	40.3–45.5 (42.2)
Snout to anus	39.3–40.6 (39.8)	38.3–42.8 (40.3)
Snout to pectoral-fin base	20.7–22.6 (21.9)	21.1–25.1 (22.6)
Snout to pelvic-fin base	18.9–21.1 (19.7)	14.9–23.0 (19.5)

maximum length to 8 inches (203 mm). Miller and Lea (1972) report a maximum total length (TL) for the genus *Rathbunella* as “around 8.5 in.” or 216 mm. Fitch and Lavenberg (1975) report the same maximum length of 216 mm, but state this may be a different species as the largest they personally observed was 159 mm. Eschmeyer and Herald (1983) report a smaller maximum size of 160 mm, likely from Fitch and Lavenberg (1975). Love (2011) reports 161 mm as the maximum size and Kells et al. (2016) report 8.5 in., likely following Miller and Lea (1972).

Stevenson and Matarese (2005) examined UCLA W60-64, 215 mm standard length (SL), which is potentially the source for the previous reported largest specimen; however, this is not recorded as the largest specimen in their study (Stevenson and Matarese 2005: Table 1). This specimen is now LACM 51837-1 and is remeasured as 213 mm SL and 245 mm TL (W. Ludt, pers. comm. 2019). Additionally, Stevenson and Matarese (2005) report the locality in error as “100 mi off Long Beach”, as the verbatim locality in the UCLA catalog is “Los Angeles Co.: off Long Beach, Horseshoe Kelp Bed”.

Based on morphological comparison, we determined that these large specimens represent *R. hypoplecta* and herein provide morphological and molecular support for our identification. We increase the maximum size for *R. hypoplecta* and the genus *Rathbunella* to 277 mm TL (unpreserved; Fig. 1A) and report this in Love and Passarelli (2020). Additionally, four of the five specimens collected exhibited dark coloration likely matching the “Deep-water Ronquil” a potential undescribed species mentioned by Eschmeyer and Herald (1983) with a darker overall body color and bright blue bars between pairs of anal-fin rays, while one specimen had the more common light coloration with a sandy body color with a bright blue stripe through the anal fin. Stevenson and Matarese (2005) suggested that the

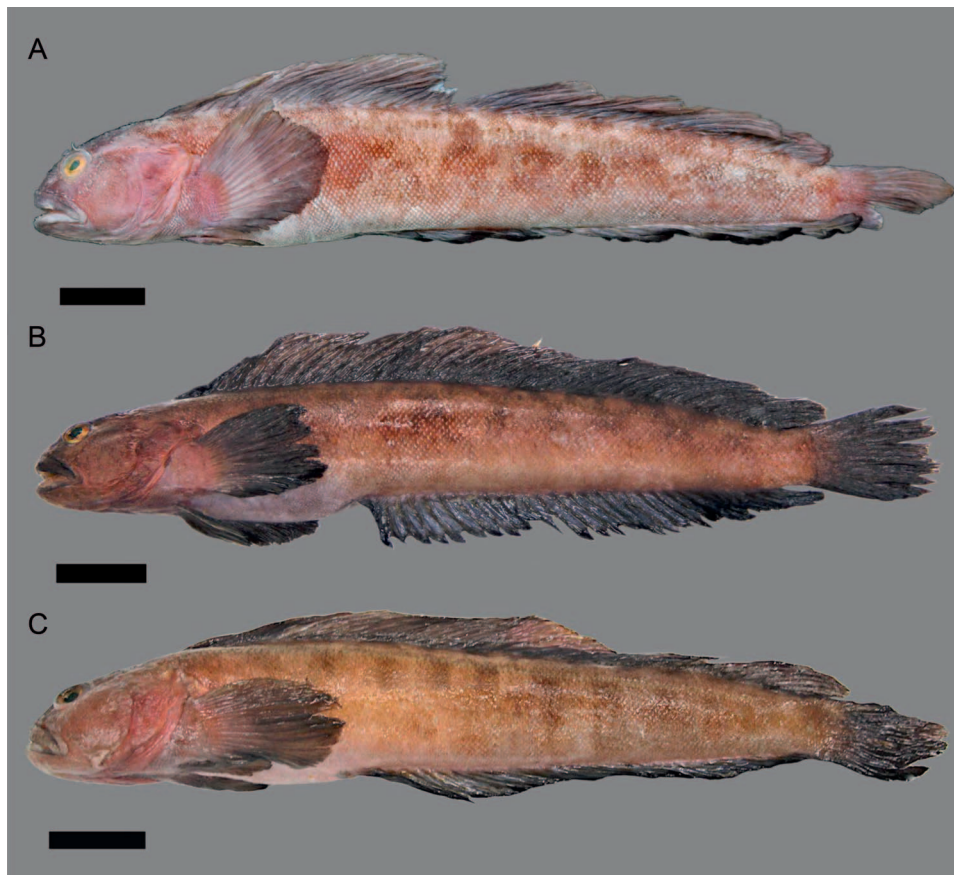


Fig. 1. Large specimens of *Rathbunella hypoplecta* collected in San Diego County, California, USA. A) SIO 19-56, 242 mm SL, largest individual, preserved; B) SIO 19-7, 217 mm SL, dark-phase coloration prior to preservation; C) SIO 19-57, 209 mm SL, light-phase coloration prior to preservation. Scale bars equal 20 mm.

