*Zootaxa* 1671: 3–31 (2008)
www.mapress.com/zootaxa/


ISSN 1175-5326 (print edition)
**ZOOTAXA**
ISSN 1175-5334 (online edition)

# Five new species of the damselfish genus *Chromis* (Perciformes: Labroidei: Pomacentridae) from deep coral reefs in the tropical western Pacific

RICHARD L. PYLE*, JOHN L. EARLE† & BRIAN D. GREENE‡
*Department of Natural Sciences, Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii 96817-2704, USA.*[1]
*E-mail: *deepreef@bishopmuseum.org, †earlej001@hawaii.rr.com, ‡bgreene@hawaii.edu.*

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## Abstract

Five new species of the damselfish genus *Chromis*[2] (Perciformes[3]: Labroidei[4]: Pomacentridae[5]) are described from specimens collected from deep (>60 m) coral-reef habitat in the western Pacific by divers using mixed-gas closed-circuit rebreather gear. Two of the five new species (*C. abyssus* and *C. circumaurea*) are each described from specimens taken at a single locality within the Caroline Islands (Palau and Yap, respectively); one (*C. degruyi*) is described from specimens collected or observed throughout the Caroline Islands, and two (*C. brevirostris* and *C. earina*) are described from specimens collected from several localities throughout the Caroline Islands, Fiji, and Vanuatu. All five species can easily be distinguished from other known *Chromis*, and from each other, on the basis of color and morphology. These new species represent the first five scientific names prospectively registered in the official ICZN ZooBank registry[6]. Moreover, the electronic online edition of this document has been specially formatted with many embedded links to additional resources available online via the internet to enhance access to taxonomically-relevant information, and as a demonstration of the utility of international standards for biodiversity informatics.

**Key words**: *Chromis abyssus*, *Chromis brevirostris*, *Chromis circumaurea*, *Chromis degruyi*, *Chromis earina*, new species, taxonomy, cybertaxonomy, mesophotic, mixed-gas diving, rebreather, ZooBank

## Introduction

Over the past two decades, the authors have developed and refined techniques for using advanced dive gear and various gas mixtures to allow safe excursions to depths of 50–150 m, which exceeds the depths that can be safely reached using conventional SCUBA. Initial exploratory deep dives by the authors at various localities throughout the tropical Pacific have revealed a rich diversity of coral-reef-associated fishes inhabiting

*Accepted by L. A. Rocha: 11 Dec. 2007; published: 1 Jan. 2008*
*urn:lsid:zoobank.org:pub:68376390-7809-46FF-9EC4-1371B4AAD0FF*

these depths (Pyle 1996a, 1996b, 1999, 2000). In addition to the discovery of many new species of fishes, initial exploration of deep coral reefs (sometimes referred to as "mesophotic" reefs) has led to new insights concerning ecological and biogeographic processes in both the Pacific (Pyle 2000, unpublished data) and the tropical Atlantic (Feitoza *et al*. 2005).

The pomacentrid genus *Chromis* Cuvier 1814 (type species *Sparus*[7] *chromis*[8] Linnaeus 1758) is the largest genus of the family, with 86 valid species. Fishes of this genus are among the few pomacentrid species known to inhabit deep coral reefs, perhaps a reflection of their principal food (zooplankton), in contrast to species of genera that are dependant primarily on benthic algae. At least 34 species of *Chromis* are known to inhabit depths of 50 m or more, but only nine are restricted to such depths, and only five (*C. okamurai*[9] Yamakawa and Randall 1989, *C. mirationis*[10] Tanaka 1917, *C. struhsakeri*[11] Randall and Swerdloff 1973, *C. abyssicola*[12] Allen and Randall 1985, and *C. onumai*[13] Senou and Kudo 2007) are known only from depths of 60 m or more. Except for two specimens of *C. brevirostris* collected at a depth of 60 m, all specimens of the new species described herein were collected at depths of 85 m or more.

Whereas the print (paper) edition of this article represents the publication through which these five new scientific names are made available under the current (4th Edition) International Commission of Zoological Nomenclature (ICZN)[14] Code of Nomenclature[15], the concurrently distributed electronic online edition is intended to exemplify the utility of modern international biodiversity informatics standards. Symbolically published on the 250th anniversary of the officially recognized date of publication of *Systema Naturae* (Linnaeus 1758), it is our hope that this article will help demonstrate the value of electronic informatics standards in enhancing the work of all taxonomists throughout the next quarter-millennium and beyond.

## Material and methods

*Specimen collection and deposition*

All specimens were collected with hand nets (sometimes with the aid of rotenone or quinaldine sulphate) by divers using Cis-Lunar® MK-5P mixed-gas, closed-circuit rebreathers, generally following protocols outlined by Pyle (1996c). In all cases, specimens were collected in full accordance with local government regulations, and in compliance with appropriate animal care standards. Most specimens were photographed when fresh, usually following the technique described by Randall (1961). Before exposure to formalin, tissue samples (usually the right pelvic fin) were removed from many specimens and stored in vials containing DMSO for later analysis. Holotypes of *C. abyssus*, *C. brevirostris*, *C. circumaurea*, and *C. degruyi* are deposited in the fish collection of the Bernice P. Bishop Museum, Honolulu (BPBM)[16]; the holotype of *C. earina* is deposited in the fish collection of Muséum National d'Histoire Naturelle, Paris (MNHN)[17]. Paratypes are deposited in these two insitutions, as well as The Natural History Museum, London (BMNH)[18]; California Academy of Sciences, San Francisco (CAS)[19]; United States National Museum of Natural History, Washington, D.C. (USNM)[20]; and the Western Australian Museum, Perth (WAM)[21]. Tissue samples were deposited for long-term cryogenic storage at the Pacific Center for Molecular Biodiversity (PCMB)[22], located at BPBM. All of these collections have been registered with the Biodiversity Collections Index (BCI)[23].

*Counts, measurements and molecular analysis*

Counts of median fin rays, vertebrae, and predorsal bones were taken from digitally-scanned radiograph images ("x-rays")[24]. Measurements of standard length (SL), lengths from tip of snout to origins of dorsal, pelvic and anal fins, dorsal- and anal-fin bases, and dorsal- and anal-fin spine lengths of specimens not bent or otherwise distorted were calculated to the nearest tenth (0.1) of a mm from radiograph images[25], and verified against measurements taken directly from specimens. All other counts and measurements were taken directly from specimens using a Fowler® Ultra-Cal IV 300-mm digital caliper. Measurement values were recorded to

the nearest hundredth (0.01) of a mm, but rounded to the nearest tenth (0.1) of a mm for analyses. Methods of counts and measurements are mostly consistent with those described in Allen & Randall (2004).

Unless otherwise indicated, specimen lengths are SL[26], measured as the straight-line distance between the anteriormost tip of the upper lip and the posterior edge of the hypural plate; head length[27] is between anteriormost tip of upper lip and posterior edge of opercle flap; body depth[28] is maximum vertical distance between belly and base of dorsal spines; body width[29] is maximum width posterior to opercular opening; snout length[30] is straight-line distance from anteriormost tip of upper lip to closest point on anterior fleshy edge of orbit; orbit diameter[31] is horizontal fleshy diameter; interorbital width[32] is least bony width between eyes; upper jaw length[33] is straight-line distance from anteriormost tip of upper lip to ventroposteriormost tip of maxilla; caudal peduncle depth[34] is least depth; caudal peduncle length is horizontal distance between verticals at posterior base of anal fin and posterior edge of hypural plate[35]; fin spine[36] and ray[37] lengths are straight-line distances between extreme base and distal tip (including filamentous extension, if any); caudal fin length[38] is horizontal distance from posterior edge of hypural plate to a vertical at distal tip of longest ray (including filamentous extension, if any); caudal concavity[39] is horizontal distance between tips of the shortest and longest rays; pectoral-fin length[40] is length of longest ray; pelvic fin length[41] is length of longest ray; pectoral-fin ray count[42] includes small splint-like, uppermost rudimentary ray; lateral-line scale count[43] includes only those scales with tubes; a separate count is provided for pored or pitted scales occurring midlaterally on caudal peduncle[44]; scale-row counts above[45] and below[46] lateral line to origins of dorsal and anal fins (respectively) with values that include ".5" refer to small truncate scales (if any) at bases of respective fins; gill-raker counts[47] include all rudiments and are provided as separate values for upper and lower limbs of first gill arch; last fin ray of dorsal and anal fins sometimes branched at or near extreme base and counted as a single ray, but only when connected at or near the extreme base[48] (otherwise counted as two[49]).

Unless otherwise indicated, measurements provided in the text represent proportion of SL. Measurements provided in the tables represent percent of SL. Counts, measurements and proportions appearing in parentheses represent ranges for paratypes, if different from the holotype. Counts represented as two values separated by a pipe "|" represent values taken from left|right sides of specimens.

Total genomic DNA was extracted from available tissue samples using the Qiagen Dneasy® tissue kit following the manufacturer's protocol. In compliance with the Barcode of Life initiative, a fragment of the cytochrome oxidase I (COI) gene from the mitochondrial DNA (mtDNA) was amplified for holotypes (and some paratypes) of all species. Primers used for amplification and sequencing were BOL-F1 (5' TCA ACY AAT CAY AAA GAT ATY GGC AC 3') and BOL-R1 (5' ACT TCY GGG TGR CCR AAR AAT CA 3'), modified from Ward *et al*. (2005). Each PCR had a total volume of 25 µl, containing between 10–20 ng of purified DNA, 2.5 µl of 10x reaction buffer, 1.5 µl of 8 mM pre-mixed dNTPs, 2.5 mM of MgCl2, 0.25 µM of each primer and two units of Taq DNA polymerase (Promega, Madison, WI). Cycling parameters for the mtDNA were as follows: initial denaturation at 94°C for 2 min; 35 cycles of 94°C for 45 sec, 50°C for 45 sec, 72°C for 55 sec; and a final extension at 72°C for 2.5 min. The resulting reaction was purified with exonuclease I and shrimp alkaline phosphatase enzymes. Excess oligonucleotide primers were removed through simultaneous incubation of PCR product with exonuclease I and shrimp alkaline phosphatase (USB Corp., Cleveland OH).

Because of a broader ongoing effort by Luiz Rocha and colleagues to analyze phylogenetic patterns of species within the genus *Chromis*, no attempt is made to infer evolutionary affinities of these five new species, other than qualitative discussions about similarities with other species, if relevant.

*Electronic content and hyperlinks*

The online edition of this article includes extensive use of "hyperlinks" (embedded links that allow simple redirection to online documents and resources via the internet). When viewing this online edition using hyperlink-enabled software, clicking on the hyperlink text (dark blue in color) using the computer mouse pointer will redirect the reader to the hyperlinked location or resource. There are two general categories of such

hyperlinks: internal, and external. Internal hyperlinks are used for linking between taxon names included within this text and the full treatment (or first mention) of those taxa elsewhere within this document. Similarly, internal hyperlinks are used for linking between literature citations in the text and the corresponding full bibliographic citations in the "References" section of this aritcle. External hyperlinks are used for linking portions of this document to electronic resources and information, such as online registration records of taxon names, taxon usage instances, natural history specimen collections, literature, data files, and images. All such external hyperlinks are denoted by a superscript number at their first use, corresponding to a Universal Resource Locator (URL) as listed in the "Embedded External Hyperlinks" Appendix at the end of this article. These URLs are included primarily to allow access to the online resources from the print edition, when the online edition is not available.

