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Pseudanthias timanoa, a new fairy basslet from New Caledonia, South Pacific (Teleostei: Serranidae: Anthiadinae)

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Abstract

A new fairy basslet, *Pseudanthias timanoa* n. sp., is described from 21 specimens, 50.0–79.1 mm SL, collected recently from New Caledonia, in the southwestern corner of the tropical Pacific Ocean. The new species is typically found on deep coral-reef slopes, at depths of 50–100 m. One of many slender, brightly colored fairy basslets found throughout the Indo-West Pacific Ocean, *P. timanoa* is part of the *Pseudanthias lori* species complex. It is distinguished from its congeners by the live color pattern, which is bright reddish pink with a series of 7 red-orange bars along the upper body followed by a deeper-red rectangular saddle on the caudal peduncle. Mature males develop a greatly elongated third dorsal-fin spine, up to about 1.5 times head length and long, trailing caudal-fin filaments. The sequence of the mtDNA barcode marker COI for the new species is 10.3% divergent (p-distance) from the nearest relative in the Barcode of Life Database, *P. lori*, from the Coral Sea and Philippines. The new species appears in the aquarium trade as the Sunrise Anthias. With this discovery, there are now 16 species of *Pseudanthias* documented from New Caledonia.

Key words: taxonomy, ichthyology, coral-reef fishes, DNA barcoding, goldies, Sunrise Anthias.

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Introduction

The fairy basslets of the genus *Pseudanthias* Bleeker, 1871 belong to one of the larger genera of coral-reef fishes, with 66 species recognized by Anderson (2018), 63 species recognized by Parenti & Randall (2020), and 64 species valid in Fricke, Eschmeyer & Van der Laan (2020), all from the coral reefs of the Indo-Pacific region. A number of species have yet to be described. They are very colorful and attractive small members of the serranid subfamily Anthiadinae, and thus frequently found in the aquarium-fish trade. A number of common names are used for these fishes: fairy basslets, goldies, seaperches, and, less aptly, "anthias", which is now a genus name for a mostly New World group of Anthiadinae. There are several subgroups within the genus, including the complex of saddled fairy basslets related to *Pseudanthias lori* (Lubbock & Randall, 1976). That group contains a set of slender species, mostly red to pink, with various red bars and stripes along the body.

In 2009, in New Caledonia, Tony Nahacky and the second author discovered a different-looking saddled fairy basslet at 50 m that resembled *P. lori*, but were larger and swimming faster and in open water. In 2013, the species was first collected, with a barrier net, by the second author and Albert Joseph and it has since entered the aquarium trade as the Sunrise Anthias. It is distinguished both by color pattern and a divergent mtDNA-barcode marker COI sequence from its close relatives in the *P. lori* complex of fairy basslets. It is described here as a new species.

There are many species of *Pseudanthias* on the reefs of New Caledonia, with 14 species originally listed in Fricke & Kulbicki (2006). More recently, Fricke et al. (2011) updated the list, substituting *Pseudanthias engelhardi* (Allen & Starck, 1982) for *Pseudanthias carlsoni* Randall & Pyle, 2001 (as synonyms); removing *Pseudanthias cichlops* (Bleeker, 1853); and adding three species: *Pseudanthias randalli* (Lubbock & Allen, 1978) and two deepwater species from over 200 m: *Pseudanthias rubrolineatus* (Fourmanoir & Rivaton, 1979) and *Pseudanthias xanthomaculatus* (Fourmanoir & Rivaton, 1979) The latter species has now been redescribed as *Odontanthias xanthomaculatus* by Gill & Russell (2019). Fricke et al. (2011) thus removed one and added two valid species (for a total of 15 species). The update of New Caledonia fishes by Fricke et al. (2015) did not discuss *Pseudanthias*.