“deepwater” specimens do not represent a separate species but a regular color phase for *R. hypoplecta*. We provide genetic comparisons of the dark and light color phase specimens and conclude these are indeed different color phases of the same species.

Materials and Methods

Methods of counting and measuring follow Hubbs and Lagler (1958) and Stevenson and Matarese (2005). Measurements were taken with digital calipers and are reported to the nearest 0.1 mm. Fin element and vertebral counts were taken from digital radiographs. Gill raker counts are presented as upper (epibranchial) + lower (ceratobranchial) rakers on the anterior face of the first arch; the angle raker is included in the second count. Recently collected specimens are compared with counts and measurements from Stevenson and Matarese (2005). Where counts were recorded bilaterally, both counts are given and separated from each other by a slash; the first count presented is the left count. Morphometric values for the specimens are presented in Table 1. Specimens examined and reported

are deposited in the Scripps Institution of Oceanography (SIO); institutional abbreviation follows Sabaj (2019).

To further verify species identity, mitochondrial cytochrome c oxidase subunit I (COI) sequences from the recent specimens were compared with publicly available sequences obtained from Genbank. PCR reactions were prepared to amplify an approximately 655 bp fragment of the cytochrome oxidase I (COI) mtDNA gene using an M13-tailed primer cocktail COI-3 from Ivanova et al. (2007). Reactions were prepared with a final concentration of 2 mM each dNTP, 0.25 μ M of each primer, 0.5 mg/ml Bovine Serum Albumin (BSA), and 0.5U of standard DNA polymerase. Following a denaturation at 94°C for two minutes, 35 cycles of the following cycling were performed: 94°C for 30 sec, 55°C for 30 sec, and 72°C for 1 min. A final extension at 72°C for three min terminated the cycling. Di-deoxy Sanger sequencing was performed in both directions with universal M13 primers using BigDye Terminator v3.1 chemistry following manufacturer's protocol. Sequences were generated on an ABI3730 at the Southwest Fisheries Science Center. Sequences were aligned and edited in Sequencher v4.8, and the resulting contig was compared to sequences in GenBank using the BLAST function.

Results

Rathbunella hypoplecta (Gilbert, 1890)

Fig 1A–C, Table 1

Material.—*Rathbunella hypoplecta*, five specimens, 208.5–242 mm SL, San Diego County, California, USA: SIO 19-7 (Fig. 1B), 217 mm SL, 256 mm TL, Box Canyon, 33°19' 6"N, 117°31' 48"W, 78.6 m, hook and line, recreational fisherman, 25 March 2019; SIO 19-55, 236 mm SL, 271 mm TL, Devil's Reef, ca. 3.7 km (2.3 mi) off Leucadia, 33°03' 54"N, 117°31' 48"W, 85.4 m, hook and line, recreational fisherman, 5 May 2019; SIO 19-56 (Fig. 1A), 242 mm SL, 276 mm TL, Box Canyon, 33°19' 6"N, 117°03' 54"W, 72.1 m, hook and line, recreational fisherman, 9 May 2019; SIO 19-57 (Fig. 1C), 209 mm SL, 245 mm TL, Box Canyon, Devil's Reef, ca. 3.7 km (2.3 mi) off Leucadia, 33°03' 54"N, 117°20' 30"W, 87.1 m, hook and line, recreational fisherman, 18 June 2019; SIO 19-68, 225 mm SL, 261 mm TL, 3.2 km (2 mi) off Del Mar Fairgrounds, 32°58' 36"N, 117°18' 48"W, 69.5 m, hook and line, recreational fisherman, 4 October 2019.

Diagnosis.—A species of the genus *Rathbunella* differentiated from its congener, *R. aleni*, by the following combination of characters: ctenoid scales weak with short cteni (vs. long); preopercular pores 7 + 1 (vs. 7); first dorsal-fin pterygiophore inserted between first and second neural spine; anal-fin membrane solid bright blue, sometimes in bands (vs. a single stripe).