Whenever possible, information made accessible through external hyperlinks conforms to current standards and protocols as developed and maintained through Biodiversity Information Standards (formerly Taxonomic Databases Working Group; TDWG[50]). Most external hyperlinks are represented as a Life Science Identifier (LSID[51]) enclosed within an HTTP proxy (to allow viewing through standard web browsers), but others represent direct HTTP URLs or other standard protocols (e.g., "mailto"). All five new species names established herein have been prospectively registered in ZooBank (Polaszek *et al*. 2005a; 2005b), the official online registration system for the ICZN, which was launched the same day this article was published. All other scientific names mentioned in this article have been retrospectively registered in ZooBank, and hyperlinks are directed to Taxon-Name Usage records, most of which represent taxonomic concepts corresponding to those names as asserted herein. An Appendix at the end of this article lists most of the URLs, which are included for the benefit of readers of the print edition. Excluded from the Appendix are all internal hyperlinks, the three "mailto" hyperlinks associated with the email addresses of the authors, the ZooBank publication LSID for this article that appears on the bottom of the first page, and the embedded hyperlinks associated with the five ZooBank LSIDs for the new species described herein (all six ZooBank LSIDs can be viewed through any standard web browser by appending the LSID to the prefix "http://zoobank.org/").

DNA Barcodes have been deposited in GenBank[52], in compliance with the Barcode of Life Data Systems (BOLD)[53] and associated Fish Barcode of Life Initiative[54], and are accessible through hyperlinks associated with PCMB numbers for each specimen. Images included in this article, as well as other relevant images, have been made available through Morphbank[55]. Holotypes of *C. abyssus* and *C. degruyi* were scanned at the University of Texas High-Resolution X-ray CT Facility, and visualizations of those scans were provided by the Digital Morphology (DigiMorph)[56] project. References cited in this document are registered with ZooBank[6], and are available as full-page images through the Biodiversity Heritage Library (BHL)[57] when copyright allows. Descriptive data concerning type specimens of the five new species are available through the TDWG-compliant Structure of Descriptive Data (SDD) standard. The content of this article is available as marked-up text using the TaxonX[58] and taXMLit standards. A more detailed description of how these various standards were implemented in the generation of this document are included in a separate article, currently in preparation and planned for publication in 2008.

***Chromis abyssus*, new species**
urn:lsid:zoobank.org:act:8BDC0735-FEA4-4298-83FA-D04F67C3FBEC
Deep Blue Chromis
(Figs. 1a –1c; Table 1; Morphbank[59]; DigiMorph[60]; GenBank[61]; Barcode[62])

**Holotype.** BPBM 40861[63] (81.6 mm SL), Belau (Palau) Islands; off Ngemelis Island; below and slightly N of Blue Holes caverns (7°8'16.49"N, 134°13'18.5"E): above large rock outcrop, 110 m, hand net, R.L. Pyle, 27 April 2007 [PCMB 3113[64]].

**TABLE 1.** Proportional measurements (%SL) and counts of *Chromis abyssus*, new species. Values separated by a pipe "|" are left|right or upper|lower.

| | Holotype | Paratypes | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | BPBM 40861 | BMNH 2007.10.31.1 | BPBM 40855 | BPBM 40855 | BPBM 40855 | CAS 225755 | MNHN 2007-1922 | USNM 391136 | USNM 391136 | WAM P.32898 |
| standard length (mm) | 81.6 | 50.2 | 37.6 | 47.2 | 98.0 | 64.1 | 63.7 | 44.4 | 90.2 | 64.5 |
| body depth | 57.84 | 60.16 | 54.52 | 63.35 | 56.43 | 56.47 | 58.40 | 61.49 | 58.76 | 56.28 |
| body width | 17.89 | 17.13 | 15.43 | 17.80 | 21.33 | 19.03 | 17.43 | 17.79 | 19.51 | 18.45 |
| head length | 33.21 | 35.06 | 35.11 | 35.59 | 32.76 | 33.85 | 33.91 | 35.81 | 33.70 | 33.33 |
| snout length | 8.09 | 7.57 | 6.12 | 7.63 | 6.22 | 6.86 | 8.48 | 6.76 | 7.87 | 7.29 |
| orbit diameter | 12.50 | 14.54 | 15.43 | 15.25 | 12.35 | 12.95 | 13.34 | 15.32 | 11.64 | 13.18 |
| interorbital width | 11.89 | 12.95 | 13.56 | 13.56 | 12.55 | 12.17 | 11.62 | 12.84 | 11.86 | 12.25 |
| caudal-ped. depth | 15.32 | 16.14 | 13.56 | 15.68 | 15.20 | 15.29 | 14.91 | 14.64 | 15.30 | 15.04 |
| caudal-ped. length | 11.03 | 9.56 | 9.31 | 8.47 | 9.80 | 8.42 | 8.01 | 8.56 | 8.76 | 7.60 |
| upper jaw length | 9.31 | 9.56 | 10.11 | 9.96 | 8.27 | 9.98 | 9.26 | 10.36 | 8.20 | 9.77 |
| predorsal length | 43.59 | 42.41 | 43.09 | 44.58 | 43.32 | 41.84 | 39.39 | – | 40.38 | 44.28 |
| spinous dorsal-fin base | 44.68 | 45.30 | 41.76 | 46.10 | 49.48 | 45.98 | 44.46 | – | 45.21 | 45.71 |
| soft dorsal-fin base | 17.39 | 17.49 | 15.43 | 16.82 | 17.36 | 15.79 | 15.98 | 17.07 | 17.05 | 17.71 |
| 1st dorsal spine | 9.22 | 11.24 | 10.85 | 12.86 | 10.12 | 11.01 | 10.00 | – | 9.08 | 10.67 |
| 2nd dorsal spine | 15.05 | 17.95 | 16.62 | 19.15 | 16.31 | 16.93 | 16.92 | 17.73 | 14.01 | 16.96 |
| 3rd dorsal spine | 18.49 | 21.37 | 20.05 | 22.10 | 20.36 | 20.66 | 20.82 | 21.17 | 18.45 | 20.99 |
| 4th dorsal spine | 20.00 | 22.19 | 20.59 | 22.52 | 22.23 | 21.20 | 21.76 | 22.50 | 19.70 | 21.94 |
| 5th dorsal spine | 20.48 | 21.41 | 20.72 | 22.80 | 22.19 | 21.00 | 22.37 | 22.73 | 19.81 | 21.94 |
| 6th dorsal spine | 20.43 | 22.07 | 20.08 | 22.12 | 22.46 | 20.37 | 21.85 | 22.48 | 20.06 | 21.78 |
| last dorsal spine | 16.16 | 16.37 | 13.51 | 16.08 | 16.38 | 15.90 | 15.79 | 16.19 | 14.94 | 15.26 |
| longest dorsal ray | 22.79 | 20.52 | – | 21.40 | 23.78 | 22.00 | 19.78 | – | 21.84 | 21.55 |
| preanal length | 70.25 | 74.22 | 72.71 | 71.53 | 70.86 | 72.53 | 72.42 | 70.52 | 76.64 | 72.95 |
| 1st anal spine | 9.15 | 10.64 | 9.79 | 11.42 | 9.50 | 10.09 | 9.80 | 8.99 | 9.10 | 9.94 |
| 2nd anal spine | 24.80 | 26.35 | 23.59 | 26.78 | 27.32 | 25.55 | 23.75 | 25.27 | 24.42 | 26.91 |
| Longest anal ray | 22.67 | 23.84 | – | 23.14 | 23.08 | 22.45 | 22.59 | – | 21.64 | 24.09 |
| caudal length | 34.56 | 34.86 | 28.46 | 33.05 | 33.67 | 34.01 | 30.46 | 27.48 | 33.04 | 31.94 |
| caudal concavity | 17.16 | 13.35 | 12.50 | 17.16 | 13.06 | 16.69 | – | – | 17.41 | 22.02 |
| longest pectoral ray | 36.15 | 36.06 | 34.31 | 34.53 | 34.39 | 36.97 | 32.50 | 34.91 | 34.81 | 37.67 |
| prepelvic length | 44.35 | 49.94 | 48.40 | 46.97 | 45.22 | 47.33 | 49.54 | 44.12 | 48.70 | 45.55 |
| pelvic-spine length | 19.24 | 20.12 | 18.35 | 19.49 | 20.20 | 19.66 | 18.68 | 19.37 | 17.63 | 18.76 |
| 1st pelvic soft ray | 34.93 | – | 36.17 | 36.86 | 26.63 | 39.31 | 33.28 | – | 24.83 | 35.50 |
| dorsal rays | XIV,13 | XIV,13 | XIV,13 | XIV,13 | XIV,13 | XIV,12 | XIV,13 | XIII,12 | XIV,13 | XIV,13 |
| anal rays | II,13 | II,13 | II,12 | II,14 | II,13 | II,13 | II,13 | II,13 | II,14 | II,13 |
| pectoral rays | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 18 | 19 |
| pelvic rays | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 |
| principal caudal rays | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 |
| procurrent caudal rays | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 |
| spiniform caudal rays | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 |
| tubed l.l. scales | 16\|14 | 15\|14 | – | 14\|14 | 16\|15 | 15\|14 | 14\|14 | 11\|15 | 15\|15 | 15\|15 |
| pored ped. scales | 7\|6 | 7\|6 | 8\|– | 7\|– | 7\|7 | 7\|5 | 6\|6 | 7\|6 | 7\|7 | 5\|6 |
| scales above l.l. | 3.5\|3.5 | 3.5\|3 | 3.5\|3.5 | 3.5\|3 | 3\|3 | 3\|– | 3\|– | 3.5\|3.5 | 3\|3 | –\|3 |
| scales below l.l. | 9\|9 | 9\|9 | –\|– | 9\|9 | 9\|10 | 10\|– | 9\|9 | 9\|9 | 9\|10 | 9\|10 |
| circumped. scales | 15 | 15 | – | 15 | 15 | – | 14 | 14 | 14 | 14 |
| gill rakers | 7+18 | 6+18 | 7+18 | 7+18 | –+18 | 7+18 | 7+18 | 7+18 | 7+17 | 7+18 |
| supraneural bones | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| vertebrae | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 |

**Paratypes.** BMNH 2007.10.31.1[65] (50.2 mm SL) [PCMB 3103[66]]. BPBM 40855[67] (3; 37.6–98.0 mm SL) [PCMB 3100[68], 3102[69]]. CAS 225755[70] (64.1 mm SL) [PCMB 3105[71]]. MNHN 2007.1922[72] (63.7 mm SL) [PCMB 3104[73]]. USNM 391136[74] (2; 44.4–90.2 mm SL) [PCMB 3101[75]]. WAM P.32898-001[76] (64.5 mm SL) [PCMB 3106[77]]. All from same locality as holotype: sand and rubble slope with scattered rock outcroppings, 107–116 m, quinaldine and hand net, R.L. Pyle and B.D. Greene, 25 April 2007.

**Diagnosis.** Dorsal rays XIV,12–13 (usually 13); anal rays II,12–14 (usually 13); pectoral rays 18–19 (usually 19); spiniform caudal rays 3; tubed lateral-line scales 14–16; gill rakers 6–7+17–18 (usually 7+18; total 24–25, usually 25); body depth 1.58–1.83 in SL; color when fresh dark gray with a large iridescent dark blue spot at center of each scale; membranes on median fins and pelvic fins opaque charcoal gray, with an iridescent dark blue margin on the spinous portion of the dorsal and anal fins; caudal fin mottled iridescent dark blue and black; pectoral fins with a black ovoid spot covering the basal portion and pectoral-fin axil.

**Description.** Dorsal rays XIV,13 (two paratypes with XIV,12); anal rays II,13 (II,12–14); all dorsal and anal rays branched, the last to base in some specimens; pectoral rays 19 (one paratype with 18), the upper 2 and lowermost unbranched; pelvic rays I,5; principal caudal rays 8+7=15; upper and lower procurrent caudal rays 5, the anterior 3 spiniform, the posterior 2 segmented and unbranched; tubed lateral-line scales 16|14 (14–16 except for one paratype with 11|15); posterior midlateral scales with a pore or deep pit 7|6 (5–8); scales above dorsal fin to origin of dorsal fin 3.5 (3–3.5); scales below lateral line to origin of anal fin 9 (9–10); gill rakers 7+18=25 (6–7+17–18=24–25), 6 gill rakers on upper limb of gill arch in one paratype, 17 gill rakers on lower limb of gill arch in one paratype); surpaneural (predorsal) bones 3; vertebrae 12+13.