Kuiter's (2004) book is mostly concordant with the list, but he considered several species in New Caledonia to be different from holotypes from distant locations, i.e. *P.* cf. *cheirospilos* (for *Pseudanthias squamipinnis* [Peters, 1855] from Mozambique); *Pseudanthias* cf. *cooperi* (Maldives type; mtDNA evidence suggests *Pseudanthias kashiwae* (Tanaka, 1918) is the senior synonym for all Pacific populations [BCV unpublished]); *P.* cf. *pascalus* (Japan type); and *P.* cf. *ventralis* (Pitcairn Island type). He also considered the local *P.* cf. *randalli* to be *P.* cf. *flavicauda* (type Fiji). He did not include the local antitropical population of *Pseudanthias elongatus* (Franz, 1910). Laboute & Grandperrin (2016) documented *Pseudanthias dispar* Herre, 1955 from the Loyalty Islands. If there is only one *P. randalli*/*P. flavicauda* entity in New Caledonia (and mtDNA evidence suggests there is [BCV unpublished]), the total, with this description, would be 16 documented species.

Materials and Methods

Type specimens are deposited at the Muséum national d'Histoire naturelle, Paris, France (MNHN); Bishop Museum, Honolulu, HI, USA (BPBM); California Academy of Sciences, San Francisco, CA, USA (CAS); and Scripps Institution of Oceanography, San Diego, CA, USA (SIO).

Measurements and format follow Randall & Pyle (2001). When last dorsal-fin and anal-fin rays are not split to base, i.e. a space before the unsplit last ray insertion, it was counted as a separate ray. A 652-bp segment was amplified from the 5′ region of the mitochondrial cytochrome c oxidase (COI) gene using a variety of primers (Ivanova et al. 2007). DNA extractions were performed with the NucleoSpin96 (Machery-Nagel) kit under automation with a Biomek NX liquid-handling station (Beckman-Coulter) equipped with a filtration manifold. PCR amplifications were performed in 12.5 µl volume including 6.25 µl of 10% trehalose, 2 µl of ultra-pure water, 1.25 µl of 10× PCR buffer (10mM KCl, 10mM $(NH_4)_2SO_4$, 20mM Tris-HCl (pH 8.8), 2mM $MgSO_4$, 0.1% Triton X-100), 0.625 µl of $MgCl_2$ (50mM), 0.125 µl of each primer (0.01mM), 0.0625 µl of each dNTP (10mM), 0.0625 µl of *Taq* DNA polymerase (New England Biolabs), and 2 µl of template DNA. The PCR conditions consisted of 94°C for 2 min., 35 cycles of 94°C for 30 sec., 52°C for 40 sec., and 72°C for 1 min., with a final extension at 72°C for 10 min. Sequences were compiled using the Barcode of Life Data Systems (Ratnasingham & Hebert 2007, Ward et al. 2009) and data are publicly accessible on BOLD (http://www.boldsystems.org) and GenBank. Sequence divergences were calculated using BOLD p-distance algorithms.

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Sunrise Anthias

urn:lsid:zoobank.org:act:63197817-8862-4305-9781-125E5BFFA4A2

mtDNA COI sequence BIN https://doi.org/10.5883/BOLD:ACL3565

Figures 1–8

Pseudanthias timanoa with incorrect authorship "Randall, 2014", a *nomen nudum* until the present description, Laboute & Grandperrin 2016: 217, fig. a single photograph (without any description in the text, and based on no description, publication, or collected specimen).

Holotype. MNHN 2020-0175, 73.3 mm SL, France, New Caledonia, Grand Terre, Mbere Reef, -22.3526°, 166.2362°, A. Teitelbaum, 1 December 2013.

Paratypes. BPBM 41379, (6 specimens) 50.8–77.3 mm SL, same data as holotype; SIO 20-17, (5 specimens) 50.0–64.7 mm SL, France, New Caledonia, Grand Terre, Dukati Reef, -22.6968°, 166.65493°, 45 m, rubble near reef drop-off, A. Teitelbaum, 24 October 2016; CAS 247237, (9 specimens) 58.8–79.1 mm SL, France, New Caledonia, Grand Terre, Dukati Reef, -22.6968°, 166.65493°, A. Teitelbaum, 1 December 2017.

