A new species of deep-sea grunt, *Rhonciscus pauco* (Lutjaniformes: Haemulidae), from Puerto Rico

Jose Tavera [Corresp., 1] , Michelle Schärer [2] , Arturo Acero P [3]

1 Departamento de Biología, Universidad del Valle, Cali, Colombia

2 HJR Reefscaping, Boquerón, Puerto Rico

3 Instituto para el Estudio de las Ciencias del Mar, CECIMAR, Universidad Nacional de Colombia, Santa Marta, Colombia

Corresponding Author: Jose Tavera
Email address: jose.tavera@correounivalle.edu.co

A fourth species of the genus *Rhonciscus* (Lutjaniformes: Haemulidae) is described from various specimens collected by small-scale fishers from the insular upper slope of western Puerto Rico. The new species was molecularly recovered as sister to the eastern Pacific *R. branickii*, to which it bears many morphological similarities. It is distinguished from other *Rhonciscus* species by the number of scale rows between the dorsal fin and the lateral line (7), larger and thus fewer scales along the lateral line (48–50), large eyes (9.4–10.4 times in SL), longer caudal peduncle (15.2–20% of SL), larger sized penultimate (14.7–19.1 % in SL) and last (7.4–9.5 % in SL) dorsal fin spine which translates to a less deeply notched dorsal fin, and its opalescent silver with golden specks live coloration. This grunt, only now recognized by ichthyologists, but well known by local fishers that target snappers and groupers between 200 and 500 m in depth, occurs in far deeper waters than any western Atlantic grunt.

A new species of deep-sea grunt, *Rhonciscus pauco*
(Lutjaniformes: Haemulidae), from Puerto Rico

6   Jose Tavera[1], Michelle Schärer [2], Arturo Acero P[3]

8   [1] Departamento de Biología, Universidad del Valle, Cali, Colombia.
9   [2] HJR Reefscaping, P.O. Box 1442, Boquerón, PR 00622
10   [3] Instituto para el Estudio de las Ciencias del Mar, CECIMAR, Universidad Nacional de
11   Colombia sede Caribe, El Rodadero, Santa Marta, Colombia

13   Corresponding Author:
14   Jose Tavera
15   Calle 13 # 100-00 office 4063, 760032, Cali, Colombia.
16   Email address: jose.tavera@correounivalle.edu.co

Abstract

20   A fourth species of the genus *Rhonciscus* (Lutjaniformes: Haemulidae) is described from various
21   specimens collected by small-scale fishers from the insular upper slope of western Puerto Rico.
22   The new species was molecularly recovered as sister to the eastern Pacific *R. branickii*, to which
23   it bears many morphological similarities. It is distinguished from other *Rhonciscus* species by the
24   number of scale rows between the dorsal fin and the lateral line (7), larger and thus fewer scales
25   along the lateral line (48–50), large eyes (9.4–10.4 times in SL), longer caudal peduncle (15.2–
26   20% of SL), larger sized penultimate (14.7–19.1 % in SL) and last (7.4–9.5 % in SL) dorsal fin
27   spine which translates to a less deeply notched dorsal fin, and its opalescent silver with golden
28   specks live coloration. This grunt, only now recognized by ichthyologists, but well known by
29   local fishers that target snappers and groupers between 200 and 500 m in depth, occurs in far
30   deeper waters than any western Atlantic grunt.

31

Introduction

33   The family Haemulidae (together with the snappers, Lutjanidae) is one of the two clades grouped
34   in the order Lutjaniformes Bleeker (*Betancur-R. et al., 2017*), a tropical lineage that includes
35   commercially important shore fishes. The number of recognized grunt species in two recent
36   checklists varies between 134 and 136, grouped into two subfamilies (*Nelson, Grande & Wilson,*
37   *2016; Fricke, Eschmeyer & Fong, 2021*). Approximately 62 species of the subfamily
38   Haemulinae inhabit New World waters, with the subfamily Plectorhinchinae restricted to African

39   shores and to the Indian and western Pacific Oceans. The most recent revision by *Tavera, Acero*
40   *& Wainwright (2018)* recognized 15 New World haemulid genera.
41   The genus *Pomadasys* Lacepède, 1802 (type species *Sciaena argentea* Forsskål, 1775) included
42   several loosely related species from tropical and temperate seas. Species in this polyphyletic
43   assemblage exhibit color and morphological convergence which has resulted in several of them
44   being uncritically assigned to *Pomadasys* (*Tavera et al., 2012*). This genus was split into at least
45   five lineages widely spread throughout the family phylogeny, one of which became the genus
46   *Rhonciscus* (*Tavera, Acero & Wainwright, 2018*). Further revision is needed to clarify the
47   systematics and taxonomy of the *Pomadasys (sensu lato)* polyphyletic assemblage.
48   As for the New World species, Jordan & Evermann (1896) described two genera, *Rhencus* (type
49   species *Pristipoma panamense* Steindachner, 1876) and *Rhonciscus* (type species *Pristipoma*
50   *crocro* Cuvier 1830). These two genera were considered junior synonyms of *Pomadasys* until
51   *Tavera, Acero & Wainwright (2018)* resurrected them. The genus *Rhonciscus* comprises rather
52   elongate species found in marine and brackish waters, but also in rivers and freshwater streams.
53   It presently includes three species, *R. crocro*, distributed from southern Florida (USA) to at least
54   Rio de Janeiro (Brazil), in the western Atlantic (WA), and two Eastern Pacific (EP) species: *R.*
55   *branickii* (Steindachner, 1879) from southern Baja California (Mexico) to Paita (Perú), and *R.*
56   *bayanus* (Jordan & Evermann, 1898) from Mazatlán (Mexico) to Rio Tumbes, Perú. Both *R.*
57   *crocro* and *R. bayanus* can be found in freshwater rivers or streams flowing into the ocean. A
58   fourth, unrecognized *Rhonciscus* species is described based on 14 specimens captured by fishers
59   off the west coast of Puerto Rico, WA.
60
61   ## Materials & Methods
62   **Data collection and analysis**
63   In May 2017 two specimens were collected by the same fisherman from the insular upper slope
64   (280–360 m) off the west coast of Puerto Rico (Tres Cerros, Rincón; 18°20'39'' N; 67°17'00''
65   W). Both grunts were caught incidentally on hooks at the end of buoyed vertical line gear,
66   locally known as *cala con boya*, used by the deep-water, small-scale artisanal fleet. The
67   specimens were deposited at the ichthyology collections of the Sam Noble Museum of Natural
68   History of the University of Oklahoma (Norman, OK, USA) and the Florida Museum of Natural
69   History of the University of Florida (Gainesville, FL, USA). Institutional abbreviations follow
70   Sabaj (2019). Twelve additional specimens were caught in August 2019 by another fisher with
71   Antillean fish traps deployed between 200 and 250 m in depth, approximately 5 km west of the
72   mouth of the Rio Grande de Añasco river (Figure 1). Counts and measurements follow *Bussing*
73   *(1993)* and *Rocha & Rosa (1999)*. Measurements were made with calipers and recorded to the
74   nearest 0.1 mm and are presented also as percentage of standard length (SL) in Table 1.
75   Information on other *Rhonciscus* species is included in Table 2 for comparison.
76   Tissue samples were taken from the pectoral fin of the holotype and paratype specimens and
77   stored in 96% EtOH. Molecular information is provided as additional evidence of the
78   evolutionary distinction of this new taxon. DNA extraction and COI PCR amplification details