Body moderately deep, depth 1.73 (1.58–1.83) in SL, and compressed, the width 3.23 (2.65–3.56) in body depth; head length 3.01 (2.79–3.05) in SL; dorsal profile of head with slight convexity anterior to eye, slight concavity dorsal to eye, and slight convexity on nape; snout shorter than orbit diameter, its length 4.11 (4.00–5.74) in head length; orbit diameter 2.66 (2.28–2.90) in head length; interorbital space convex, its width 2.79 (2.59–2.92) in head length; caudal-peduncle depth 2.17 (2.15–2.59) in head; caudal-peduncle length 3.01 (3.34–4.39) in head.

Mouth terminal, small, oblique, the upper jaw forming an angle of about 40º to horizontal axis of head and body; posterior edge of maxilla reaching slightly beyond a vertical at anterior edge of pupil, the upper jaw length 3.57 (3.39–4.11) in head; an outer row of conical teeth in each jaw, largest anteriorly; about 27 upper and about 20 lower teeth on each side of jaw; a narrow band of villiform teeth lingual to outer row, in 2–3 irregular rows anteriorly, narrowing to a single row on side of jaws; tongue triangular with rounded tip; gill rakers long and slender, the longest on lower limb near angle about four-fifths length of longest gill filaments; nostril with a fleshy rim, more elevated on posterior edge and located at level of middle of pupil, slightly less than one-third distance from front of snout to base of upper lip.

Opercle ending posteriorly in a flat spine, the tip relatively obtuse and obscured by a large scale; margin of preopercle smooth, the posterior margin extending dorsally to level of upper edge of pupil; suborbital with free lower margin extending nearly to a vertical at posterior edge of pupil.

Scales finely ctenoid; anterior lateral line ending beneath rear portion of spinous dorsal fin (between 11th and 12th dorsal-fin spines); head scaled except lips, tip of snout, and a narrow zone from orbit to edge of snout containing nostrils; a scaly sheath at base of dorsal and anal fins, about two-thirds pupil diameter at base of middle of spinous portion of dorsal fin, progressively narrower on soft portion; a column of scales on each membrane of dorsal fin, narrowing distally, those on spinous portion of dorsal progressively longer, reaching about two-thirds distance to spine tips on posterior membranes; scales on anal-fin membrane in two columns, progressively smaller distally; small scales on caudal fin extending slightly more than two-thirds distance to posterior margin; small scales on basal one-fifth of pectoral fins; a median scaly process extending posteriorly from between base of pelvic fins, its length about half that of pelvic spine; axillary scale above base of pelvic spine about one-half length of spine. Origin of dorsal fin over second lateral-line scale, the pre-dorsal length 2.29 (2.24–2.54) in SL; base of spinous portion of dorsal fin contained 2.24 (2.02–2.39) in SL; base of soft

portion of dorsal fin contained 5.75 (5.65–6.48) in SL; first dorsal spine 10.85 (7.78–11.01) in SL; second dorsal spine 6.64 (5.22–7.14) in SL; third dorsal spine 5.41 (4.53–5.42) in SL; fourth dorsal spine 5.00 (4.44–5.08) in SL; fifth dorsal spine 4.88 (4.39–5.05) in SL; sixth dorsal spine 4.90 (4.45–4.99) in SL; last dorsal spine 6.19 (6.11–7.40) in SL; membranes of spinous portion of dorsal fin moderately incised; fourth dorsal soft ray longest, sometimes with a filamentous extension, its length 4.39 (4.21–5.06) in SL; first anal spine 10.92 (8.76–11.13) in SL; second anal spine 4.03 (3.66–4.24) in SL; first anal soft ray the longest, its length 4.41 (4.15–4.62) in SL; caudal fin forked, without significant filamentous extensions, its length 2.89 (2.87–3.64) in SL, the caudal concavity 5.83 (4.54–8.00) in SL; fourth pectoral-fin ray longest, 2.77 (2.65–3.08) in SL; pelvic spine 5.20 (4.95–5.67) in SL; first soft ray of pelvic fin filamentous, usually reaching to first through third anal-fin ray (when not broken or damaged), its length 2.86 (2.54–4.03) in SL.

Color of adults and juveniles when fresh predominantly charcoal gray, a large iridescent dark blue spot at center of each scale (including scales on head and median fins), blue spots occupying about half of visible area of each scale on body, decreasing in size slightly towards abdomen and ventral portion of body, blue spots forming a near-continuous line along base of dorsal and anal fins, a vertical column of scales with iridescent dark blue spots extending dorsally on each interspinous membrane of dorsal fin, blue spots on scales covering soft portions of dorsal and anal fins varying in size, forming a mottled pattern of blue and black; membranes on median fins and pelvic fins opaque charcoal gray, with an iridescent dark blue margin on spinous portion of the dorsal fin, and a broad iridescent dark blue margin on the anal fin; caudal fin mottled iridescent dark blue and black; pelvic-fin spine entirely iridescent dark blue, an iridescent dark blue streak on the pelvic-fin soft rays, the filamentous extension on the pelvic fin white; pectoral fins translucent charcoal gray with a ovoid black spot on base and axil; iris charcoal gray to black; iridescent blue fleshy orbit margin.

Color in alcohol similar to general color pattern when fresh, except charcoal gray pigment sometimes fades to brownish gray, and iridescent dark blue is either faded to pale gray blue, or has disappeared altogether (leaving the specimen uniform brownish gray, or sometimes charcoal gray overall).

**Distribution.** Only collected from the type locality; also observed at similar depths at Augulpelu Reef in Palau. An individual of what appears to be this species was observed and photographed by Mr. Forrest Young at 120–150 m near Manado, Sulawesi, Indonesia.

**Etymology.** Named *abyssus*, a Latinized form of the Greek noun *abyssos* (meaning "abyss"), to honor the documentary film *Pacific Abyss*, produced by the British Broadcasting Corporation (BBC), which funded the expedition on which the type specimens were collected. The vernacular name "Deep Blue Chromis", a reference to both the life color of this species and the relatively (within the context of the genus) deep-dwelling habits, is suggested instead of the more literally translated "Abyss Chromis", so as not to imply that the species inhabits depths commonly defined as "abyssal".

**Remarks.** This species was first observed by the senior author on May 10, 1997, during a mixed-gas rebreather dive to 120 m on the east side of Augulpelu Reef; Palau (07º 16.41' N, 134º 31.44' E). It was later observed at the same reef at depths of 117–139 m from a submersible by Patrick L. Colin and Lori J. Bell in February–March, 2001. In April 2005, Mr. Forrest Young and colleagues observed several individuals of this (or a very similar) species during mixed-gas rebreather dives at depths of 120–150 m at Manado, Sulawesi, Indonesia. The type specimens included herein are the first of this species to be collected.

From these observations, *C. abyssus* appears to prefer depths in excess of 115 m, staying close to the substratum among boulders and rock outcroppings, where it takes refuge in small caves and holes. Juveniles and some subadults were also observed around limestone talus. Adults were usually observed singly or in pairs, while subadults and juveniles were seen in small groups. All type specimens were collected in the same general area, where the species is not uncommon. Other *Chromis* observed in the vicinity include three of the new species described herein (*C. brevirostris*, *C. degruyi*, and *C. earina*).

*Chromis abyssus* is not obviously allied with any other known species of the genus. It shares some similarities with a group of seven Indo-Pacific deep-dwelling *Chromis* species, characterized by a similar stout

body shape, a large eye, and usually XIV dorsal spines. In their 1985 description of *C. abyssicola*, Allen and Randall noted a complex of deep-dwelling *Chromis* species distinguished by, among other characters, 19 or 20 pectoral rays, and 28–34 gill rakers. In addition to *C. abyssicola*, their complex included *C. megalopsis*[78] Allen 1976 (now regarded as a junior synonym of *C. mirationis* Tanaka 1917), *C. mirationis* Tanaka 1917 and *C. struhsakeri* Randall and Swerdloff 1973, to which we would add the subsequently named *C. planesi*[79] Lecchini and Williams 2004. *C. abyssus* has fewer pectoral rays (18 or 19) and fewer gill rakers (24–28) than members of this species complex, and may comprise a second grouping of deep-dwelling *Chromis* species, along with *C. okamuri* Yamakawa and Randall 1989 from Japan, the East African *C. woodsi*[80] Bruner and Arnam 1979 (both easily distinguished from *C. abyssus* on the basis of color and certain morphological characters such as number of gill rakers and tubed lateral-line scales), as well as the two new species *C. circumaurea* and *C. degruyi*, both described herein. Of the remaining two deep-dwelling Indo-Pacific stout-bodied *Chromis* species with XIV spines, *C. onumai* Senou and Kudo 2007 has the high pectoral-ray count of the first complex (19–20) and the gill-raker count of the second (25–27). *C. axillaris*[81] (Bennett 1831) has a wide gill-raker range (26–30) and cannot easily be placed in either complex by this character. Of the three new *Chromis* with XIV dorsal-fin spines described herein (*C. abyssus*, *C. circumaurea*, and *C. degruyi*), each has a unique and distinctive color pattern, and is readily distinguished from the others. Among the three, the former two (*C. abyssus* and *C. circumaurea*) share the most similarities both in terms of morphology and in Barcode DNA sequence data.

***Chromis brevirostris*, new species**
urn:lsid:zoobank.org:act:2BD7CAEF-F09B-4647-B92F-62CBBC0E565C
Shortsnout Chromis
(Figs. 2a –2c; Tables 2 & 3; Morphbank[82]; GenBank[83]; Barcode[84])

**Holotype.** BPBM 40804[85] (63.7 mm SL), Caroline Islands; Puluwat Atoll; Alet Islet, S side (7°21'15.44"N, 149°10'47.03"E): outer reef drop-off with small caves and holes, 100–103 m, quinaldine and hand net, R.L. Pyle and B.D. Greene, 11 April 2007 [PCMB 3033[86]].

**Paratypes.** BMNH 2007.10.31.2[87] (55.2 mm SL), Belau (Palau) Islands; Augulpelu Reef, W side (7°16'24.6"N, 134°31'26.4"E): shelf flanked by numerous small caves, 90 m, hand net, R.L. Pyle, 16 May 1997. BPBM 37671[88] (55.4 mm SL), same collecting data as BMNH 2007.10.31.2, except collected on 6 May 1997. BPBM 37713[89] (59.6 mm SL), same locality and depth as and BPBM 37671: cave in drop-off, rotenone, R.L. Pyle and J.L. Earle, 12 May 1997. BPBM 39993[90] (62.5 mm SL), Fiji Islands; Viti Levu Island; outside of Suva Harbor; S of "Fish Patch"; southern wall (18°9'32.7"S, 178°23'58.44"E): sloping sand and rubble with rock outcroppings, 87–92 m, rotenone, R.L. Pyle and D.F. Pence, 3 February 2002. BPBM 40422[91] (3; 25.5–46.9 mm SL), Marshall Islands; Kwajalein Atoll, S end; Ennubuj (= Carlson) islet; ocean side: cave within ledge, 100 m, rotenone, B.D. Greene, 30 December 2005. BPBM 40703[92] (2; 50.9–59.5 mm SL), Vanuatu; Espiritu Santo; off W coast (15°33'39.28"S, 167°16'29.82"E): steep slope with rubble and sand, with some rocky outcrops with small caves and undercuts; many gorgonians, 60 m, quinaldine and hand net, B.D. Greene, 7 October 2006. CAS 225756[93] (2; 46.5–50.8 mm SL), same collecting data as BPBM 39993. MNHN 2007-1923[94] (57.9 mm SL), Vanuatu; Espiritu Santo; off N end of Tutuba Island (15°32'28.57"S, 167°16'51.17"E): at base of outer reef drop-off ranging from 60–100 m, 100 m, rotenone and vacuum device, R.L. Pyle, 10 October 2006. USNM 391137[95] (4; 41.6–68.5 mm SL), Caroline Islands; Yap, S end; "Magic Kingdom" (9°26'3.41"N, 138°2'5.96"E): among boulders on sloping shelf above deep drop-off, 98–100 m, hand net, R.L. Pyle and B.D. Greene, 20 April 2007 [PCMB 3072[96], 3073[97], 3074[98], 3075[99]]. WAM P.32899-001[100] (2; 58.1–61.4 mm SL), Belau (Palau) Islands; Augulpelu Reef, W side; shelf flanked by numerous small caves (7°16'24.6"N, 134°31'26.4"E), 90 m, hand net, R.L. Pyle and J.L. Earle, 17 May 1997.