Diagnosis. A species of *Pseudanthias* with dorsal-fin elements X,15 or 16 (most 16), third spine greatly elongated in mature males, up to about 1.5 times head length, 2.2 in SL, up to three times length of next spines; anal-fin elements III,7; pectoral-fin rays 18 or 19 (most 19); caudal fin deeply lunate with filamentous tips in mature males (eroded away in aquarium specimens), maximum caudal concavity 3.1 in SL in intact paratype; body elongate, body depth 3.4 (3.2–4.0) in SL; head and body reddish pink with 7 red-orange bars along upper body followed by a deeper-red, saddle-like rectangle on caudal peduncle.

Figure 1. *Pseudanthias timanoa,* fresh paratype, male, 55.1 mm SL, SIO 20-17, from aquarium trade with caudal filaments eroded, collected from Dukati Reef, New Caledonia (Benjamin C. Victor).

Description. (holotype, then range of paratypes in parentheses, if different) Dorsal-fin elements X,15 (15 or 16, most 16, (when 15 a deeply divided last ray); anal-fin elements III,7, all dorsal-fin and anal-fin rays branched, last sometimes to base; pectoral-fin rays 18 or 19 (usually 19), about two upper and lower rays unbranched; pelvic-fin rays I,5; principal caudal-fin rays 8+7, middle 13 branched; pored lateral-line scales 50 or 51 (48–54); scales above first lateral-line scale to base of second dorsal-fin spine 4 1/2; scales above lateral-line apex to base of middle dorsal-fin spines 3 1/2; scales below lateral line to origin of anal fin about 15; circumpeduncular scales about 26; gill rakers 10+26 (9–11+24–27); branchiostegal rays 7.

Body elongate, body depth 3.4 (3.2–4.0) in SL; larger males relatively stout, body width 1.8 (1.7–2.4) in body depth; head length 3.5 (3.2–3.9) in SL; snout very short, length 4.0 (4.2–6.7) in HL; orbit diameter 3.6 (2.7–3.6) in HL; full posterior margin of bony orbit with a single row of tiny papillae facing toward pupil; interorbital space relatively broad, convex, least bony width 3.8 (3.4–4.2) in HL; caudal-peduncle depth 2.1 (1.8–2.4) in HL; caudal-peduncle length 1.4 (1.1–1.4) in HL.