79   can be seen in (*Tavera et al., 2012*). Sequencing was performed in one direction on an ABI 3100
80   automated sequencer (Applied Biosystems, Foster City, CA). The sequences available in
81   GenBank for all species of the genus *Rhonciscus* plus *Haemulon sciurus* (outgroup) were used
82   for molecular comparisons and a preliminary phylogenetic reconstruction. GenBank accession
83   numbers are as follows: *R. bayanus* MF446583; *R. branickii* JQ741307, JQ741308, MF956957,
84   HQ676794; *R. crocro* JQ741309; and *H. sciurus* EU697541. COI sequences were cleaned and
85   trimmed with Geneious 9.1.8 (*Kearse et al., 2012*) and Muscle (*Edgar, 2004*) was used as the
86   alignment algorithm with default parameters. Phylogenetic relationships were assessed using
87   Maximum Likelihood (ML) method. Five independent runs with a random starting tree,
88   GTRGamma model of nucleotide substitution, 1000 Bootstrap analysis and search for the best
89   scoring ML tree were performed with RAxML GUI 0.93 (*Silvestro & Michalak, 2012;*
90   *Stamatakis, 2014*). Corrected intraspecific and interspecific genetic distances were calculated for
91   all available sequences.
92
93   **Ethical approval**
94   "All applicable international, national, and/or institutional guidelines for the care and use of
95   animals were strictly followed. All animal sample collection protocols complied with the current
96   laws of Puerto Rico." Specimens were collected under the authorization of the Puerto Rico
97   Department of Natural and Environmental Resources research permit # 2017-IC-031 granted to
98   M. Schärer.
99
100   *"The electronic version of this article in Portable Document Format (PDF) will represent a*
101   *published work according to the International Commission on Zoological Nomenclature (ICZN),*
102   *and hence the new names contained in the electronic version are effectively published under that*
103   *Code from the electronic edition alone. This published work and the nomenclatural acts it*
104   *contains have been registered in ZooBank, the online registration system for the ICZN. The*
105   *ZooBank LSIDs (Life Science Identifiers) can be resolved and the associated information viewed*
106   *through any standard web browser by appending the LSID to the prefix http://zoobank.org/. The*
107   *LSID for this publication is: [urn:lsid:zoobank.org:act:6BF57CB4-60DE-4FCE-BF33-*
108   *B02DF8E7FE05]. The online version of this work is archived and available from the following*
109   *digital repositories: PeerJ, PubMed Central SCIE and CLOCKSS."*
110
111   # Results
112   ***Rhonciscus pauco* sp. nov.**
113   urn:lsid:zoobank.org:act:6BF57CB4-60DE-4FCE-BF33-B02DF8E7FE05
114   Opalescent Grunt
115   (Spanish name: *Ronco opalescente*)
116   Figures 2 to 5
117
118   **Holotype**. OMNH 86864, 266 mm SL. Tres Cerros, Rincón, Puerto Rico, 18.34433 °N;

119 67.28343 °W. Collected with hook and line at 280 m depth. May 1, 2017.
120
121 **Paratype**. UF 242681, 305 mm SL. Tres Cerros, Rincón, Puerto Rico,
122 18.34433 °N; 67.28343 °W. Collected with hook and line at 360 m depth. May 5, 2017.
123
124 **Diagnosis**. A species of the genus *Rhonciscus* with XIII, 12 (total 25) dorsal-fin rays; anal-fin
125 rays III, 7; pectoral-fin rays 15-16, 17(1); rather elongate body, maximum depth 32–37.4% SL;
126 convex predorsal profile; eye large, its diameter 9.4 to 10.4 % SL; snout subequal to eye, its
127 length 7.6 to 11.5% SL; very coarse serrations on angle of preopercular margin; pectoral fin long
128 (28–32.5% SL) extending beyond the tip of pelvic fin, barely reaching anus; head length 30–37.3
129 % SL; longest dorsal-fin spine (fifth) (12.1–19.1 % SL); relatively long and much thicker second
130 anal-fin spine (16.4–21.8 % SL), long caudal peduncle (15.2–20% of SL), and a large size of the
131 penultimate (14.7–19.1 % in SL) and last dorsal-fin (7.4–9.5 % in SL) spines which translate to a
132 less deeply notched dorsal fin, eye diameter 0.5 to 0.6 times length of anal fin spine; maxilla
133 reaching anterior border of pupil; seven scale rows between dorsal fin and lateral line; 48 to 50
134 lateral– line scales.
135
136 **Description**. Measurements are presented as percentage of SL in Table 1. Body elongate, with
137 greatest depth at vertical through origin of pelvic fins (2.7 to 3.1 times in SL); predorsal profile is
138 slightly convex with a tenuous depression above the eye; head length 2.7 to 3.3 in SL; eye
139 diameter 9.6–10.6 times in SL and 3.1–3.7 times in head length (HL); interorbital distance 2.1–
140 4.2 in HL; snout slightly convex, length 3.3–4.1 in HL; mouth terminal and moderately oblique;
141 maxilla reaches to or slightly beyond anterior margin of pupil, 3 to 3.8 in HL: maxilla covered by
142 suborbital when mouth is closed; upper and lower jaws with small conical teeth; conspicuously
143 serrated preopercle (Figure 4A); mouth strongly protrusible; one to two rear chin pores, well-
144 separated (Figure 4B); total number of first arch gill-rakers 16, upper limb 5; lower limb 11;
145 anterior narine 12 to 18 in HL: posterior narine 18.8 to 33 in HL; pectoral-fin length 1.6 to 2.2 in
146 HL; predorsal-fin length 2.8 to 3.3 in SL; prepectoral-fin length 2.6 to 3.2 in SL; prepelvic-fin
147 length 2.5 to 2.8 in SL; preanal-fin length 1.4 to 1.5 in SL; fifth dorsal-fin spine 3.3 to 6.5 in HL;
148 second anal-fin spine 4.6 to 6.1 in SL; depth of caudal peduncle 8.8–10.8 times in SL; length of
149 caudal peduncle 5–6.6 in SL; length of penultimate dorsal spine 5.3–6.8 times in SL and last
150 dorsal spine 10.5–13.5 times in SL; lateral-line scales 48–50; scale rows between lateral line and
151 dorsal fin 7; no scales present on anal or dorsal fin membranes (Figure 4c); pelvic fin with
152 elongate filament on first ray (Figure 4D).
153
154 **Color in life**. Body opalescent silver with golden specks; some of the spines reflect iridescent
155 blue in direct light. Opaque to translucent dorsal, anal, fins and dusky caudal fin (Figure 3). Two
156 small dark spots present on the trailing edge of the lower lobe of the caudal fin. A black marking
157 across the marginal edge of the spine dorsal fin membrane (Figure 4C). Brown to blackish spots
158 over the attachment of some scales, especially towards the back of the trunk (Figure 4C). Figure