**Diagnosis.** Dorsal rays XIII,13–14 (usually 14); anal rays II,15–16; pectoral rays 18–19 (usually 19); spiniform caudal rays 2–3 (usually 3); tubed lateral-line scales 14–16; gill rakers 6–8+19–22 (usually 6–7+19–21; total 26–29); body depth 1.57–1.77 in SL; color when fresh pale lavender-tinged gray dorsally, paler ventrally; three or four rows of scales dorsally from nape to upper caudal peduncle with gold edges; small scales on basal sheath of dorsal fin almost entirely gold; median fin membranes lavender gray or translucent blue, suffused with gold color; iris yellow.

**Description.** Dorsal rays XIII,14 (two paratypes with 13); anal rays II,16 (one paratype with 15, another paratype deformed with only 13); all dorsal and anal rays branched, the last to base; pectoral rays 18 (one paratype with 19 on only the right side), the upper 2 and lowermost unbranched; pelvic rays I,5; principal caudal rays 8+7=15 (one paratype with 7+7=14) ; upper and lower procurrent caudal rays 5, the anterior 3 (2–3) spiniform (when 3, the anteriormost vestigial and not penetrating scales), the posterior 2 segmented and unbranched; tubed lateral-line scales 15 (14–16); posterior midlateral scales with a pore or deep pit 7 (0–8); scales above dorsal fin to origin of dorsal fin 4 (3.5–4); scales below lateral line to origin of anal fin 10 (9–10, usually 10); gill rakers 8+21=29 (6–8+19–22=26–29, 6 gill rakers on upper limb of gill arch in one paratype, 22 gill rakers on lower limb of gill arch in one paratype); surpaneural (predorsal) bones 3; vertebrae 12+13.

Body moderately deep, depth 1.69 (1.57–1.77) in SL, and compressed, the width 3.04 (2.94–3.75) in body depth; head length 3.13 (2.71–3.26) in SL; dorsal profile of head smoothly convex, sometimes with a very slight concavity anterior to eye; snout shorter than orbit diameter, its length 4.25 (3.45–4.80) in head length; orbit diameter 2.41 (2.00–2.66) in head length; interorbital space convex, its width 2.60 (2.56–3.39) in head length; caudal-peduncle depth 2.05 (1.86–2.24) in head; caudal-peduncle length 3.49 (2.82–4.49) in head.

Mouth terminal, small, oblique, the upper jaw forming an angle of about 42º to horizontal axis of head and body; posterior edge of maxilla reaching slightly beyond a vertical at anterior edge of pupil, the upper jaw length 3.28 (2.91–3.57) in head; teeth multi-serial, an outer row of conical teeth in each jaw, largest anteriorly; about 25 upper and about 21 lower teeth on each side of jaw; a narrow band of villiform teeth lingual to outer row, in 2–3 irregular rows anteriorly, narrowing to a single row on side of jaws; tongue triangular with rounded tip; gill rakers long and slender, the longest on lower limb near angle about two-thirds length of longest gill filaments; nostril with a fleshy rim, more elevated on posterior edge and located at level of middle of pupil, slightly less than one-sixth distance from front of snout to base of upper lip.

Opercle ending posteriorly in a flat spine, the tip broadly obtuse and obscured by a large scale; margin of preopercle smooth, the posterior margin extending dorsally to level of upper edge of pupil; suborbital with free lower margin extending nearly to a vertical at posterior edge of orbit.

Scales finely ctenoid; anterior lateral line ending beneath rear portion of spinous dorsal fin (between 12th and 13th dorsal-fin spines); head scaled except lips, tip of snout, and a narrow zone from orbit to edge of snout containing nostrils; a scaly sheath at base of dorsal and anal fins, about two-thirds pupil diameter at base of middle of spinous portion of dorsal fin, progressively narrower on soft portion; a column of scales on each membrane of dorsal fin, narrowing distally, those on spinous portion of dorsal progressively longer, reaching about four-fifths distance to spine tips on posterior membranes; scales on anal-fin membrane in two columns, progressively smaller distally; small scales on caudal fin extending slightly more than two-thirds distance to posterior margin; small scales on basal one-sixth of pectoral fins; a median scaly process extending posteriorly from between base of pelvic fins, its length about half that of pelvic spine; axillary scale above base of pelvic spine slightly more than one-half length of spine.

Origin of dorsal fin over second lateral-line scale, the pre-dorsal distance 2.50 (2.37–2.76) in SL; base of spinous portion of dorsal fin contained 2.09 (2.02–2.42) in SL; base of soft portion of dorsal fin contained 5.20 (4.69–5.38) in SL; first dorsal spine 9.41 (7.61–11.00) in SL; second dorsal spine 6.83 (5.54–8.20) in SL; third dorsal spine 6.07 (4.51–6.98) in SL; fourth dorsal spine 5.79 (4.35–6.45) in SL; fifth dorsal spine 5.73 (4.18–6.31) in SL; sixth dorsal spine 5.67 (3.94–6.14) in SL; last dorsal spine 5.91 (4.71–6.25) in SL; membranes of spinous portion of dorsal fin moderately incised; fourth dorsal soft ray longest, usually with a fila-

mentous extension, its length 4.20 (2.55–4.34) in SL; first anal spine 9.30 (8.03–10.29) in SL; second anal spine 4.95 (4.32–5.44) in SL; eleventh anal soft ray the longest, its length 4.99 (3.05–5.05) in SL; caudal fin forked, its length 1.59 (1.19–2.44) in SL, the third or fourth principal caudal ray (upper and lower) with filamentous extension, the caudal concavity 2.31 (1.52–4.19) in SL; fourth pectoral-fin ray longest, 2.41 (2.30–2.76) in SL; pelvic spine 4.99 (3.99–5.63) in SL; first soft ray of pelvic fin filamentous, usually reaching to second anal-fin ray (when not broken or otherwise damaged), its length 3.94 (2.41–3.76) in SL.

Color of adults and juveniles when fresh pale lavender-tinged gray dorsally, fading to pale bluish-white on thorax; pale bluish gray ventrally from anus to caudal fin; three or four rows of scales dorsally from nape to upper caudal peduncle with gold edges; small scales on basal sheath of dorsal fin can be almost entirely gold; faint gold tinge on posterior operculum and on scales along ventral margin anterior to pelvic-fin origin; intensity of gold color variable, appearing more pearlescent underwater in some individuals; dorsal- and anal-fin membranes pale translucent blue, suffused with gold, particularly basal 2/3 and distal portion of spinous dorsal fin, and basal and distal 1/3 of anal fin; soft dorsal fin gold tinged except for median portion; the extreme distal margin of the dorsal fin, anal fin and pelvic fin pale turquoise blue; caudal fin lavender gray with faint gold wash on membranes; pectoral fin translucent; pelvic fins white; iris yellow, fleshy membrane of orbit turquoise blue, especially dorsally; interorbital space turquoise above upper lip, extending dorsally into nape in some specimens.

Color in alcohol drab grayish light brown over most of body, darker brown above lateral line; scales above lateral line with pale spot corresponding to gold markings in life; dorsal fin uniform brown except for a pale gray submarginal line; anal fin brown with pale grayish brown markings and submarginal line; interorbital region and anterior head uniform brown; thorax slightly lighter than body color, with pale ventral edge.

**Distribution.** This species has been observed or collected from the Marshall Islands southward to Fiji, across the Caroline Islands from Puluwat to Palau, and south to Vanuatu. An underwater photo of what seems to be this species (or an undescribed species very similar to *C. brevirostris*) taken in Bali, Indonesia, appears as "*Chromis* sp." on p. 531 of Kuiter & Debelius, 2006. *C. brevirostris* was not observed at Rarotonga (Cook Islands), Kiritimati (Line Islands), or American Samoa during brief surveys of deep reefs at those localities.

**Etymology.** Named *brevirostris*, an adjective derived from the Latin words *brevis* (meaning "short") and *rostrum* (meaning "beak" or "snout"), in reference to the very short snout of this species relative to other species in the genus.

**Remarks.** Generally abundant in its typical environment, which is characterized by steep slopes and drop-offs at depths of about 90–120 m. Usually found in association with small holes and limestone talus, often in aggregations ranging from a half-dozen to several dozen individuals feeding low in the water column.

*Chromis brevirostris*, as well as the new species *C. earina* (described herein) are both deep-dwelling *Chromis* species with XIII dorsal spines, a deep body (1.57–1.9 in S.L.), short snout (3.45–4.8 in head), and large eye (2.0–2.6 in head). Most counts are similar, and these two species appear to have more affinities with each other than with any other species in the genus. They can be readily distinguished from each other on the basis of color and by differences in general body shape (particularly the shape of the head profile, which is smoothly convex in *C. brevirostris*, as opposed to slightly concave dorsal to the eye in *C. earina*), and dorsal- and anal-fin soft ray counts. *Chromis brevirostris* has 13–14 dorsal-fin soft rays and 15–16 anal-fin soft rays (except for one deformed individual with only 13 anal-fin soft rays); whereas *C. earina* has 11–12 dorsal-fin soft rays and 12 anal-fin soft rays. Table 3 lists selected characters for four Indo-Pacific *Chromis* species which seem to be most similar to *C. brevirostris* and *C. earina*. These four species, including *C. alpha*[101] Randall 1988a, *C. nigroanalis*[102] Randall 1988b, *C. ovatiformis*[103] Fowler 1946, and *C. pembae*[104] Randall and McCosker 1992 (which we collectively and informally refer to here as the "*Chromis alpha* complex") all have XIII dorsal spines, a roughly similar body shape, and have been recorded at a depth of 40 m or greater. For each of these species, at least one count, and all gill raker counts, range outside the respective ranges for *C. brevirostris* and *C. earina*.