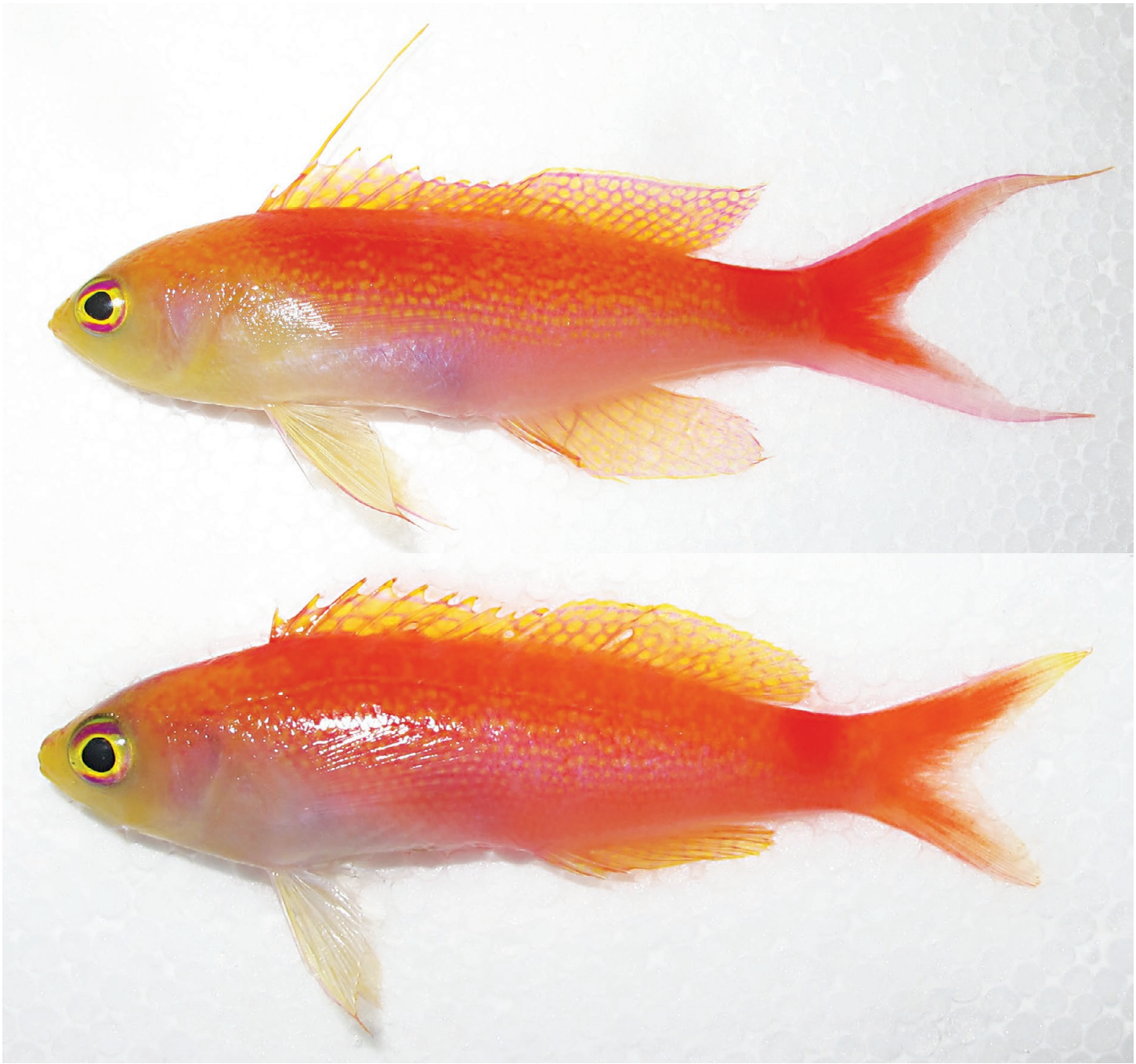

Figure 2. *Pseudanthias timanoa,* freshly collected paratypes, male, 77.3 mm SL (above), female (below), BPBM 41379, New Caledonia (Antoine Teitelbaum).

Mouth moderately large, the maxilla reaching to below posterior half of eye, upper-jaw length 2.1 (2.1–2.5) in HL; mouth terminal and strongly oblique, gape at angle of about 35° to horizontal axis; posterior margin of maxilla straight to slightly indented; front of upper lip with a finely papillate, large, fleshy pad on mature males; a pair of widely separated canines at front of upper jaw, followed by an outer row of slender, much smaller, caniniform to conical teeth and an inner band of tiny teeth, becoming multiple rows medially; lower jaw with a pair of smaller, forward-projecting recurved canines medial to upper canines when mouth closed, preceded by a band of villiform teeth, becoming a row of small slender caniniform teeth rearward, no prominent tooth but slightly larger about halfway from front; vomer with a small triangular patch of tiny teeth, palatines with a band of small viliform teeth. Tongue small, triangular, and pointed.

Gill rakers long and slender, well longer than gill filaments midway, and about 3/4 orbit diameter. Anterior naris a short membranous tube, flap on rear rim, posterior naris a larger flat aperture. Opercle with three flat spines, upper a slightly rounded projection, middle larger and pointed, third much smaller and pointed (sometimes not externally visible); preopercle with 33 (22–34) fine serrae, more numerous with size, progressively larger ventrally, none below angle; subopercle and interopercle without serrae.