159 5 is an underwater photograph taken at 218 meters depth in western Puerto Rico where two
160 specimens of the new species, including their live coloration, can be seen.
161
162 **Distribution**. *Rhonciscus pauco* is found on the deep shelf and upper slope of the western coast
163 of the northeastern Caribbean island of Puerto Rico. We are uncertain of the species' exact
164 range, but fishers report capturing them exclusively in fine sediment habitats distributed between
165 the municipalities of Rincón and Mayagüez, off western Puerto Rico (Figure 1). No additional
166 information is currently available.
167
168 **Habitat.** Collection depths range from 200–360 m in fine unconsolidated sediment or mud
169 habitats (Figure 5).
170
171 **Etymology**. The name *pauco* comes from the fisher's nickname Paúco, Edwin Font, who already
172 knew of this fish locally called *burro* or *ronco* (grunt). Mr. Font was the first to report and
173 provided specimens to MS, although it is recognized by various fishers as a component of the
174 deep-water catch in western Puerto Rico.
175
176 **Comparisons**. *Rhonciscus pauco* is morphologically very close to its sister EP species *R.*
177 *branickii* with which many measurements and counts overlaps. However, it can be distinguished
178 from the three species of the genus, the WA *R. crocro*, and both EP species, *R. bayanus* and *R.*
179 *branickii*, by the seven scale rows between the dorsal fin and the lateral line; *R. branickii* has five
180 according to (*McKay & Schneider, 1995*) or six (our data), while *R. bayanus* and *R. crocro* have
181 eight scale rows above the lateral line. It differs clearly from its WA congener by having 48–50
182 lateral–line scales (vs 66–72 in *R. crocro*) and 11 short lower gill rakers (vs 7–9 in *R. crocro*).
183 Our scale counts for *R. crocro* differ from those presented by *Lindeman & Toxey* (2002), who
184 report five and six rows between the dorsal fin and the lateral line and 53–55 lateral–line scales
185 as opposed to eight rows and 66–72 lateral–line scales. In both cases the new species can be
186 unambiguously distinguished. The new species has a coarse serrated preopercle, with 2–3 large
187 spines at the corner and 20–21 relatively small spines on the vertical border; the preopercle is
188 weakly or not serrated in *R. bayanus*. *Rhonciscus pauco* has much larger eyes (9.4–10.4% of SL)
189 compared to 7.2–8.1% in *R. bayanus*, 7.1–8.9% in *R. branickii*, and 6.7–7.8% in *R. crocro*.
190 *Bussing (1993)* reported that the eye diameter of *R. branickii* ranged between 2.9 and 3.8 times
191 in head length while *McKay & Schneider* (1995) published 3.1–3.4; *Meek & Hildebrand (1925)*
192 reported larger eyes (2.6 to 3.2) based on specimens smaller than 15 cm. Our data for *R. pauco*
193 (Table 2: 3.08-3.66) overlap such information; however, the lack of size data in *Bussing (1993)*
194 and *McKay & Schneider (1995)* precludes a more detailed comparison. With our data, that are
195 size comparable, *R. pauco* can be clearly separated from *R. branickii*.
196 Furthermore, *R. pauco* has a longer caudal peduncle (15.2–20 % of SL) compared to 11.9–16.3
197 % in *R. bayanus*, 14.0–15.5 % in *R. branickii* and 11.1–14.9 % in *R. crocro*. The larger size of
198 the penultimate (14.7–19.1 % in SL) and last dorsal-fin (7.4–9.5 % in SL) spines translate to a

199 less deeply notched dorsal fin in *R. pauco*. Additionally, similarly sized *R. pauco* can be
200 distinguished from its EP sister species *R. branickii* by having longer snouts and longer maxilla
201 (3.24–4.09 and 3–3.77 in HL in *R. pauco* vs 4.41–5.27 and 3.86–4.69 in *R. branickii*). A detailed
202 comparison of morphometric proportions is included in Table 2. Life coloration is another
203 feature separating the new Puerto Rican species from *R. branickii*; *R. pauco* is light silver to
204 golden in color, with opalescence, while its sister species EP is dull dark brown, without bright
205 colors or opalescence, and with a darker marking along the entire opercular margin.
206
207 **Discussion**
208 The unexpected discovery of a new species of grunt at this depth on the Puerto Rican slope is an
209 issue of biogeographic interest in the Caribbean. For snapper and grouper fishermen in deep
210 waters off the west coast of Puerto Rico, this species is well known, despite having gone
211 unnoticed and not being formally described until now. *R. pauco* is captured incidentally with the
212 snappers *Etelis oculatus* and *Pristipomoides macropthalmus* but discarded due to its low market
213 value. It is commonly referred to as *burro*, *ronco* or *viejo*, the latter name also used by some
214 fishers to identify the congener grunt, *R. crocro*, that is not rare in shallow, brackish waters of
215 large volume rivers throughout Puerto Rico (*Engman et al., 2019*).
216 Other than a new record of a single specimen of *R. branickii* (USNM 422650) collected in the
217 eastern Pacific off Panama at 430 to 500m, only six Caribbean grunt species occur at one
218 hundred meters depth or below, with 120 m as the maximum known depth (*Robertson et al.,*
219 *2019*). The new species is found inhabiting waters deeper than 200 m where there is extremely
220 low light penetration.
221 What is even more surprising is that two of the four *Rhonciscus* species are known to occupy
222 very shallow, often brackish or freshwater environments. The type species of the genus, *R.*
223 *crocro*, inhabits waters shallower than 20 m and is frequently found in the lower parts of short,
224 rapid rivers or slow creeks in eastern Florida (*Lindeman pers. com. 2022*) as well as in 1 m or
225 less in depth in the Rio Grande de Añasco river, where it flows into the ocean (MS pers. obs.).
226 The two EP *Rhonciscus* species are also reported in shallow water, especially *R. bayanus*, known
227 at depths less than 10 m (*Robertson & Allen, 2015*). *Rhonciscus branickii*, on the other hand, has
228 been reported once at a depth of 500 m; this species is very similar to *R. pauco* and is considered
229 its sister species. However, *R. branickii* is an EP species. Besides this deep record no other grunt
230 of this genus been reported from depths at which *R. pauco* has been caught. The evolutionary
231 processes that led to the existence of this deep–water grunt in the northeastern Caribbean, far
232 away from the continental shores of Central and South America with its WA congener known
233 primarily from coastal rivers, are of utmost biogeographical interest.
234 Finally, the phylogenetic tree (Figure 6), which includes all valid species of the genus, resulted in
235 a topology with *R. pauco* placed as a sister species to the EP *R. branickii*, with a sequence
236 divergence of 1.7–2.3%, establishing a new trans-isthmian sister-pair within the family
237 Haemulidae. Remaining COI genetic distances of *R. pauco* are 13.6–14% with *R. bayanus* and
238 12.7–13.2% with *R. crocro*. The distance between these geminate species across the isthmus of

239   Panama is relatively small (1.7–2.3%) yet consistent with values of two other trans-isthmian
240   pairs in the genus *Anisotremus* (2.0–2.4%) (*Tavera et al., 2012*). The COI genetic distances in
241   seven trans-isthmian sister pairs of Haemulidae range from 2.0% between *Anisotremus*
242   *surinamensis* (WA) and *A. interruptus* (EP) to 18% between *Genyatremus cavifrons* (WA) and
243   *G. pacifici* (EP). Interspecific distance values near 2% divergence have been reported in both
244   freshwater and marine fishes (*Ward et al., 2005; Shen et al., 2016*). In any case, interspecific
245   genetic distances between *R. pauco* and *R. branickii* are larger than the intraspecific genetic
246   distances (*R. pauco*: 0% and *R. branickii*: 0.2–0.8%).
247   It is common to find variable intra- and interspecific distances and defining a threshold becomes
248   difficult as the mutation rate varies considerably among species. A small distance may indicate
249   very strong differentiation between sister species that have diverged comparatively recently,
250   while COI will not detect "substantial" differentiation. Perhaps this marker in this group evolves
251   quite slowly despite the irrefutable fact that the new species is reproductively isolated, adapted to
252   different environmental conditions, yet resembling its EP sibling species. The magnitude of
253   variability in the mtDNA divergence between all pairs of trans-isthmic grunts is consistent with
254   an asynchronous divergence, as described for other taxa (*Knowlton & Weigt, 1998; Leigh,*
255   *O´Dea & Vermeij, 2014; O´Dea et al., 2016*).
256
257   **Additional material examined:**
258   ***Rhonciscus pauco:*** 240 mm SL, mouth of the Rio Grande de Añasco, Puerto Rico 2021. 250
259   mm SL, mouth of the Rio Grande de Añasco, Puerto Rico 2021.195 mm SL, Puerto Rico 2021.
260   198 mm SL, mouth of the Rio Grande de Añasco, Puerto Rico 2021. 205 mm SL, mouth of the
261   Rio Grande de Añasco. Puerto Rico 2021. 237 mm SL, mouth of the Rio Grande de Añasco,
262   Puerto Rico 2021. 205 mm SL, mouth of the Rio Grande de Añasco, Puerto Rico 2021. 199 mm
263   SL, mouth of the Rio Grande de Añasco, Puerto Rico 2021. 210 mm SL, mouth of the Rio
264   Grande de Añasco, Puerto Rico 2021. 215 mm SL, mouth of the Rio Grande de Añasco, Puerto
265   Rico 2021. 206 mm SL, mouth of the Rio Grande de Añasco, Puerto Rico 2021. 199 mm SL,
266   mouth of the Rio Grande de Añasco, Puerto Rico 2021.
267   ***Rhonciscus bayanus:*** CIRUV 186.2 mm SL. Gorgona Island, Colombia, 2018.
268   Photograph 185.6 mm SL. Chiapas, Mexico, 2011. ***Rhonciscus branickii:*** CICIMAR
269   159.2 mm SL. Piura, Peru, 2009. CICIMAR 234.4 mm SL. Baja California, Mexico, 2010.
270   CICIMAR 191.2 mm SL. Baja California, Mexico, 2010. CICIMAR 193.7 mm SL.
271   Baja California, Mexico, 2010. CIRUV 170.4 mm SL. Gorgona Island, Colombia, 2018.
272   ***Rhonciscus crocro***: Holotype MNHN 733 185.7 SL, Martinique Island, West Indies, 1830.
273   CICIMAR 220.4 mm SL. Buritaca, Colombia, 2010. INVEMAR 245.5 mm SL.
274   Ciénaga Grande, Colombia, 2010. INVEMAR 176.7 mm SL. Buritaca, Colombia, 2010.
275   Photograph 332.1 mm SL. Rio Grande de Añasco, Puerto Rico, 2018.
276
277   **Conclusions**