**TABLE 2.** Proportional measurements (%SL) and counts of *Chromis brevirostris*, new species. Values separated by a pipe "|" are left|right or upper|lower.

| | Holotype | | Paratypes | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BPBM 40804 | BMNH 2007.10.31.2 | BPBM 37671 | BPBM 37713 | BPBM 39993 | BPBM 40422 | BPBM 40422 | BPBM 40422 | BPBM 40703 | BPBM 40703 |
| standard length (mm) | 63.7 | 55.2 | 55.4 | 59.6 | 62.5 | 25.5 | 28.8 | 46.9 | 50.9 | 59.5 |
| body depth | 59.34 | 61.78 | 61.17 | 62.21 | 60.58 | 63.37 | 63.74 | 59.70 | 61.18 | 60.13 |
| body width | 19.51 | 18.59 | 17.87 | 19.80 | 19.90 | 18.16 | 16.99 | 17.44 | 18.45 | 18.99 |
| head length | 31.92 | 32.19 | 32.98 | 30.72 | 31.02 | 36.90 | 35.05 | 32.11 | 33.52 | 33.71 |
| snout length | 7.50 | 8.21 | 8.36 | 8.41 | 7.54 | 8.08 | 8.34 | 8.70 | 8.06 | 9.80 |
| orbit diameter | 13.23 | 13.84 | 13.36 | 12.68 | 13.92 | 17.37 | 17.44 | 13.86 | 15.15 | 15.31 |
| interorbital width | 12.28 | 11.58 | 11.57 | 12.01 | 11.98 | 10.86 | 11.70 | 11.94 | 11.71 | 11.58 |
| caudal-ped. depth | 15.53 | 16.36 | 16.48 | 16.48 | 16.05 | 16.86 | 15.92 | 15.71 | 15.56 | 15.09 |
| caudal-ped. length | 9.12 | 8.77 | 8.94 | 9.01 | 9.74 | 10.43 | 8.41 | 8.57 | 7.49 | 8.27 |
| upper jaw length | 9.72 | 9.96 | 10.65 | 10.08 | 9.41 | 12.67 | 10.93 | 9.79 | 10.65 | 10.42 |
| predorsal length | 39.97 | 40.87 | 41.26 | 40.29 | 36.26 | 41.96 | 41.11 | 40.09 | 42.28 | 41.23 |
| spinous dorsal-fin base | 47.82 | 47.90 | 48.94 | 47.11 | 44.53 | 41.88 | 44.08 | 46.08 | 46.95 | 44.97 |
| soft dorsal-fin base | 19.22 | 20.72 | 19.82 | 20.74 | 20.86 | 21.02 | 19.55 | 20.11 | 20.33 | 19.56 |
| 1st dorsal spine | 10.63 | 10.65 | 9.84 | 10.50 | 10.48 | 13.14 | 12.73 | 9.77 | 11.14 | 9.26 |
| 2nd dorsal spine | 14.65 | 14.80 | 14.77 | 14.75 | 14.53 | 18.04 | 17.75 | 14.52 | 14.93 | 13.01 |
| 3rd dorsal spine | 16.47 | 16.56 | 17.62 | 17.37 | 16.69 | 22.16 | 20.24 | 16.50 | 17.27 | 15.39 |
| 4th dorsal spine | 17.28 | 17.92 | 18.61 | 18.61 | 17.58 | 22.98 | 20.45 | 18.10 | 18.55 | 16.74 |
| 5th dorsal spine | 17.44 | 18.42 | 17.49 | 18.64 | 18.37 | 23.92 | 22.39 | 18.29 | 18.84 | 17.13 |
| 6th dorsal spine | 17.63 | 18.89 | 18.54 | 19.03 | 18.64 | 25.37 | 21.42 | 18.70 | 18.72 | 17.39 |
| last dorsal spine | 16.92 | 19.53 | 18.92 | 18.51 | 16.30 | 21.22 | 19.00 | 17.48 | 18.72 | 18.49 |
| longest dorsal ray | 23.81 | 37.43 | – | 28.26 | 26.42 | 39.18 | 31.59 | 34.93 | 29.71 | 27.19 |
| preanal length | 63.86 | 63.66 | 62.71 | 60.97 | 65.34 | 68.39 | 62.18 | 60.15 | 61.87 | 66.99 |
| 1st anal spine | 10.75 | 11.29 | 10.97 | 10.08 | 10.46 | 12.16 | 12.46 | 10.94 | 10.69 | 9.98 |
| 2nd anal spine | 20.19 | 20.92 | 21.90 | 19.55 | 20.46 | 22.59 | 23.15 | 20.13 | 21.71 | 20.94 |
| Longest anal ray | 20.03 | 26.41 | – | 26.28 | 26.21 | 29.37 | 27.68 | 32.75 | 25.28 | 22.86 |
| caudal length | 62.92 | 61.39 | – | 61.80 | 63.22 | 83.88 | 66.47 | 53.30 | 54.11 | 41.06 |
| caudal concavity | 43.22 | 38.10 | – | 44.38 | 46.38 | 65.96 | 36.85 | 33.52 | 35.62 | 23.88 |
| longest pectoral ray | 41.41 | 43.57 | – | 39.03 | 42.42 | 41.96 | 38.62 | 42.84 | 43.42 | 42.34 |
| prepelvic length | 40.89 | 43.51 | 41.48 | 40.60 | 46.74 | 49.88 | 44.88 | 40.21 | 40.84 | 48.30 |
| pelvic-spine length | 20.05 | 19.47 | 19.98 | 19.26 | 18.11 | 24.04 | 25.09 | 18.96 | 21.34 | 20.61 |
| 1st pelvic soft ray | 25.40 | 33.48 | | 37.89 | 26.62 | 41.57 | 41.35 | 36.35 | 36.66 | 32.69 |
| dorsal rays | XIII,14 | XIII,14 | XIII,13 | XIII,14 | XIII,14 | XIII,14 | XIII,14 | XIII,13 | XIII,14 | XIII,14 |
| anal rays | II,16 | II,16 | II,15 | II,16 | II,16 | II,16 | II,16 | II,16 | II,16 | II,16 |
| pectoral rays | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| pelvic rays | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 |
| principal caudal rays | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 |
| procurrent caudal rays | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 |
| spiniform caudal rays | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 2\|2 | 2\|2 | 3\|3 | 3\|3 | 3\|2 |
| tubed l.l. scales | 15\|15 | –\|16 | 16\|16 | 14\|14 | 14\|15 | 15\|14 | 15\|15 | 16\|16 | 14\|14 | 15\|15 |
| pored ped. scales | 7\|7 | 7\|7 | 6\|– | 6\|7 | 8\|7 | 2\|2 | 1\|0 | 7\|7 | 5\|6 | 6\|5 |
| scales above l.l. | 4\|4 | 3.5\|3.5 | 4\|4 | 3.5\|3.5 | 3.5\|3.5 | 4\|4 | 3.5\|3.5 | 3.5 | 3.5\|3.5 | 4\|3.5 |
| scales below l.l. | 10\|10 | 10\|– | 10\|– | –\|10 | 10\|9 | 10\|– | 10\|– | 10\|10 | 10\|10 | 10\|– |
| circumped. scales | 14 | 14 | 14 | 14 | 15 | 15 | 14 | 14 | 14 | 15 |
| gill rakers | 8+21 | 7+20 | 7+20 | 7+19 | 7+19 | 6+21 | 8+20 | 7+19 | 8+19 | 7+21 |
| supraneural bones | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| vertebrae | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 |

**TABLE 2 (continued).** Proportional measurements (%SL) and counts of *Chromis brevirostris*, new species. Values separated by a pipe "|" are left|right or upper|lower.

| | Paratypes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | CAS 225756 | CAS 225756 | MNHN 2007-1923 | USNM 391137 | USNM 391137 | USNM 391137 | USNM 391137 | WAM P.32899 | WAM P.32899 |
| standard length (mm) | 46.5 | 50.8 | 57.9 | 41.6 | 64.6 | 66.1 | 68.5 | 58.1 | 61.4 |
| body depth | 60.13 | 57.68 | 60.69 | 58.87 | 58.99 | 56.52 | 58.69 | 60.53 | 59.12 |
| body width | 17.68 | 16.10 | 19.29 | 16.73 | 18.20 | 19.14 | 19.61 | 20.59 | 18.52 |
| head length | 33.63 | 31.56 | 33.66 | 33.77 | 31.61 | 31.56 | 31.28 | 33.44 | 31.94 |
| snout length | 7.12 | 7.52 | 9.29 | 7.07 | 8.54 | 7.64 | 7.80 | 8.50 | 8.62 |
| orbit diameter | 14.84 | 14.70 | 14.49 | 14.71 | 11.89 | 12.77 | 12.12 | 12.98 | 12.49 |
| interorbital width | 11.42 | 11.59 | 12.02 | 11.66 | 12.07 | 11.51 | 12.09 | 12.01 | 12.04 |
| caudal-ped. depth | 15.55 | 15.65 | 16.29 | 15.77 | 15.77 | 14.86 | 15.85 | 16.44 | 16.86 |
| caudal-ped. length | 9.29 | 9.98 | 8.00 | 9.18 | 8.22 | 7.81 | 7.59 | 11.84 | 8.52 |
| upper jaw length | 10.45 | 9.57 | 10.12 | 9.50 | 9.27 | 8.99 | 9.49 | 9.90 | 9.87 |
| predorsal length | 39.10 | 38.80 | 41.19 | 36.97 | 39.97 | 39.03 | 39.49 | 38.67 | 39.93 |
| spinous dorsal-fin base | 46.09 | 43.86 | 49.62 | 41.37 | 44.85 | 45.08 | 46.23 | 44.01 | 46.69 |
| soft dorsal-fin base | 19.14 | 18.62 | 19.22 | 19.28 | 19.81 | 20.48 | 19.99 | 21.33 | 18.58 |
| 1st dorsal spine | 10.92 | 9.84 | 11.17 | 9.59 | 9.16 | 9.88 | 9.09 | 9.74 | 10.29 |
| 2nd dorsal spine | 15.46 | 14.07 | 15.56 | 15.41 | 12.94 | 12.19 | 12.31 | 13.30 | 14.43 |
| 3rd dorsal spine | 17.27 | 16.10 | 18.39 | 18.00 | 15.62 | 15.02 | 14.34 | 16.09 | 16.56 |
| 4th dorsal spine | 18.15 | 17.24 | 18.93 | 20.10 | 17.00 | 15.81 | 15.50 | 17.04 | 17.67 |
| 5th dorsal spine | 18.30 | 18.01 | 19.67 | 20.34 | 17.43 | 16.19 | 15.84 | 17.93 | 17.74 |
| 6th dorsal spine | 18.65 | 18.27 | 19.97 | 20.10 | 18.11 | 16.78 | 16.29 | 17.87 | 17.67 |
| last dorsal spine | 17.40 | 16.42 | 19.07 | 18.13 | 18.17 | 17.07 | 16.23 | 17.95 | 15.99 |
| longest dorsal ray | 30.69 | 31.04 | 26.34 | 35.00 | 35.84 | 25.73 | 23.04 | 32.19 | – |
| preanal length | 65.70 | 66.44 | 66.68 | 65.63 | 63.20 | 65.37 | 63.07 | 63.56 | 65.41 |
| 1st anal spine | 10.26 | 10.69 | 10.48 | 11.51 | 10.91 | 10.05 | 9.72 | 10.22 | 10.67 |
| 2nd anal spine | 20.84 | 20.85 | 22.63 | 22.21 | 19.95 | 19.02 | 18.39 | 18.97 | 18.42 |
| Longest anal ray | 24.92 | 24.55 | 20.67 | 22.60 | 19.80 | 21.45 | 23.99 | 26.30 | – |
| caudal length | 51.89 | – | 60.10 | 67.93 | – | 58.74 | 57.62 | 61.27 | 42.54 |
| caudal concavity | 34.69 | – | 34.91 | 53.10 | – | 40.97 | 37.20 | 39.35 | 23.88 |
| longest pectoral ray | 40.15 | 42.80 | 43.02 | 41.49 | 40.39 | 38.59 | 38.66 | 38.97 | 36.17 |
| prepelvic length | 45.98 | 46.63 | 47.03 | 48.10 | 44.20 | 46.41 | 43.84 | 45.73 | 45.99 |
| pelvic-spine length | 18.82 | 19.98 | 20.66 | 20.29 | 18.95 | 18.80 | 17.75 | 17.81 | 19.14 |
| 1st pelvic soft ray | 31.68 | 33.60 | 36.27 | 37.62 | 35.45 | 34.51 | 35.27 | 33.13 | 32.67 |
| dorsal rays | XIII,14 | XIII,14 | XIII,13 | XIII,14 | XIII,14 | XIII,14 | XIII,14 | XIII,14 | XIII,14 |
| anal rays | II,16 | II,16 | II,13 | II,16 | II,16 | II,16 | II,16 | II,16 | II,16 |
| pectoral rays | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| pelvic rays | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 |
| principal caudal rays | 8+7 | 8+7 | 7+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 |
| procurrent caudal rays | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 |
| spiniform caudal rays | 3\|3 | 3\|2 | 3\|2 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|2 |
| tubed l.l. scales | 14\|16 | 16\|14 | 14\|15 | 16\|15 | 15\|14 | 15\|15 | 15\|14 | 16\|16 | 15\|15 |
| pored ped. scales | 8\|7 | 5\|6 | 5\|5 | 2\|2 | 7\|7 | 7\|8 | 7\|7 | 5\|5 | 5\|7 |
| scales above l.l. | –\|– | 3.5\|– | 3.5\|3.5 | 4\|3.5 | 3.5\|3.5 | 3.5\|3.5 | 3.5\|4 | 4\|3.5 | 4\|4 |
| scales below l.l. | 10\|– | 10\|10 | 10\|10 | 10\|10 | 10\|10 | 10\|10 | 10\|10 | 10\|10 | 9\|9 |
| circumped. scales | 14 | 14 | 15 | 14 | 14 | 14 | 14 | 14 | 14 |
| gill rakers | 7+20 | 7+22 | 7+20 | 8+20 | 7+21 | 7+20 | 7+19 | 7+21 | 7+19 |
| supraneural bones | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| vertebrae | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 |