Head and body fully scaled with ctenoid scales except lips and front of snout around nares; no scales on spinous portion of dorsal and anal fins, but one to several rows of small scales along base of soft portions; caudal fin mostly scaled, scales progressively smaller posteriorly; small scales on about one-third of pectoral fins, none on pelvic fins. Lateral line a smooth curve approximately following contour of back, last pored scale ending on base of caudal fin (and included in count).

Urogenital papilla of mature males long, narrow, and pointed, up to 2/3 orbit diameter, urogenital opening of female a simple orifice; some individuals have intermediate degrees of filamentous fins and not yet a developed urogenital papilla, likely reflecting gender fluidity. Sex-change and complex mating systems are documented for *Pseudanthias* species.

Origin of dorsal fin slightly anterior to pectoral-fin insertion, predorsal distance 3.3 (3.1–3.5) in SL; dorsal-fin and anal-fin spinous membranes with short, filamentous distal extensions; first dorsal-fin spine 5.4 (4.9–5.5) in HL; second dorsal-fin spine 2.7 (2.3–3.7) in HL; third dorsal-fin spine longest, greatly extended in mature males, 1.56 times HL, 2.2 in SL, (male paratypes not intact), 1.8–2.6 in HL in females (intermediates not included); longest (antepenultimate or penultimate) dorsal-fin soft ray 1.4 (1.5–3.1) in HL; origin of anal fin below base of second to third dorsal-fin soft ray, preanal distance 1.7 (1.6–1.7) in SL; first anal-fin spine 4.9 (2.3–4.7) in HL; second anal-fin spine 2.5 (2.5–3.5) in HL; third anal-fin spine 2.4 (2.2–2.9) in HL; longest (antepenultimate or

Figure 3. *Pseudanthias timanoa,* mature male, 32 m depth, Dukati Reef, New Caledonia (Richard Bajol).

Figure 4. *Pseudanthias timanoa,* mature male, New Caledonia (Patrick Plantard).

penultimate) anal-fin soft ray 1.1 (1.3–2.1) in HL; pectoral fins pointed, longest ray 0.9 (0.9–1.1) in HL; origin of pelvic fins just behind lower base of pectoral fins, prepelvic distance 2.7 (2.6–3.4) in SL; pelvic-fin spine 1.8 (1.7–2.1) in HL; second pelvic-fin soft ray longest 0.9 (0.9–1.3) in HL; caudal fin deeply lunate with trailing filaments on mature males (eroded away on aquarium specimens), length as measured on mostly intact types 2.4 (2.1–4.0) in SL, caudal concavity on non-eroded males as wide as 3.1 in SL.

Color in life. (Figs. 1–4, 6 & 7) Head and body mainly reddish pink, but can blanch to white on lower half of head and body and/or develop a yellowish head; upper body with a series of 7 reddish to orange bars (posterior three bars more orange), from below dorsal-fin origin to below rear end of soft dorsal fin, followed by a deeper-red, roughly rectangular saddle occupying upper two-thirds of caudal peduncle; freshly dead individuals can develop a red wash obscuring bars and saddle (Fig. 2); rows of opalescent yellow spots on sides, about one per scale; upper part of head variably yellowish, upper lip yellow, often yellowish forehead and band from upper eye towards dorsal-fin origin; iris bright yellow with purple bands on upper and lower portions; dorsal-fin and anal-fin membranes with a fine, reticulated matrix of small, round, yellow spots with a thin purple and yellow edging along rim; caudal fin reddish to yellowish with a purplish band along upper and lower margins; pelvic fins translucent to yellow; pectoral fins translucent.

Color in alcohol. (Fig. 5) Head and body lose all color and become uniformly yellowish brown.

Figure 5. *Pseudanthias timanoa,* preserved paratype, BPBM 41379, male, 77.3 mm SL, New Caledonia (John E. Randall).

Figure 6. *Pseudanthias timanoa,* school underwater at 74 m, New Caledonia (Pierre Laboute).