278 Based on morphology, geographic distribution, and molecular analyses, this study describes as a
279 new species the first known western Atlantic deep-sea-dwelling grunt collected from the upper
280 Puerto Rican slope. This finding is an issue of evolutionary and biogeographic interest for the
281 family, which is composed of shallow water species, commonly found on upper shelf waters up
282 to 100 m in depth with a strong preference for shallow environments of less than 40 m.
283 Moreover, the fact that some species of the genus *Rhonciscus* are frequently found in estuaries,
284 rivers and freshwater streams makes this finding more remarkable.
285
286

Acknowledgements

288 We are indebted with E. Font for the initial collection of specimens and for sharing the
289 traditional ecological knowledge of this fish and its habits, as well as H. Vargas that provided
290 additional specimens that led to the scientific recognition of this new species of grunt. The
291 authors are extremely appreciative of A. Veglia and N. Schizas of the Department of Marine
292 Sciences of the University of Puerto Rico for initial advice. K. Overly and T. Battista were
293 instrumental in obtaining the photo from a NOAA NCCOS 2022 ROV dive off western Puerto
294 Rico. Puerto Rico Department of Natural and Environmental Resources collection permit #
295 2017-IC-031. Contribution No. 19 of the Instituto de Ciencias del Mar y Limnología de la
296 Universidad del Valle, INCIMAR. Contribution No. xxxx of the Instituto de Estudio de las
297 Ciencias del Mar, CECIMAR.
298
299

References

301 Betancur-R R, Wiley EO, Arratia G, Acero A, Bailly N, Miya M, Lecointre G, Ortí G. 2017.
302 Phylogenetic classification of bony fishes. *BMC Evolutionary Biology* 17: 162. Doi 10.1
303 186/s12862-017-0958-3
304
305 Bussing WA. 1993. *Pomadasys empherus*, a new species of haemulid fish from the tropical
306 eastern Pacific. *Revista de Biología Tropical*, 41 (2) 245–251.
307
308 Edgar RC. 2004. MUSCLE: a multiple sequence alignment method with reduced time and space
309 complexity. *BMC Bioinformatics*, 5, 113.
310
311 Engman AC, Kwak TJ, Fischer JR, Lilyestrom CG. 2019. Fish assemblages and fisheries
312 resources in Puerto Rico's riverine estuaries. *Marine and Coastal Fisheries* 11:189–201. doi:
313 10.1002/mcf2.10072
314
315 Fricke R, Eschmeyer WN, Fong JD. 2021. Species by family/subfamily.
316 http://researcharchive.calacademy.org/research/ichthyology/catalog/SpeciesByFamily.a sp.
317 (accessed on 10 February 2021).

318

319 Ivanova NV, Zemlak TS, Hanner RH, Hebert PDN. 2007. Universal primer cocktails for fish
320 DNA barcoding. *Molecular Ecology Notes*, 7, 544–548.

321

322 Jordan DS, Evermann BW. 1896. *The fishes of North and Middle America: a descriptive*
323 *catalogue of the species of fish-like vertebrates found in the waters of North America, north of*
324 *the Isthmus of Panama.* US Government Printing Office. Vol. 47.

325

326 Kearse M, Moir R, Wilson A, Stones-Havas S, Cheung M, Sturrock, Buxton S, Cooper A,
327 Markowitz S, Duran C, Thierer T, Ashton B, Meintjes P, Drummond A. 2012. Geneious Basic:
328 An integrated and extendable desktop software platform for the organization and analysis of
329 sequence data. *Bioinformatics*, 28, 1647–1649.

330

331 Knowlton N, Weigt LA. 1998. New dates and new rates for divergence across the Isthmus of
332 Panama. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, 265 (1412),
333 2257–2263.

334

335 Leigh EG, O'Dea A, Vermeij GJ. 2014. Historical biogeography of the Isthmus of Panama.
336 *Biological Reviews*, *89* (1), 148–172.

337

338 Lindeman KC, Toxey CS. 2002. Haemulidae. In: Carpenter KE, ed. *FAO species identification*
339 *guide for fishery purposes. The living marine resources of the Western Central Atlantic.* Rome:
340 Food and Agriculture Organization of the United Nations, 1522–1550.

341

342 McKay RJ, Schneider M. 1995. Haemulidae. Burros, corocoros, chulas, gallinazos, roncos. In:
343 Fischer W, Krupp F, Schneider W, Sommer C, Carpenter KE, Niem V, eds. *Guía FAO para*
344 *identificación de especies para los fines de la pesca. Pacifico Centro–Oriental.* Roma: Food and
345 Agriculture Organization of the United Nations, 1136–1173.

346

347 Meek, SE, Hildebrand SF. 1925. The marine fishes of Panama. Part II. Field Museum of Natural
348 History Publications Zoological Series 15(publ. 226): i–xix, 331–707.

349

350 Nelson J, Grande T, Wilson M. 2016. *Fishes of the World.* Hoboken, NJ: John Wiley & Sons.

351

352 O'Dea A, Lessios HA, Coates AG, Eytan RI, Restrepo-Moreno SA, Cione AL, ... Jackson JB.
353 2016. Formation of the Isthmus of Panama. *Science Advances*, 2(8), e1600883.

354

355 Robertson DR, Allen GR. 2015. Shorefishes of the Tropical Eastern Pacific: online information
356 system. Version 2.0 Smithsonian Tropical Research Institute, Balboa, Panamá. Available at:
357 https://biogeodb.stri.si.edu/sftep/en/pages (accessed on February 10 2021).

358

359 Robertson DR, Peña EA, Posada JM, Claro R. 2019. Shorefishes of the Greater Caribbean:
360 online information system. Version 2.0 Smithsonian Tropical Research Institute, Balboa,
361 Panamá. Available at: https://biogeodb.stri.si.edu/caribbean/en/pages (accessed on February 10
362 2021).

363

364 Rocha LA, Rosa IL. 1999. New species of *Haemulon* (Teleostei: Haemulidae) from the
365 northeastern Brazilian coast. *Copeia*, 447–452.