**TABLE 3.** Selected characters of *Chromis brevirostris*, *C. earina*, and the four species comprising what is referred to herein as the "*C. alpha* complex".

| Character | *C. brevirostris* | *C. earina* | *C. alpha* | *C. nigroanalis* | *C. ovatiformis* | *C. pembae* |
|---|---|---|---|---|---|---|
| body depth | 1.57–1.77 | 1.65–1.90 | 1.8–2.0 | 1.7–1.8 | 1.5–1.8 | 1.8–2.0 |
| dorsal soft rays | 13–14 | 11–12 | 12–13 | 11–12 | 12–13 | 11–12 |
| anal rays | 15–16 | 12 | 11–13 | 11–12 | 12–14 | 11 |
| pectoral rays | 18–19 | 17–18 | 16–18 | 17–18 | 16–18 | 17–19 |
| tubed lateral-line scales | 14–16 | 13–16 | 14–16 | 15–16 | 13–15 | 15–16 |
| gill rakers | 26–29 | 25–28 | 23–25 | 23–25 | 26–31 | 27–31 |

***Chromis circumaurea*, new species**

urn:lsid:zoobank.org:act:8ADC4817-8F1C-4C88-8B8A-5372A84CAEC9

Gold-rim Chromis

(Figs. 3a –3c, Table 4; Morphbank[105]; GenBank[106]; Barcode[107])

**Holotype.** BPBM 40836[108] (98.2 mm SL), Caroline Islands; Yap, S end; "Magic Kingdom" (9°26'3.41"N, 138°2'5.96"E): among boulders on sloping shelf above deep drop-off, 98–100 m, hand net, R.L. Pyle and B.D. Greene, 20 April 2007 [PCMB 3080[109]].

**Paratypes.** BMNH 2007.10.31.3[110] (102.4 mm SL) [PCMB 3081[111]]. CAS 225757[112] (97.6 mm SL) [PCMB 3078[113]]. MNHN 2007-1924[114] (92.5 mm SL) [PCMB 3076[115]]. USNM 391138[116] (94.2 mm SL) [PCMB 3077[117]]. WAM P.32900-001[118] (96.6 mm SL) [PCMB 3079[119]]. All with same data as holotype.

**Diagnosis.** Dorsal rays XIV,12–13 (usually 13); anal rays II, 13–14 (usually 13); pectoral rays 18–19; spiniform caudal rays 3; tubed lateral-line scales 16–17; gill rakers 6–7+20–21 (total 26–27); body depth 1.68–1.86 in SL; color when fresh mahogany brown with bright yellow distally on spinous portion of dorsal fin; soft portion of dorsal fin, caudal fin, and anal fin bright yellow.

**Description.** Dorsal rays XIV,13 (12 in one paratype); anal rays II,13 (14 in one paratype); all dorsal and anal rays branched, the last to base in some specimens; pectoral rays 19 (18–19), the upper 2 and lowermost unbranched; pelvic rays I,5; principal caudal rays 8+7=15; upper and lower procurrent caudal rays 5, the anterior 3 spiniform, the posterior 2 segmented and unbranched; tubed lateral-line scales 16|17 (16–17); posterior midlateral scales with a pore or deep pit 8 (5–8); scales above dorsal fin to origin of dorsal fin 3.5 (3–3.5); scales below lateral line to origin of anal fin 10 (9–10.5); gill rakers 6+21=27 (6–7+20–21= 26–27); surpaneural (predorsal) bones 3; vertebrae 12+13.

Body moderately deep, depth 1.71 (1.68–1.86) in SL, and compressed, the width 3.02 (2.93–3.22) in body depth; head length 3.28 (3.18–3.37) in SL; dorsal profile of head with slight convexity anterior to eye, slight concavity dorsal to eye, and slight convexity on nape; snout shorter than orbit diameter, its length 3.71 (3.82–4.30) in head length; orbit diameter 2.61 (2.35–2.63) in head length; interorbital space convex, its width 2.61 (2.54–2.74) in head length; caudal-peduncle depth 2.04 (2.02–2.04) in head; caudal-peduncle length 3.19 (2.72–3.40) in head.

Mouth terminal, small, oblique, the upper jaw forming an angle of about 40º to horizontal axis of head and body; posterior edge of maxilla reaching slightly beyond a vertical at anterior edge of pupil, the upper jaw length 3.09 (2.86–3.22) in head; teeth multi-serial, an outer row of conical teeth in each jaw, largest anteriorly; about 32 upper and about 26 lower teeth on each side of jaw; a narrow band of villiform teeth lingual to outer row, in 2–3 irregular rows anteriorly, narrowing to a single row on side of jaws; tongue triangular with rounded tip; gill rakers long and slender, the longest on lower limb near angle about three-fourths length of longest gill filaments; nostril with a fleshy rim, more elevated on posterior edge and located at level of middle of pupil, slightly less than one-third distance from front of snout to base of upper lip.

**TABLE 4.** Proportional measurements (%SL) and counts of *Chromis circumaurea*, new species. Values separated by a pipe "|" are left|right or upper|lower.

| | Holotype | Paratypes | | | | |
|---|---|---|---|---|---|---|
| | BPBM 40836 | BMNH 2007.10.31.3 | CAS 225757 | MNHN 2007-1924 | USNM 391138 | WAM P.32900 |
| standard length (mm) | 98.2 | 102.4 | 97.6 | 92.5 | 94.2 | 96.6 |
| body depth | 58.42 | 57.64 | 53.90 | 55.98 | 59.46 | 57.89 |
| body width | 19.38 | 17.92 | 17.82 | 19.14 | 18.56 | 19.48 |
| head length | 30.50 | 30.17 | 30.50 | 29.71 | 31.20 | 31.48 |
| snout length | 8.24 | 7.89 | 7.97 | 6.91 | 7.61 | 7.76 |
| orbit diameter | 11.72 | 11.78 | 11.59 | 12.64 | 12.51 | 12.40 |
| interorbital width | 11.72 | 11.30 | 11.28 | 11.70 | 11.48 | 11.48 |
| caudal-ped. depth | 14.98 | 14.85 | 14.99 | 14.59 | 15.44 | 15.59 |
| caudal-ped. length | 9.56 | 8.89 | 9.42 | 10.15 | 11.46 | 9.34 |
| upper jaw length | 9.88 | 9.38 | 10.25 | 10.38 | 10.19 | 9.83 |
| predorsal length | 43.24 | 42.39 | 41.59 | 40.43 | 41.84 | 43.57 |
| spinous dorsal-fin base | 46.72 | 46.02 | 47.33 | 45.86 | 47.78 | 47.05 |
| soft dorsal-fin base | 16.24 | 16.12 | 15.76 | 16.55 | 16.30 | 17.62 |
| 1st dorsal spine | 7.92 | 9.19 | 9.55 | 10.09 | 9.60 | 9.88 |
| 2nd dorsal spine | 14.64 | 15.69 | 14.54 | 15.60 | 15.16 | 16.33 |
| 3rd dorsal spine | 18.11 | 18.65 | 18.09 | 19.03 | 19.72 | 20.79 |
| 4th dorsal spine | 20.49 | 20.05 | 19.64 | 20.25 | 20.89 | 21.16 |
| 5th dorsal spine | 20.57 | 20.37 | 19.94 | 20.58 | 20.90 | 21.48 |
| 6th dorsal spine | 20.73 | 20.58 | 19.70 | 20.12 | 21.00 | 21.59 |
| last dorsal spine | 15.62 | 16.04 | 15.22 | 15.77 | 15.31 | 16.31 |
| longest dorsal ray | 23.82 | 22.88 | 21.41 | 21.61 | 23.94 | 23.93 |
| preanal length | 72.39 | 73.13 | 69.82 | 72.25 | 70.72 | 70.90 |
| 1st anal spine | 8.35 | 9.52 | 9.05 | 9.52 | 9.41 | 9.38 |
| 2nd anal spine | 26.56 | 25.67 | 24.97 | 25.72 | 24.10 | 25.23 |
| Longest anal ray | 23.95 | 22.77 | 21.94 | 23.19 | 22.97 | 22.40 |
| caudal length | 31.52 | 29.46 | 34.41 | 37.31 | 35.36 | 34.90 |
| caudal concavity | 18.33 | 15.53 | 16.19 | 17.51 | 19.21 | 18.22 |
| longest pectoral ray | 36.10 | 36.71 | 35.38 | 35.39 | 37.22 | 38.20 |
| prepelvic length | 43.63 | 42.37 | 42.21 | 42.69 | 42.27 | 43.65 |
| pelvic-spine length | 17.29 | 18.39 | 18.56 | 18.38 | 18.13 | 19.66 |
| 1st pelvic soft ray | 25.68 | 25.43 | 25.59 | 25.37 | 23.82 | 26.21 |
| dorsal rays | XIV,13 | XIV,13 | XIV,13 | XIV,12 | XIV,13 | XIV,13 |
| anal rays | II,13 | II,13 | II,13 | II,14 | II,13 | II,13 |
| pectoral rays | 19 | 18 | 19 | 19 | 18 | 19\|18 |
| pelvic rays | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 |
| principal caudal rays | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 |
| procurrent caudal rays | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 |
| spiniform caudal rays | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 |
| tubed l.l. scales | 17\|16 | 16\|17 | 17\|16 | 17\|17 | 16\|16 | 17\|16 |
| pored ped. scales | 8\|8 | 7\|5 | 6\|7 | 7\|6 | 6\|8 | 7\|7 |
| scales above l.l. | 3.5\|3.5 | 3.5\|3.5 | 3.5\|3.5 | 3.5\|3.5 | 3.5\|3.5 | 3.5\|3 |
| scales below l.l. | 10\|10 | 10.5\|9.5 | 9\|10 | 9\|10 | 9\|9 | 10\|10 |
| circumped. scales | 14 | 13 | 14 | 15 | 14 | 14 |
| gill rakers | 6+21 | 6+20 | 6+21 | 6+21 | 6+21 | 7+20 |
| supraneural bones | 3 | 3 | 3 | 3 | 3 | 3 |
| vertebrae | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 |

Opercle ending posteriorly in a flat spine, the tip relatively obtuse and obscured by a large scale; margin of preopercle smooth, the posterior margin extending dorsally to level of upper edge of pupil; suborbital with free lower margin extending nearly to a vertical at posterior edge of pupil.

Scales finely ctenoid; anterior lateral line ending beneath rear portion of spinous dorsal fin (between 12th and 13th dorsal-fin spines); head scaled except lips, tip of snout, and a narrow zone from orbit to edge of snout containing nostrils; a scaly sheath at base of dorsal and anal fins, about two-thirds pupil diameter at base of middle of spinous portion of dorsal fin, progressively narrower on soft portion; a column of scales on each membrane of dorsal fin, narrowing distally, those on spinous portion of dorsal progressively longer, reaching about two-thirds distance to spine tips on posterior membranes; scales on anal-fin membrane in two columns, progressively smaller distally; small scales on caudal fin extending slightly more than two-thirds distance to posterior margin; small scales on basal one-fifth of pectoral fins; a median scaly process extending posteriorly from between base of pelvic fins, its length about half that of pelvic spine; axillary scale above base of pelvic spine slightly more than one-third length of spine.