Description.—D V–VI, 40–41 (45–46 total elements); A II, 32 (34 total elements); P 15–17/16–17; Vertebrae 14 + 36 (one with 34), total 50 (one with 48); upper procurrent caudal-fin rays 7; upper principal caudal-fin rays 7 (one with 6); lower principal caudal-fin rays 6; lower procurrent caudal-fin rays 6 (one with 7); pored lateral-line scales 83–85. Head rounded, cheek with scales; snout rounded, blunt, 24.4–27.6% HL; eye diameter 18.6–20.7% HL; interorbital width 14.0–17.1% HL; jaws subequal, lips thick; mouth slightly oblique and short, not extending past midorbit, upper jaw length 36.1–40.7% HL; teeth in upper and lower jaw small, conical, some slightly recurved, a few larger teeth, no canines; small teeth on vomer and palatine; gill rakers stout with tooth patches, 3–4 + 10–11; branchiostegal membranes joined broadly and free from isthmus. Preopercular lateralis canal with 7 pores plus a single pore from secondary caniculus off anteroventral end of

main canal; mandibular canal with 4 pores. Scales weakly ctenoid, over entire body except just anterior dorsal-fin, head anterior of cheek and on fin membranes except dorsal and caudal-fin bases. Lateral line originating posterior to opercular margin and terminating before dorsal-fin insertion.

Coloration when fresh.—Four of the five retained specimens displayed a dark color phase (Fig. 1A–B), likely the “Deepwater Ronquil” of Eschmeyer and Herald (1983), whereas one (SIO 19-57; Fig. 1C) displayed the more typical light sandy color phase reported in *Rathbunella hypoplecta* (Love 2011). The dark-phase specimens are generally dark blue-black with indistinct lighter barring along the body. When fresh, anal fin with iridescent royal blue bars nearly touching to give solid blue appearance to fin, fading to dark gray-black in death (Fig 1B), no red bars evident between anal-fin membranes as described in Eschmeyer and Herald (1983), tips of anal-fin rays black. The light color phase sandy beige to grey ground color with more distinct darker barring along the body and base of dorsal fin; dorsal fin dark grey-blue; when fresh, anal fin with bright royal blue stripe down length covering distal two-thirds of fin fading to dark grey-black in death, tips of anal-fin rays black (Fig. 1C).

Coloration in alcohol (Fig. 1A).—Dark and light-phase specimens similar in preservation. Head dark brown dorsally, cheek reddish-brown; body tan in ground with dark brown chain extending along midbody to caudal peduncle; 10–12 indistinct dark brown blotches on dorsal surface, extending into dorsal-fin element bases, blotches 2–3 elements long. Dorsal fin dark gray becoming brown distally; anal fin light gray, rays light brown, distal tips of anal-fin rays distinctly black; pectoral fin light gray becoming dark distally; pelvic fins blue-black; caudal fin brown with thin dark margin.

Habitat.—These specimens were collected by recreational fishermen bottom-fishing for rockfishes (*Sebastes*) on deep rocky reef habitats 3.2–4.8 km (2–3 mi) offshore in 69.5–87.1 m of water.

Discussion

We resolved 649–652 bp of the COI gene for two specimens: SIO 19-7 and SIO 19-57 (GenBank Accession numbers: OP480876 and OP480877, respectively). BLAST results recover 99.85–100.00% and 99.69–99.85%, respectively, matches of these sequences to vouchers identified as *Rathbunella hypoplecta* on Genbank: EU400166 and GU440493, which correspond to voucher SIO 03-60, and KF930350, corresponding to tissue KUT 494 and voucher KU 28137. The next closest sequence is 88.89–88.99% similar (FJ165465) and identified as *Xiphister mucosus* in Stichaeidae. Interestingly, this is more similar than sequences from other bathymasterid genera. Unfortunately, no public COI sequence exists for *R. alleni* for intrageneric comparison. We also found that the COI sequences were 99.85% identical between the light-phase (SIO 19-57; Fig. 1C) and dark-phase specimens (SIO 19-7; Fig. 1B) providing additional evidence that the dark-phase specimens do not represent a distinct species.

Morphometrics and meristics are reported in Table 1. All five specimens fall within the meristic and morphometric ranges reported for *R. hypoplecta* by Stevenson and Matarese (2005) except some morphometrics just outside the range (Table 1). In the new specimens, we found a slightly longer snout length (27.6 vs. 27.0% HL) and upper jaw length (40.7 vs. 38.6% HL), a slightly smaller eye diameter (18.6 vs. 18.9% HL), a wider interorbital width (17.1 vs. 15.4% HL). In body measurements, we identified a slightly deeper body at dorsal-fin origin (15.6 vs. 15.2% SL), a slightly shorter dorsal-fin base (76.2 vs. 76.8%

SL), a slightly narrower caudal peduncle depth (6.9 vs. 7.2% SL) and a shorter snout to pectoral-fin base (20.7 vs. 21.1% SL). The new specimens differ from *R. alleni* in having weakly ctenoid body scales (vs. strong), an accessory preopercular pore and the first dorsal-fin pterygiophore inserted between the first and second neural spine (vs. anterior or dorsal to the first neural spine).

Conclusions

This new material increases the known maximum size for the genus *Rathbunella* from 216 mm SL to 242 mm SL (276 mm TL) in preservation and 277 mm TL unpreserved. Additionally, we used genetic comparisons of this material to determine that the potentially undescribed “Deepwater Ronquil” of Eschmeyer and Herald (1983) is in fact just the dark-phase coloration of *Rathbunella hypoplecta*.

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