366

367 Sabaj MH. 2019. Standard symbolic codes for institutional resource collections in herpetology
368 and ichthyology: an online reference. Version 7.1. 21 March 2019. American Society of
369 Ichthyologists and Herpetologists, Washington, D.C. Electronically accessible. Available from:
370 https://www.asih.org/

371

372 Shen Y, Guan L, Wang D, Gan X. 2016. DNA barcoding and evaluation of genetic diversity in
373 Cyprinidae fish in the midstream of the Yangtze River. *Ecology and evolution*, *6* (9), 2702–2713.

374

375 Silvestro D, Michalak I. 2012. RaxmlGUI: A graphical front-end for RAxML. *Organisms*
376 *Diversity and Evolution*, 12, 335–337.

377

378 Stamatakis A. 2014. RAxML version 8: A tool for phylogenetic analysis and postanalysis of
379 large phylogenies. *Bioinformatics*, 30, 1312–1313.

380

381 Tavera J, Acero A, Balart EF, Bernardi G. 2012. Molecular phylogeny of grunts (Teleostei,
382 Haemulidae), with an emphasis on the ecology, evolution, and speciation history of New World
383 species. *BMC Evolutionary Biology*, 12 (1), 1-16.

384

385 Tavera J, Acero A, Wainwright PC. 2018. Multilocus phylogeny, divergence times, and a major
386 role for the benthic-to-pelagic axis in the diversification of grunts (Haemulidae). *Molecular*
387 *Phylogenetics and Evolution*, 121. 212–223.

388

389 Ward RD, Zemlak TS, Innes BH, Last PR, Hebert PD. 2005. DNA barcoding Australia's fish
390 species. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 360 (1462),
391 1847–1857.

392

Meristic and morphometric characters of the holotype, paratype, and twelve additional specimens of the new species *Rhonciscus pauco.*

Meristics	Holotype	Paratype	1	2	3	4	5	6	7	8	9	10	11	12
Dorsal fin	XIII, 12	XIII, 12	XIII, 12	XIII, 12	XIII, 12	XIII, 12	XIII, 12	XIII, 12	XIII, 12	XIII, 12	XIII, 12	XIII, 12	XIII, 12	XIII, 12
Anal fin	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7
Pectoral fin rays	16	17	15	16	15	15	16	16	16	16	16	15	15	16
First arch gill-rakers (upper + lower limb)	5+11	5+11	5+11	5+11	5+11	5+11	5+11	5+11	5+11	5+11	5+11	5+11	5+11	5+11
Lateral line scales	50	50	50	50	50	50	50	50	49	48	48	50	50	50
Morphometrics (mm)														
Total length	266	305	280	283	237	234	240	275	240	233	244	250	243	235
standard length	229	244	240	250	195	198	205	237	205	199	210	215	206	199
Head length	78.8	90.9	72	82.7	60.8	63.7	63.3	77.7	72.5	68.3	68	69.9	69.3	61.8
Eye diameter	23.5	24.8	23	24.3	19.6	20	20.5	22.9	20.6	20.1	19.8	21	21.4	19.2
Snout length	22.3	28	21	20.3	15.1	15.6	18.3	22	18.6	19.5	18.8	17.2	17.9	15.1
Maxillae length	21	24.8	24	23.6	20.2	18.3	19.8	22.3	20	21.4	18	19.8	21.4	17.4
Interorbital length	18.8	22.1	34	28.5	21.3	21.8	21	26.7	19.5	16.3	20	19.5	20.8	16.9
Maximum depth	73.9	91.2	80.8	83.7	70.5	68.3	67.4	80.3	69.1	63.7	68.1	68.6	67.5	67.3
Caudal peduncle depth	22.7	23.4	24.5	24.2	20.4	20.7	20.8	24.7	21.4	20.5	19.6	24	22.8	22.5
Caudal peduncle length	40.8	42.9	39.8	47.4	36.3	33.3	39.4	47.4	39.1	36	32	36	40.4	30.3
Predorsal length	72.6	85	74.4	83.4	60.4	60.8	65.8	79.2	68.8	70.9	67.1	73.4	67.3	63.4
Preanal length	156	174	172	172	139	143	143	163	144	142	147	154	148	140
Prepelvic length	92.9	95	87.6	94.6	75	78.4	80.3	90.2	81.2	76.4	77.7	81.5	76.6	73.7
Prepectoral length	78	85.8	76.8	85.9	62	70.2	68.3	79.4	78.8	67	73.1	71.5	71.5	67.3
Pectoral length	65.5	79.4	74.2	75.6	59.5	61.8	57.2	68.4	59.3	59.6	61.7	60.6	59.6	56.7
First anal spine	24.1	16.8	15.7	12.7	17	14.3	15.3	15	13.9	14.9	12.1	15.3	12.7	12.4
Second anal spine	37.6	47.2	44.2	45.8	38.5	40.7	41.2	45.7	40.3	39.8	42.4	41.9	41	43.4
Third anal spine	25.1	29.8	27.9	25.9	27.1	24.9	25.7	29.4	26.7	23.7	22.4	28.9	24.3	27.7
Pelvic length	47	55.3	48.5	45.7	39.3	43.1	37.3	46.1	42	37.4	41.9	43.3	39.3	42.2
Pelvic length including filament	53.1	61.1	53.9	53.9	43	45.7	46	52.7	46.7	46.8	48.1	45	47.1	46
First dorsal spine	10.9	11.8	11.4	7.3	11.3	9.7	10.2	9.4	10.3	8.3	10.3	8.1	8.2	9.2
Fourth dorsal spine	37.5	42.3	36.8	38.5	37.2	35.8	36.1	28.6	37	34.4	34.6	33.6	32.4	35
Fifth dorsal spine	38.9	43.7	36.3	37.7	37.3	35.9	33.1	36.8	35.3	33.5	35.5	31.6	32.6	35.8