Origin of dorsal fin over fourth lateral-line scale, the pre-dorsal distance 2.31 (2.30–2.47) in SL; base of spinous portion of dorsal fin contained 2.14 (2.09–2.18) in SL; base of soft portion of dorsal fin contained 6.16 (5.68–6.35) in SL; first dorsal spine 12.62 (9.91–10.88) in SL; second dorsal spine 6.83 (6.13–6.88) in SL; third dorsal spine 5.52 (4.81–5.53) in SL; fourth dorsal spine 4.88 (4.73–5.09) in SL; fifth dorsal spine 4.86 (4.66–5.02) in SL; sixth dorsal spine 4.82 (4.63–5.08) in SL; last dorsal spine 6.40 (6.13–6.57) in SL; membranes of spinous portion of dorsal fin moderately incised; fourth dorsal soft ray longest, its length 4.20 (4.18–4.67) in SL; first anal spine 11.98 (10.50–11.05) in SL; second anal spine 3.77 (3.89–4.15) in SL; first anal soft ray the longest, its length 4.18 (4.31–4.56) in SL; caudal fin forked, its length 3.17 (2.68–3.39) in SL, the caudal concavity 5.46 (5.20–6.44) in SL; fourth pectoral-fin ray longest, 2.77 (2.62–2.83) in SL; pelvic spine 5.78 (5.09–5.52) in SL; first soft ray of pelvic fin without long filamentous extension, usually not reaching anal fin, its length 3.89 (3.82–4.20) in SL.

Color when fresh mahogany brown, appearing slate brown underwater; lateral line faintly brownish cream-colored; scales below lateral line with faint brownish cream-colored broad center area, forming approximately eight horizontal stripes visible underwater; spinous portion of dorsal fin same color as body, becoming bright yellow distally on first spine; second through last dorsal spines and membranes abruptly yellow distally, yellow portion increasing from distal one-fourth of fin at third spine to distal half at eleventh spine; soft dorsal fin entirely bright yellow except for posteriorly diminishing thin brown area basally on anterior 6 rays; caudal region from posterior base of dorsal fin to posterior tip of caudal fin uniform bright yellow; brown body color extends posterior to anal fin to lower anterior caudal peduncle; anal fin spines yellowish white; anal fin rays and membranes bright yellow; scales along ventral margin from anus to origin anal fin yellow; pectoral fin translucent; pelvic-fin spine translucent, medial yellow wash on anterior 3 pelvic rays, rays otherwise translucent; pelvic-fin membranes mahogany brown basally, translucent distally; iris brown with yellow wash.

Color in alcohol similar to fresh color, except yellow portions are much paler yellow, and brown portions are slightly paler brown (much paler brown on thorax).

**Distribution.** Observed from submersibles in the Marshall Islands and Mariana Islands, but only collected from Yap.

**Etymology.** Named *circumaurea*, an adjective derived from the Latin words *circum* (meaning "around") and *aurea* (meaning "golden, of gold"), in reference to the golden-yellow anal fin, caudal fin, and outer margin of the dorsal fin.

**Remarks.** This species was first observed and photographed from a submersible by Patrick L. Colin at Enewetak in the Marshall Islands. An unconfirmed sighting and video clip of this species from the Mariana Islands requires verification. It was observed at Yap at depths of 98–120 m, in a group of about a dozen individuals living among large (~1–2 m) rock boulders just above the upper edge of a precipitous drop-off. A

juvenile of approximately 40 mm SL was observed by the first author at a depth of 120 m, below the site where the type specimens were collected; its color pattern was consistent with that of the adults.

Two photos appearing on p. 390 of Kuiter & Tonozuka (2001), labelled as *Chromis analis*[120] (Cuvier 1830), bear a remarkable resemblance to *C. circumaurea*, but differ in number of dorsal-fin spines (XIII *vs*. XIV) and color of body (paler in *C. analis*), caudal peduncle (dark centrally *vs*. entriely yellow), and central region of caudal fin (transparent *vs*. yellow). This species also bears a superficial resemblance in color to *Chromis flavicauda*[121] (Günther 1880) from the western Atlantic Ocean, but is readily distinguished from that species on the basis of body color (blue in *C. flavicauda vs*. brown in *C. circumaurea*), dorsal-fin rays (XIII,11–12 *vs*. XIV,12–13, usually 13), anal-fin soft rays (11 *vs.* 13). Similarities with other deep-dwelling species with XIV dorsal-fin spines, including the new species *C. abyssus* described herein, are discussed in the Remarks section of *C. abyssus*.

***Chromis degruyi*, new species**
urn:lsid:zoobank.org:act:1859B68B-340C-44F9-BEAB-D75BAED300F2
DeGruy's Chromis
(Figs. 4a –4c; Table 5; Morphbank[122]; DigiMorph[123]; GenBank[124]; Barcode[125])

**Holotype.** BPBM 40842[126] (81.0 mm SL), Belau (Palau) Islands; Kayangel Atoll, W side; on outer reef drop-off near tip of small reef extension (8°4'16.64"N, 134°40'54.52"E): rocky ledge with holes at base of steep sandy slope with many gorgonians, 85 m, hand net, R.L. Pyle, 22 April 2007 [PCMB 3086[127]].

**Paratypes.** BMNH 2007.10.31.4[128] (38.7 mm SL), Caroline Islands; Yap, S end; "Magic Kingdom" (9°26'3.41"N, 138°2'5.96"E): deep rubble on rocky slope, 85 m, quinaldine and hand net, R.L. Pyle, 20 April 2007 [PCMB 3084[129]]. CAS 225758[130] (38.3 mm SL), Caroline Islands; Puluwat Atoll; Alet Islet, S side (7°21'15.44"N, 149°10'47.03"E): outer reef drop-off with small caves and holes, 100–103 m, quinaldine and hand net, R.L. Pyle and B.D. Greene, 11 April 2007 [PCMB 3032[131]]. USNM 391139[132] (76.6 mm SL), Belau (Palau) Islands; off Ngemlis Island; below and slightly to the N of the Blue Holes cave system (7°8'16.49"N, 134°13'18.5"E): in coral and rubble at the base of a large boulder offset from the drop-off, 88 m, hand net, R.L. Pyle, 27 April 2007 [PCMB 3114[133]]. WAM P.32901-001[134] (82.4 mm SL), Belau (Palau) Islands; Ngaruangl Atoll, S end (8°8' 50.39"N, 134°37'3.47"E), 115 m, hand net, R.L. Pyle, 23 April 2007 [PCMB 3088[135]].

**Diagnosis.** Dorsal rays XIII–XIV,11–12 (usually XIV,12); anal rays II,11–12 (usually 12); pectoral rays 18; spiniform caudal rays 3; tubed lateral-line scales 15–17; gill rakers 7+20–21 (total 27–28); body depth 1.84–1.99 in SL; color of adults when fresh dull brownish yellow with nine thin lavender-gray stripes on side of body, with a prominent black spot on dorsal half of pectoral-fin base.

**Description.** Dorsal rays XIV,12 (one paratype with XIII, another with 11); anal rays II,12 (one paratype with 11); all dorsal and anal rays branched, the last to base in some specimens; pectoral rays 18, the upper 2 and lowermost unbranched; pelvic rays I,5; principal caudal rays 8+7=15; upper and lower procurrent caudal rays 5, the anterior 3 spiniform, the posterior 2 segmented and unbranched; tubed lateral-line scales 16|15 (15–17, one paratype with 17); posterior midlateral scales with a pore or deep pit 8|9 (5–9); scales above dorsal fin to origin of dorsal fin 3; scales below lateral line to origin of anal fin 9 (one paratype with 8); gill rakers 7+20=27 (7+20–21=27–28); surpaneural (predorsal) bones 3; vertebrae 12+13.

Body moderately deep, depth 1.84 (1.92–1.99) in SL, and compressed, the width 2.87 (2.73–3.29) in body depth; head length 3.10 (2.95–3.18) in SL; dorsal profile of head with slight convexity anterior to eye, very slight concavity dorsal to eye, and very slight convexity on nape; snout shorter than orbit diameter, its length 4.05 (3.63–4.38) in head length; orbit diameter 2.77 (2.12–2.95) in head length; interorbital space convex, its width 2.73 (2.73–3.15) in head length; caudal-peduncle depth 2.18 (2.11–2.27) in head; caudal-peduncle length 2.83 (2.69–3.37) in head.

**TABLE 5.** Proportional measurements (%SL) and counts of *Chromis degruyi*, new species. Values separated by a pipe "|" are left|right or upper|lower.

| | Holotype | Paratypes | | | |
|---|---|---|---|---|---|
| | BPBM 40842 | BMNH 2007.10.31.4 | CAS 225758 | USNM 391139 | WAM P.32901 |
| standard length (mm) | 81.0 | 38.7 | 38.3 | 76.6 | 82.4 |
| body depth | 54.43 | 50.78 | 50.16 | 50.65 | 51.97 |
| body width | 19.00 | 16.98 | 15.25 | 18.49 | 18.99 |
| head length | 32.25 | 33.31 | 33.86 | 31.64 | 31.46 |
| snout length | 7.96 | 8.22 | 7.75 | 8.71 | 7.35 |
| orbit diameter | 11.62 | 14.55 | 15.98 | 10.69 | 11.59 |
| interorbital width | 11.79 | 11.42 | 10.78 | 11.07 | 11.49 |
| caudal-ped. depth | 14.78 | 15.35 | 14.96 | 14.24 | 14.90 |
| caudal-ped. length | 11.38 | 11.09 | 12.61 | 9.87 | 9.32 |
| upper jaw length | 11.06 | 10.93 | 10.89 | 10.30 | 9.88 |
| predorsal length | 41.91 | 43.49 | 41.51 | 41.87 | 42.66 |
| spinous dorsal-fin base | 46.01 | 42.69 | 44.20 | 43.45 | 46.76 |
| soft dorsal-fin base | 15.01 | 14.81 | 13.94 | 14.67 | 15.29 |
| 1st dorsal spine | 8.11 | 10.52 | 8.80 | 8.24 | 8.71 |
| 2nd dorsal spine | 12.27 | 14.63 | 13.76 | 12.56 | 13.14 |
| 3rd dorsal spine | 17.00 | 16.98 | 18.09 | 15.64 | 17.68 |
| 4th dorsal spine | 19.14 | 17.83 | 19.69 | 17.02 | 19.85 |
| 5th dorsal spine | 19.68 | 17.93 | 19.06 | 17.38 | 19.36 |
| 6th dorsal spine | 19.72 | 18.09 | 18.85 | 17.27 | 20.27 |
| last dorsal spine | 15.95 | 14.34 | 14.20 | 14.33 | 16.29 |
| longest dorsal ray | 20.21 | 19.84 | 22.01 | 21.25 | 20.81 |
| preanal length | 70.83 | 70.88 | 69.19 | 73.19 | 70.27 |
| 1st anal spine | 8.85 | 9.10 | 8.20 | 8.39 | 7.65 |
| 2nd anal spine | 26.06 | 22.12 | 26.06 | 23.72 | 26.59 |
| Longest anal ray | 22.31 | 19.84 | 19.43 | 21.84 | 23.06 |
| caudal length | 35.27 | 44.21 | 42.30 | 33.63 | 30.38 |
| caudal concavity | 17.78 | 22.89 | 21.78 | 19.67 | 18.31 |
| longest pectoral ray | 33.47 | 35.87 | 31.23 | 33.34 | 34.25 |
| prepelvic length | 43.17 | 45.35 | 40.68 | 45.90 | 41.87 |
| pelvic-spine length | 18.65 | 17.67 | 16.34 | 16.45 | 17.56 |
| 1st pelvic soft ray | 33.98 | 25.17 | 23.97 | 33.21 | 33.94 |
| dorsal rays | XIV,12 | XIII,12 | XIV,11 | XIV,12 | XIV,12 |
| anal rays | II,12 | II,12 | II,12 | II,12 | II,12 |
| pectoral rays | 18 | 18 | 18 | 18 | 18 |
| pelvic rays | I,5 | I,5 | I,5 | I,5 | I,5 |
| principal caudal rays | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 |
| procurrent caudal rays | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 |
| spiniform caudal rays | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 |
| tubed l.l. scales | 16\|15 | 15\|15 | 16\|15 | 16\|17 | 16\|15 |
| pored ped. scales | 8\|9 | 5\|6 | 8\|8 | 7\|9 | 5\|6 |
| scales above l.l. | 3 | 3 | 3 | 3 | 3 |
| scales below l.l. | 9 | 9 | 8 | 9 | 9 |
| circumped. scales | 14 | 14 | 14 | 14 | 14 |
| gill rakers | 7+20 | 7+20 | 7+20 | 7+21 | 7+21 |
| supraneural bones | 3 | 3 | 3 | 3 | 3 |
| Vertebrae | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 |