Etymology. The new species is named timanoa, a euphonious amalgamation of the second author's three children's names: Timothée, Maëlle, and Noa. The specific epithet is treated as a noun in apposition.

Distribution and habitat. The new species is apparently endemic to New Caledonia. They are found deeper than many other congeners, from 50–100 m, although in some locations they sometimes can be found within regular diving depths, at about 10–40 m. For example, on a reef south of Mato Pass, they have been seen schooling together with *P.* cf. *cheirospilos*, in 10–15 m, likely due to the topography of a steep wall bringing deepwater species up shallow. Unlike *P. lori*, *P. timanoa* are encountered in fast-swimming tight schools of up to 200 individuals well off the bottom (Fig. 6). Interestingly, *P. lori* is rarely seen around the survey areas off of Grand

Figure 7. *Pseudanthias timanoa,* two males and a female (at upper right), with a *P. lori* at lower left foreground and a *P. flavicauda* at lower right, about 90 m, New Caledonia (Patrick Plantard).

Figure 8. *Pseudanthias timanoa* (top) New Caledonia (Richard Bajol); *Pseudanthias lori* (middle) Cenderawasih Bay, W. Papua Province, Indonesia; *Pseudanthias flavoguttatus* (bottom) Tanimbar Islands, E. Banda Sea, Indonesia (both Gerald Allen).

Terre, New Caledonia, mainly occurring deeper than 90 m, but the two species can be photographed together on occasion (Fig. 7). In other locations, such as the Loyalty Islands, *P. lori* are more frequently encountered (Pierre Laboute, pers. comm.).

Comparisons. The new species has a full series of reddish-orange bars along the upper body ending in a deeper-red, saddle-like rectangle on the upper caudal peduncle– a pattern distinguishing the species from all congeners. Another diagnostic feature is the finely reticulated matrix of small round spots over the dorsal and anal fins. Other species in the complex with red bars show different color patterns (Fig. 8): *P. lori* has posterior-body bars and a broad red stripe on the caudal peduncle (eastern Indian Ocean and western Pacific from Yaeyama, Japan south to Indonesia, Philippines, PNG, and east to French Polynesia) and *Pseudanthias flavoguttatus* (Katayama & Masuda, 1980) has regular alternating red and white bars along the upper body, running unchanged onto the caudal peduncle (Japan south to Marshall and Mariana Islands, Philippines, Indonesia, to Australia). *Pseudanthias aurulentus* (Randall & McCosker, 1982) has incomplete mid-lateral bars underlying red and white stripes along the upper body (central Pacific Islands and a variation in the Coral Sea). Other members of the *lori*-complex can have colored stripes, but not a row of bars.

Morphology and meristic characters broadly overlap in the *P. lori* species complex: among the features shared by *P. lori*, *P. aurulentus, P. flavoguttatu*s, and *Pseudanthias privitera* Randall & Pyle, 2001 and the new species are the tiny papillae on the bony orbital margin, the elongated third dorsal-fin spine in males, the basic tooth arrangement, and the fin-ray, lateral-line scale, and gill-raker counts, which all have median counts varying at most by one or two from each other (data here and Randall & Pyle [2001]). Counts of pectoral-fin rays and gill rakers are one or two lower in *P. lori* than in *P. timanoa* (Randall & Lubbock 1981).

The mtDNA COI barcode sequences for the types and other specimens of the new species form a tight single lineage: n=17; average intraspecific p-dist 0.09%; maximum intraspecific distance of 0.61%; GenBank accession numbers MT887642–MT887655 and MT887657–MT887659). The nearest-neighbor lineage presently on the BOLD database (http://www.boldsystems.org) is *P. lori*, from the Coral Sea and Philippines, 10.3% divergent (minimum interspecific distance, p-dist) (GenBank accession number MT887656). A phenetic tree of *Pseudanthias* mtDNA COI sequences was presented in Williams et al. (2013) including all French Polynesian species, with *P. lori* being the closest sequence to the *P. timanoa* lineage here, but other members of the *P. lori* species complex were not sampled.