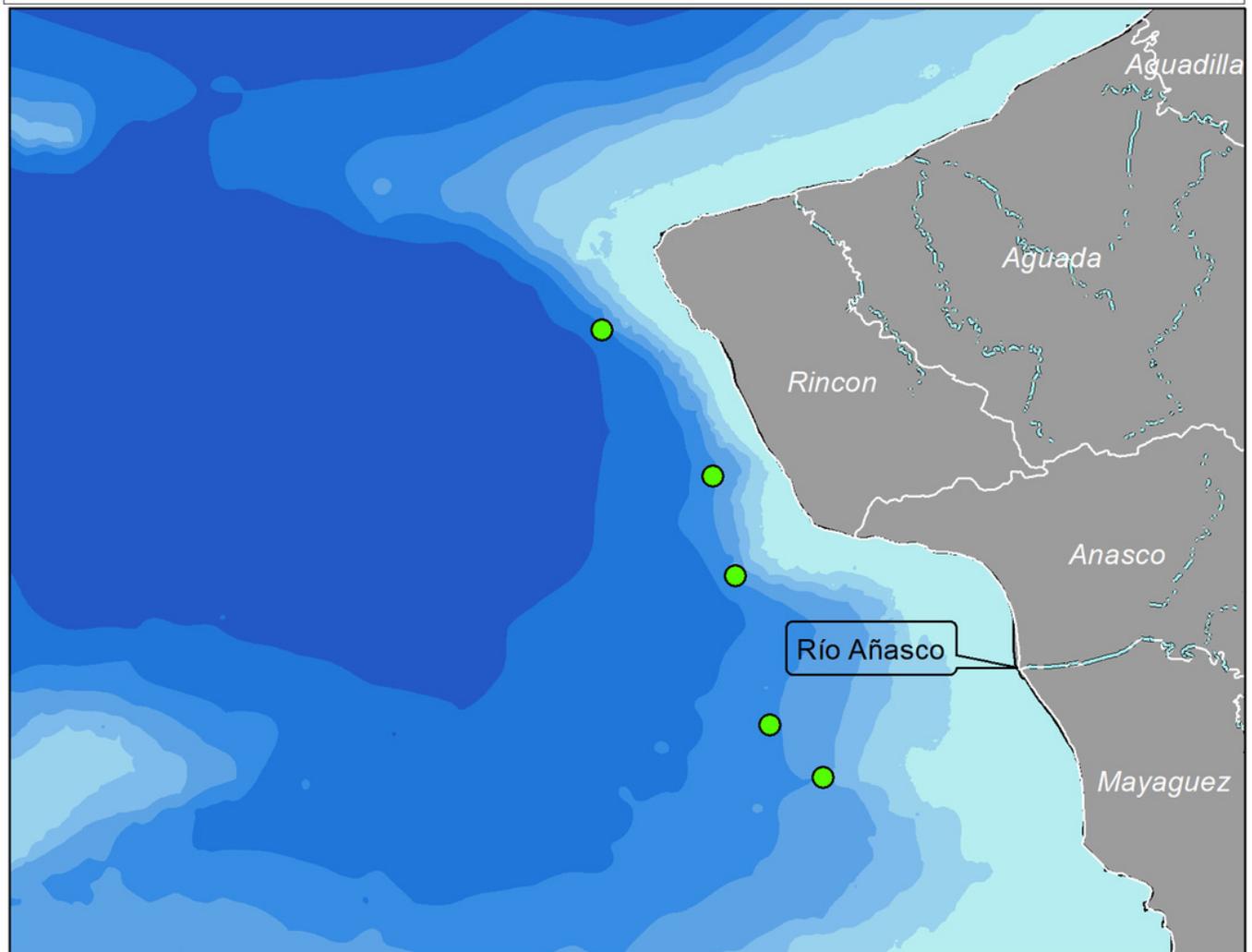
Penultimate dorsal spine	18.2	22.4	20.3	19.9	18	17.4	18.7	17.5	18.2	15.9	18.8	18.5	16.7	19
Last dorsal spine	18.1	22.9	17.2	19.7	17.8	17.2	18.3	18.1	18	17.1	19.4	19.1	16.2	16.4
First dorsal ray	25.9	31.7	25.9	30.8	24.5	26.6	26.1	31.8	27.4	25.7	25.7	28.2	24.7	22.7
Anterior narine	6	5.7	4	5.8	5.1	4.4	4.6	5.5	4.8	3.9	3.9	5.4	4.4	4.2
Posterior narine	3.6	3.7	3	4.4	2.5	2.5	3.3	3.2	2.9	2.9	2.5	2.8	2.1	2.5

Meristic and morphometric character comparison of all valid *Rhonciscus* species.

	R. pauco n=14	R. crocro n=5	R. bayanus n=4	R. branickii n=5
Ocean	WA	WA	EP	EP
Meristics				
Dorsal fin	XIII, 12	XIII, 11-12	XII+I 12	XIII, 12-13
Anal fin	III, 7	III,7	III, 7-8	III-7
Pectoral fin	15-16 (17)1	16-18	16-17	16-17
Lateral line scales	48-50	66-72	63-65	53-55
Rows of scales above LL	7	8	8	6
Range of SL (mm)	195-250	176-332	147-205	159-234
% of SL				
	Range	Range	Range	Range
Head length	30-37.25	29.41-37.52	30.41-31.53	28.49-35.57
Eye diameter	9.42-10.38	6.69-7.81	7.17-8.1	7.09-8.97
Snout length	7.58-11.47	7.35-10.88	7.7-8.84	5.52-7.81
Maxillae length	8.57-10.75	8.4-11.23	10.57-12.36	6.11-9.21
Maximum depth	31.9-37.37	28.79-32.95	27.54-33.8	31.97-36.28
Caudal peduncle depth	9.33-11.3	9.57-11.35	9.71-10.3	8.68-10.57
Caudal peduncle length	15.22-20	11.09-14.85	11.88-16.33	14.03-15.5
Predorsal length	30.7-35.62	30.93-39.35	32.23-33.9	31.19-34.63
Preanal length	68.12-72.22	71.93-76.23	67.4-71.93	70.53-74.19
Prepelvic length	36.5-40.56	35.59-43.48	35.64-36.54	34.4-39.84
Prepectoral length	31.79-38.43	30.11-38.22	29.72-31.93	29.88-34.35
Pectoral length	27.9-32.54	22.07-24.15	20.21-23.69	28.89-33.66
First anal spine	5.08-10.52	5.35-8.16	5-8.74	3.29-6.3
Second anal spine	16.41-21.8	10.82-20.34	16.66-20.01	15.4-17.21
Third anal spine	10.36-13.91	8.78-11.84	9.12-15.92	9.87-11.56
Pelvic length	18.19-22.66	18.28-22.36	16.49-22.24	21.56-25.74
First dorsal spine	2.92-5.79	2.53-3.81	2.46-3.87	2.84-4.81
Fourth dorsal spine	12.06-19.07	10.55-16.04	12.05-14.12	13.65-17.32
Fifth dorsal spine	14.69-19.12	11.56-14.88	11.26-14.88	13.02-16.24
Penultimate dorsal spine	7.38-9.54	3.63-6.03	5.08-5.66	4.06-6.66
Last dorsal spine	7.16-9.38	4.51-7.38	5.61-7	4.85-6.73
First dorsal ray	10.79-13.43	8.8-11.44	7.46-11.73	8.11-12.11
Anterior narine	1.66-2.62	0.69-0.78	0.32-0.64	0.79-1.01
Posterior narine	1.01-1.76	0.36-1.45	0.53-0.94	1.09-1.61
Times in SL				
Head length	2.68-3.33	2.67-3.4	3.17-3.29	2.81-3.51

Eye diameter	9.62-10.6	12.8-14.94	12.35-13.94	11.15-14.11
Snout length	8.71-13.17	9.19-13.61	11.31-12.98	12.81-18.13
Maxillae length	9.29-11.66	8.91-11.9	8.09-9.46	10.86-16.38
Maximum depth	2.67-3.13	3.04-3.47	2.96-3.63	2.76-3.13
Caudal peduncle depth	8.84-10.71	8.81-10.45	9.71-10.3	9.46-11.53
Caudal peduncle length	5-6.56	6.73-9.02	6.12-8.42	6.45-7.13
Predorsal length	2.8-3.25	2.54-3.23	2.95-3.1	2.89-3.21
Preanal length	1.38-1.46	1.31-1.39	1.39-1.48	1.35-1.42
Prepelvic length	2.46-2.73	2.3-2.81	2.74-2.81	2.51-2.91
Prepectoral length	2.6-3.14	2.62-3.32	3.13-3.36	2.91-3.35
Pectoral length	3.07-3.58	4.14-4.53	4.22-4.95	2.97-3.46
First anal spine	9.5-19.68	12.25-18.7	11.44-20.01	15.88-30.42
Second anal spine	4.58-6.09	4.92-9.24	5-6	5.81-6.49
Third anal spine	7.18-9.65	8.45-11.39	6.28-10.97	8.65-10.13
Pelvic length	4.41-5.49	4.47-5.47	4.5-6.07	3.88-4.64
First dorsal spine	17.25-34.24	26.24-39.46	25.85-40.69	20.79-35.25
Fourth dorsal spine	5.24-8.28	6.23-9.48	7.08-8.3	5.77-7.33
Fifth dorsal spine	5.22-6.8	6.72-8.65	6.72-8.88	6.16-7.68
Penultimate dorsal spine	10.47-13.54	16.58-27.55	17.66-19.69	15.01-24.63
Last dorsal spine	10.65-13.95	13.56-22.18	14.28-17.82	14.87-20.61
First dorsal ray	7.44-9.26	8.74-11.36	8.52-13.4	8.26-12.33
Anterior narine	38.16-60	128.07-145.12	155.83-311.63	99.21-126.91
Posterior narine	56.81-98.09	68.78-277.59	105.94-189.54	62.13-92
Times in HL				
Eye diameter	3.08-3.66	3.9-5.17	3.89-4.28	3.65-4.02
Snout length	3.24-4.09	3.45-4.21	3.44-4.09	4.41-5.27
Maxilla length	3-3.77	2.92-3.57	2.46-2.94	3.86-4.69
Pectoral length	1.63-2.21	1.98-3.25	2.04-2.77	1.76-2.73
Fifth dorsal spine	3.26-6.51	3.73-7.02	3.48-6.31	4.55-8.67
Anterior narine	11.92-18	37.66-51.62	47.38-95.69	28.27-37.56
Posterior narine	18.79-33	25.81-81.63	32.21-58.2	17.7-32.73

Figure 1

Map of Puerto Rico indicating collection sites of *Rhonciscus pauco* sp.nov.

Legend

Depth (m)

	270-360	30-90	── Rivers
540-1,000	180-270	>30	● Collection sites
360-540	90-180	Land	

Figure 2

Rhonciscus pauco, sp. nov. Sam Noble Oklahoma Museum of Natural History OMNH 86864, holotype, 266 mm SL, from Tres Cerros, Rincón, Puerto Rico.

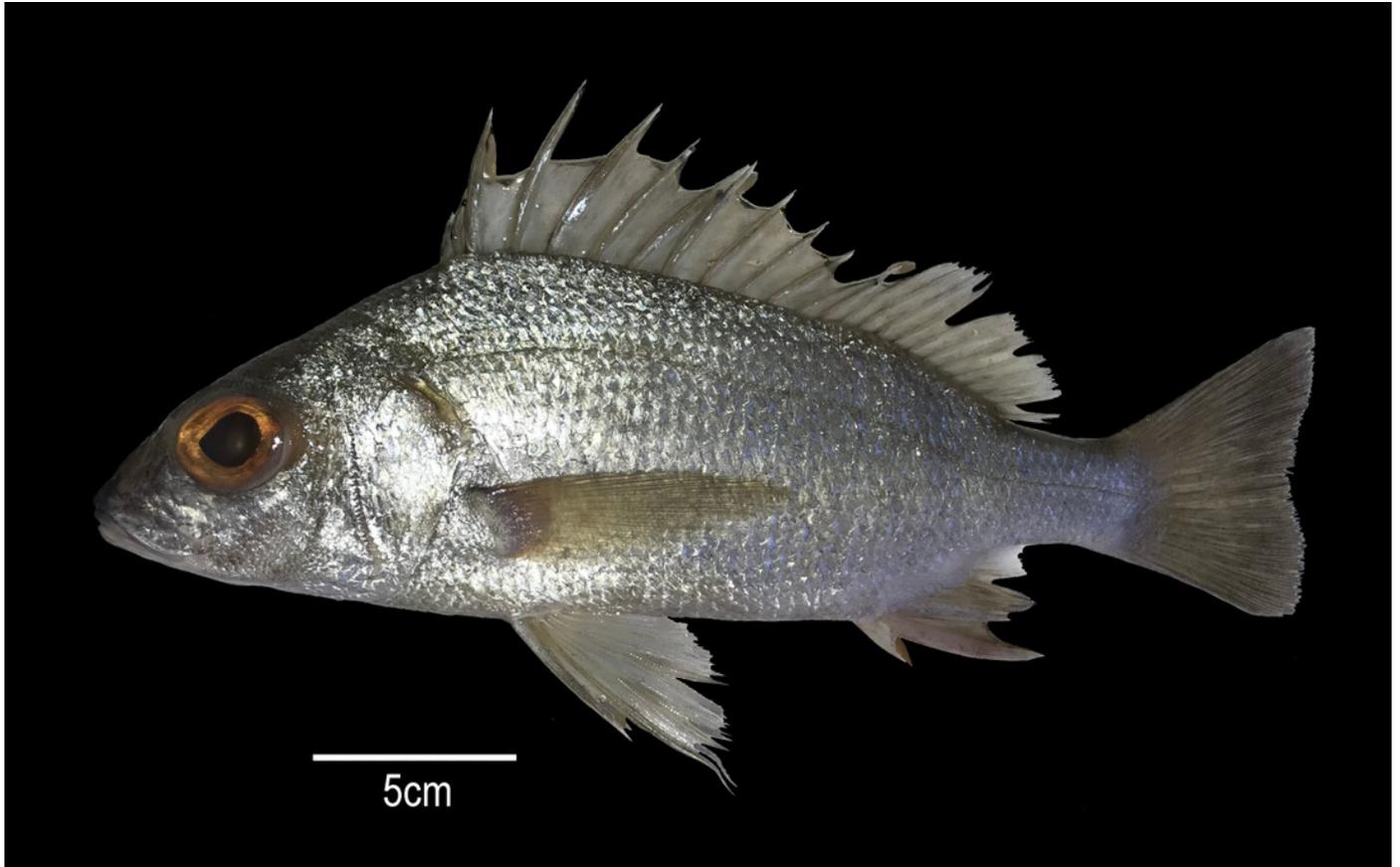



Figure 3

Rhonciscus pauco, sp. nov. Fresh coloration.

5 CM

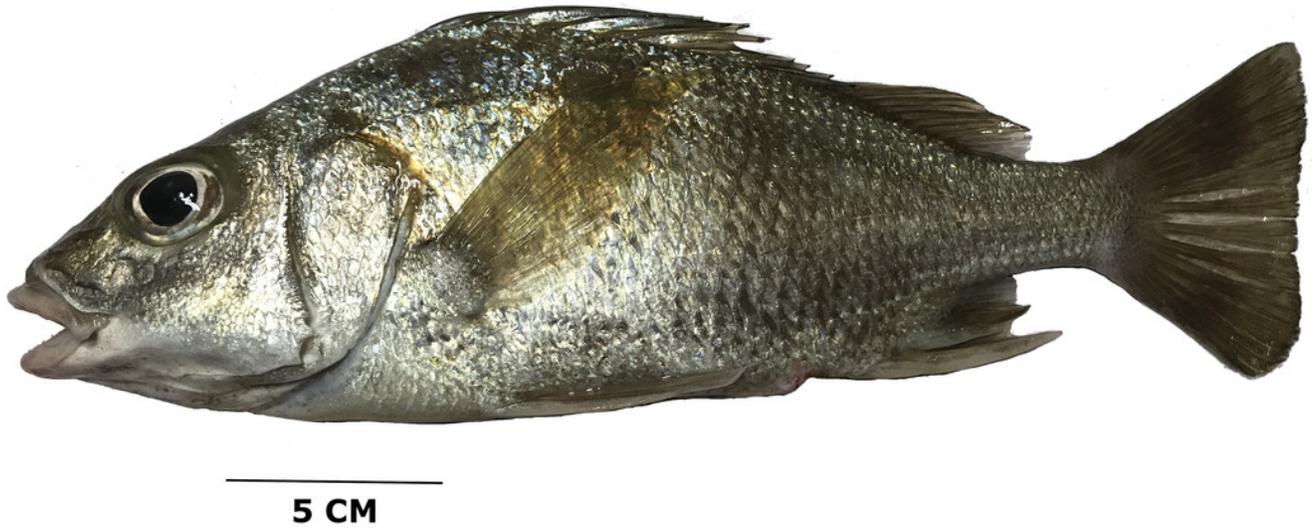



Figure 4

Rhonciscus pauco, sp. nov.

(A) Detail of the head, especially on preopercle serration. (B) Rear chin pores. (C) Spine dorsal fin membrane and dark spots over scales. (D) Pelvic fin with filament on the first ray.