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References

Anderson, W.D., Jr. (2018) Annotated checklist of anthiadine fishes (Percoidei: Serranidae). *Zootaxa*, 4475 (1), 1–62. https://doi.org/10.11646/zootaxa.4475.1

Fricke, R., Eschmeyer, W.N. & van der Laan, R. (Eds.) (2020) *Eschmeyer's Catalog of Fishes: Genera, Species, References, electronic version (3 August 2020)*, San Francisco, CA, USA. Available at http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp (last accessed 3 August 2020).

Fricke R. & Kulbicki M. (2006) Checklist of the shore fishes of New Caledonia. *In*: Payri, C.E. & Richer de Forges, B. (Eds.) *Compendium of marine species from New Caledonia. Documents scientifiques et techniques, II7, Volume spécial, Deuxième édition*. Institut de Recherche pour le Développement, Nouméa, New Caledonia, France, pp. 313–357.

Fricke R., Kulbicki M. & Wantiez L. (2011) Checklist of the fishes of New Caledonia, and their distribution in the Southwest Pacific Ocean (Pisces). *Stuttgarter Beiträge Zur Naturkunde A, Neue Serie*, 4, 341–463.

Fricke, R., Teitelbaum, A. & Wantiez, L. (2015) Twenty-one new records of fish species (Teleostei) from the New Caledonian EEZ (south-western Pacific Ocean). *Marine Biodiversity Records*, 8, 1–12. https://doi.org/10.1017/S1755267215000986

Gill, A.C. & Russell, B.C. (2019) Redescription of *Anthias xanthomaculatus* Fourmanoir and Rivaton, and its reassignment in the genus *Odontanthias* Bleeker (Teleostei: Serranidae: Anthiadinae). *Zootaxa*, 4568, 177–184. https://doi.org/10.11646/zootaxa.4568.1.11

Ivanova, N.V., Zemlak, T.S., Hanner, R.H. & Hebert, P.D.N. (2007) Universal primer cocktails for fish DNA barcoding. *Molecular Ecology Notes*, 7, 544–548.

Kuiter, R.H. (2004) *Serranidae and Plesiopidae. A Comprehensive Guide to Basslets, Hamlets, Longfins & relatives*. Aquatic Photographics, Seaford, Victoria, Australia, 212 pp.

Laboute, P. & Grandperrin, R. (2016) *Guide des poissons de Nouvelle-Calédonie. Nouvelle édition*. Éditions Catherine Ledru, Nouméa, New Caledonia, France, 696 pp.

Parenti P. & Randall J.E. (2020) An annotated checklist of the fishes of the family Serranidae of the world with description of two new related families of fishes. *FishTaxa*, 15, 1–170.

Randall J.E. & Pyle, R.L. (2001) Four new serranid fishes of the anthiine genus *Pseudanthias* from the South Pacific. *Raffles Bulletin of Zoology*, 49 (1), 19–34.

Randall, J.E. & Lubbock, R. (1981) A revision of the serranid fishes of the subgenus *Mirolabrichthys* (Anthiinae: *Anthias*), with descriptions of five new species. *Natural History Museum of Los Angeles County Contributions in Science*, 333, 1–27.

Ratnasingham, S. & Hebert, P.D.N. (2007) BOLD: The Barcode of Life Data System (www.barcodinglife.org). *Molecular Ecology Notes*, 7 (3), 355–364.

Ward, R.D., Hanner, R. & Hebert, P.D.N. (2009) The campaign to DNA barcode all fishes, FISH-BOL. *Journal of Fish Biology*, 74, 329–356.

Williams, J., Delrieu-Trottin, E. & Planes, S. (2013) Two new fish species of the subfamily Anthiinae (Perciformes, Serranidae) from the Marquesas. *Zootaxa*, 3647 (1), 167–180. https://doi.org/10.11646/zootaxa.3647.1.8