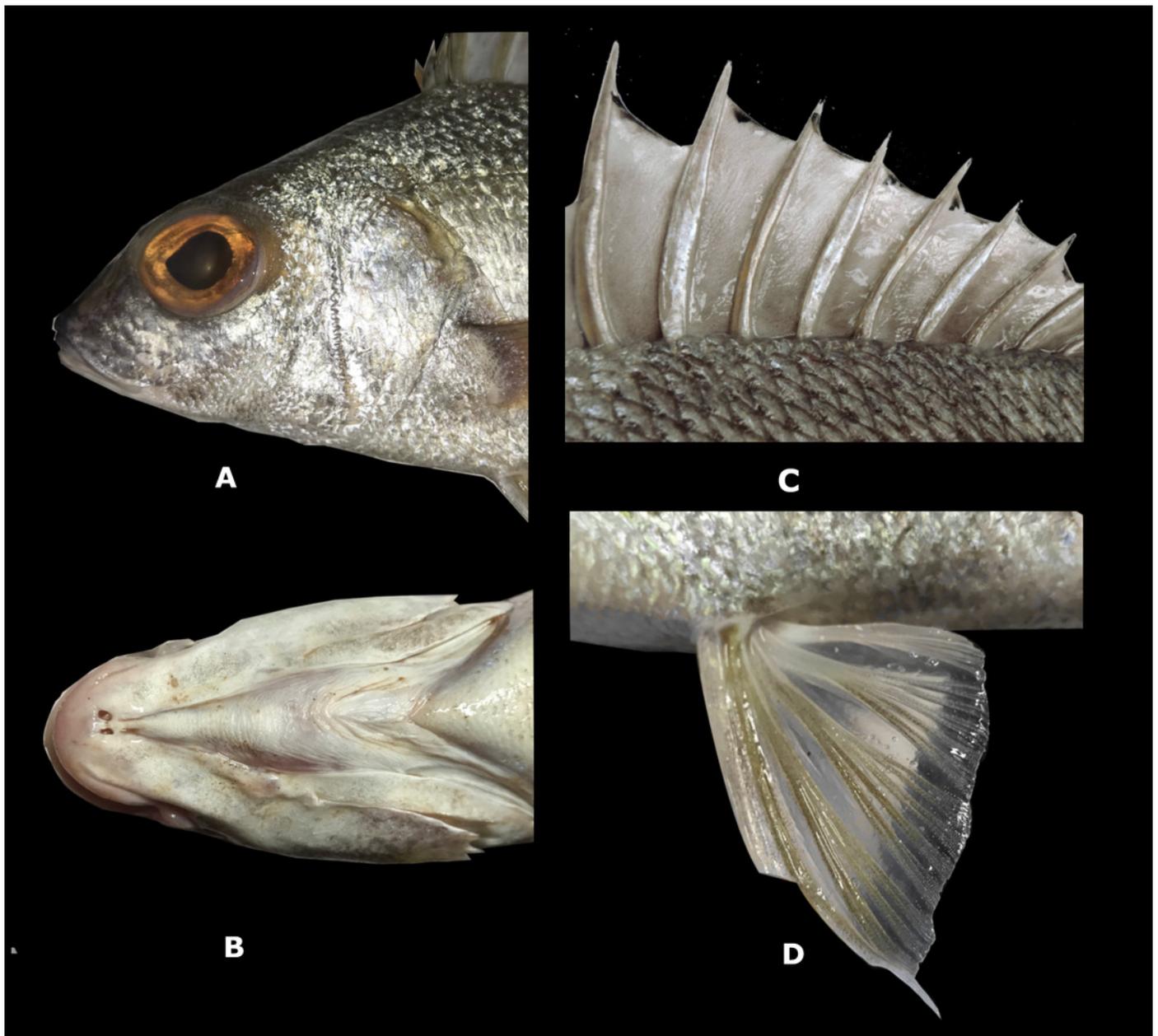



Figure 5

Rhonciscus pauco, sp. nov. Underwater photograph taken at 218 meters depth in western Puerto Rico. Image credits belongs to Tim Battista & Kate Overly (NOAA NCCOS 2022).

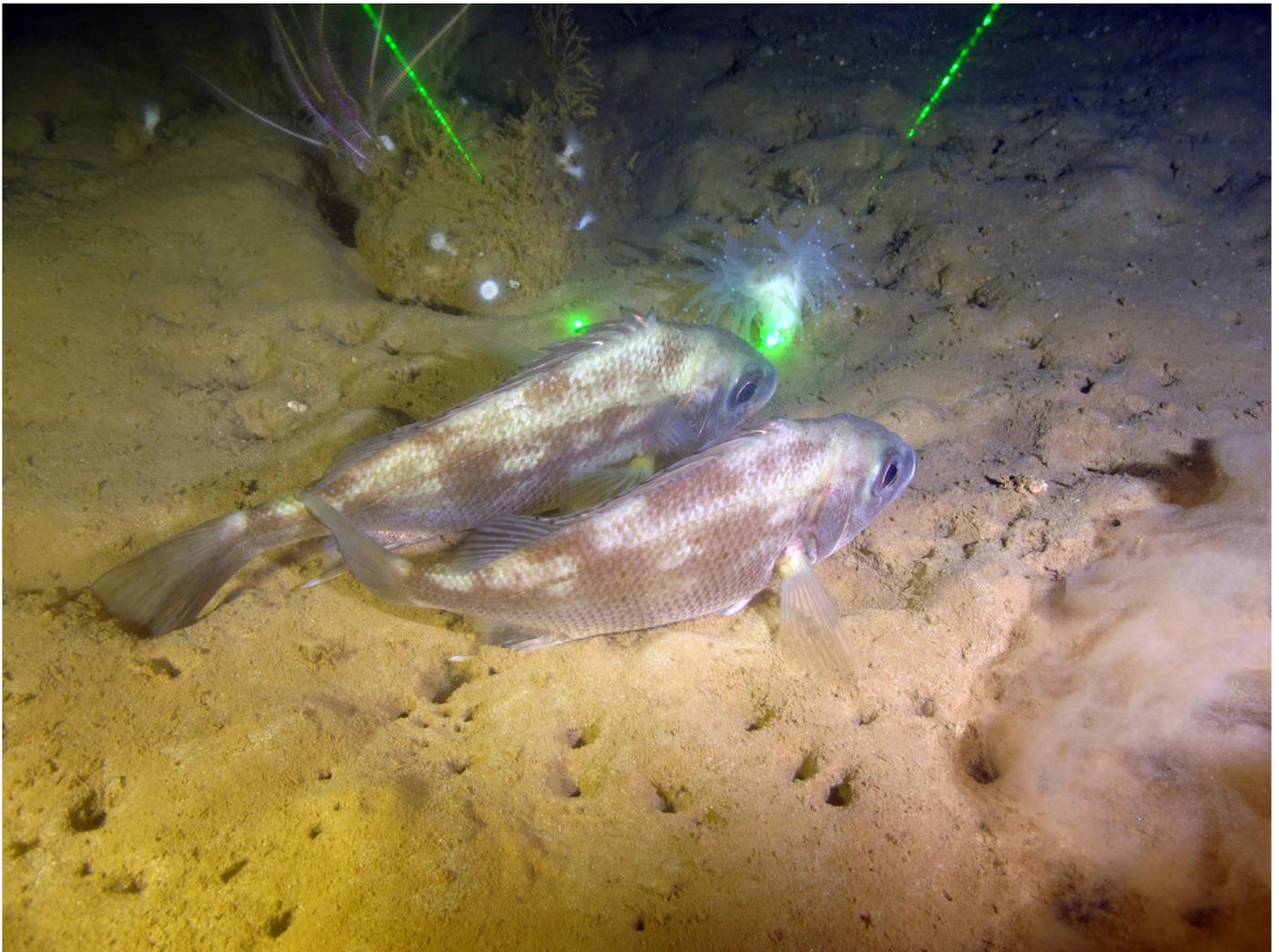



Figure 6

COI maximum likelihood phylogenetic tree of the species *Rhonciscus*, including the new species *Rhonciscus pauco*. Numbers over branches correspond to the bootstrap support.