Mouth terminal, small, oblique, the upper jaw forming an angle of about 37º to horizontal axis of head and body; posterior edge of maxilla reaching slightly beyond a vertical at anterior edge of pupil, the upper jaw length 2.91 (3.05–3.18) in head; teeth multi-serial, an outer row of conical teeth in each jaw, largest anteriorly; about 20 upper and about 20 lower teeth on each side of jaw; a narrow band of villiform teeth lingual to outer row, in 2–3 irregular rows anteriorly, narrowing to a single row on side of jaws; tongue triangular with rounded tip; gill rakers long and slender, the longest on lower limb near angle about three-fourths length of longest gill filaments; nostril with a fleshy rim, more elevated on posterior edge and located at level of middle of pupil, slightly less than one-third distance from front of snout to base of upper lip.

Opercle ending posteriorly in a flat spine, the tip relatively obtuse and obscured by a large scale; margin of preopercle smooth, the posterior margin extending dorsally to level of upper edge of pupil; suborbital with free lower margin extending nearly to a vertical at posterior edge of pupil.

Scales finely ctenoid; anterior lateral line ending beneath rear portion of spinous dorsal fin (between 13th and 14th dorsal-fin spines); head scaled except lips, tip of snout, and a narrow zone from orbit to edge of snout containing nostrils; a scaly sheath at base of dorsal and anal fins, about two-thirds pupil diameter at base of middle of spinous portion of dorsal fin, progressively narrower on soft portion; a column of scales on each membrane of dorsal fin, narrowing distally, those on spinous portion of dorsal progressively longer, reaching about two-thirds distance to spine tips on posterior membranes; scales on anal-fin membrane in two columns, progressively smaller distally; small scales on caudal fin extending slightly more than two-thirds distance to posterior margin; small scales on basal one-fifth of pectoral fins; a median scaly process extending posteriorly from between base of pelvic fins, its length about half that of pelvic spine; axillary scale above base of pelvic spine about one-half length of spine.

Origin of dorsal fin over third lateral-line scale, the pre-dorsal distance 2.39 (2.30–2.41) in SL; base of spinous portion of dorsal fin contained 2.17 (2.14–2.34) in SL; base of soft portion of dorsal fin contained 6.66 (6.54–7.17) in SL; first dorsal spine 12.33 (9.51–12.14) in SL; second dorsal spine 8.15 (6.84–7.96) in SL; third dorsal spine 5.88 (5.53–6.39) in SL; fourth dorsal spine 5.23 (5.04–5.87) in SL; fifth dorsal spine 5.08 (5.17–5.76) in SL; sixth dorsal spine 5.07 (4.93–5.79) in SL; last dorsal spine 6.27 (6.14–7.04) in SL; membranes of spinous portion of dorsal fin moderately incised; fourth dorsal soft ray longest, its length 4.95 (4.54–5.04) in SL; first anal spine 11.30 (10.99–13.08) in SL; second anal spine 3.84 (3.76–4.52) in SL; first anal soft ray the longest, its length 4.48 (4.34–5.15) in SL; caudal fin forked, its length 2.84 (2.26–3.29) in SL, the caudal concavity 5.63 (4.37–5.46) in SL; fourth pectoral-fin ray longest, 2.99 (2.79–3.20) in SL; pelvic spine 5.36 (5.66–6.12) in SL; first soft ray of pelvic fin filamentous, usually reaching to first or second anal-fin ray (when not broken or otherwise damaged), its length 2.94 (2.95–4.17) in SL.

Color of adults when fresh dull brownish yellow with nine thin lavender-gray stripes, some faint, the middle 4 or 5 extending onto caudal peduncle; nape area olive-brown, lighter on thorax and ventrally to anus, becoming yellowish white; black spot slightly smaller than orbit at upper pectoral axil; faint diffuse lavender blotch smaller than orbit on opercle edge at level of lower orbit, not apparent underwater; olivaceous with brown stripes and greenish olive in nape area when observed underwater; spinous portion of dorsal fin olive-brown, distal one-fourth yellowish white; basal half of soft dorsal fin dark brown with almost black outer margin, distal half very light yellowish white to translucent on some specimens; caudal fin olive-brown, inner rays yellowish white; anal fin spines yellowish white, rays and membranes on basal half light olive-brown becoming distally yellowish white; black blotch smaller than orbit centered in posterior distal anal fin, more apparent in large specimens; pectoral fin translucent; pelvic-fin spine and first ray white, successive rays and membranes on basal half olive-brown, distal half yellowish white; iris brownish yellow; juveniles bluish gray; a bright yellow blotch on the distal half of the soft dorsal fin, covering the second through fifth dorsal soft rays, rays 6 to last paler than anterior part of soft dorsal fin; a bright yellow stripe from posterior base of soft dorsal fin in a band approximately the width of 2 scales continuing dorsally to tip of outer rays of dorsal lobe of caudal fin; lower caudal rays with a similar yellow band commencing ventrally on caudal peduncle and

extending to distal tip of lower caudal fin rays, approximately 7 median caudal rays white; third through seventh anal-fin rays and intervening membranes bright yellow on distal third, succeeding rays white.
Color in alcohol similar to fresh color, except paler brown overall.

**Distribution.** Observed or collected throughout the Caroline Islands, from Puluwat to Palau. A *Chromis* resembling the juvenile of this species was observed in Fagatele Bay in May 2001 by the senior author.

**Etymology.** Named *degruyi* to honor Michael V. DeGruy, in recognition of the sincere enthusiasm and determination he demonstrated while attempting to collect the first adult specimen of this species.

**Remarks.** The habitat of this species is similar to that of other species described herein: deep outer-reef slopes at depths of 85–120 m, usually in the vicinity of rock outcrops with small holes and caves, and around limestone talus. It is generally not as abundant as other species of *Chromis* described here, usually found in small groups and observed feeding low in the water column.

The species appears most similar to other deep-dwelling species of *Chromis* described previously (see Remarks section of *C. abyssus*). Juveniles superficially resemble *C. opercularis*[136] (Günther in Playfair and Günther 1867) in color, but are easily distinguished from that species on several morphological characters (e.g., usually XIV dorsal-fin spines in *C. degruyi*, *vs*. XIII in *C. opercularis*; body depth 1.84–1.99 in SL *vs*. 2.1–2.3 in *C. opercularis*), as well as adult coloration. Some aspects of the adult coloration are similar to *C. planesi* Lecchini and Williams 2004, but *C. degruyi* differs from that species in many other aspects of adult coloration as well as number of pectoral-fin rays (20 in *C. planesi vs*. 18 in *C. degruyi*), dorsal-fin soft rays (usually 13 *vs*. usually 12), and tubed lateral-line scales (17 *vs*. usually 15–16).

### *Chromis earina*, new species

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Spring Chromis

(Figs. 5a –5c; Tables 3 & 6; Morphbank[137]; GenBank[138]; Barcode[139])

**Holotype.** MNHN 2007-1921[140] (63.3 mm SL), Vanuatu; Espiritu Santo; off W coast of Tutuba Island (15°32'39.28"S, 167°16'29.82"E): near large boulder along steep slope with rubble and sand; many gorgonians, 116 m, rotenone and vacuum device, R.L. Pyle and B.D. Greene, 22 October 2006 [PCMB 3131[141]].

**Paratypes.** BMNH 2007.10.31.5[142] (62.5 mm SL), Vanuatu; Espiritu Santo; off W coast of Tutuba Island (15°32'35.23"S, 167°16'49.65"E): large rock outcrop with surrounding sand and rubble, below base of large drop-off, 116 m, hand net, B.D. Greene, 20 October 2006. BPBM 37674[143] (54.0 mm SL), Belau (Palau) Islands; Augulpelu Reef, W side (7°16'24.6"N, 134°31'26.4"E): shelf flanked by numerous small caves, 90 m, hand net, R.L. Pyle, 7 May 1997. BPBM 37714[144] (4; 48.7–67.52), same locality as BPBM 37674: cave in drop-off, 90 m, rotenone, R.L. Pyle and J.L. Earle, 12 May 1997. BPBM 40720[145] (2; 59.7–64.4 mm SL), Vanuatu; Espiritu Santo; off N end of Tutuba Island (15°32'28.57"S, 167°16'51.17"E): at base of outer reef drop-off ranging from 60–100 m, 100 m, rotenone and vacuum device, R.L. Pyle, 10 October 2006. CAS 225759[146] (59.6 mm SL), Fiji Islands; Viti Levu Island; Suva; outside of Suva Harbor; S end of "Fish Patch"; below cave (18°9'36.6"S, 178°23'57.6"E): sand and rubble slope with scattered outcroppings, below base of vertical reef drop-off, 104–110 m, rotenone, R.L. Pyle, J.L. Earle, and J. Dituri, 4 February 2002. MNHN 2007-1926[147] (35.7 mm SL), same collecting data as BPBM 40720. USNM 391140[148] (66.3 mm SL), Vanuatu; Espiritu Santo; off W coast of Tutuba Island (15°32'58.78"S, 167°16'40.98"E): steep slope with rubble and sand, with some rocky outcrops with small caves and undercuts; many gorgonians, 100 m, rotenone and vacuum device, R.L. Pyle, 16 October 2006. WAM P. 32902-001[149] (53.9 mm SL), Belau (Palau) Islands; Ngemlis Island, SE tip; "Big Drop" (7°6' 11.89"N, 134°15'2.67"E), 85 m, hand net, R.L. Pyle, 18 May 1997.

**Diagnosis.** Dorsal rays XII–XIII,11–12 (usually XIII, 12); anal rays II,12; pectoral rays 17–18 (usually 18); spiniform caudal rays 3; tubed lateral-line scales 13–15 (rarely 16); gill rakers 6–8+18–21 (total 26–28,

rarely 25); body depth 1.65–1.9 in SL; color when fresh pale slate blue (bright pale green in life); a white spot (sometimes two white spots) roughly the size of a scale mid-laterally on the body; malachite green area above orbit and in inter-orbital space and nape; dorsal and anal fins with bright distal border of pale turquoise blue.

**Description.** Dorsal rays XIII,12 (one paratype with XII, another with 11); anal rays II,12; all dorsal and anal rays branched, the last to base in some specimens; pectoral rays 18 (17–18), the upper 2 and lowermost unbranched; pelvic rays I,5; principal caudal rays 8+7=15; upper and lower procurrent caudal rays 5, the anterior 3 spiniform, the posterior 2 segmented and unbranched; tubed lateral-line scales 15 (13–16, one paratype with 16); posterior midlateral scales with a pore or deep pit 8 (4–8); scales above lateral line to origin of dorsal fin 3; scales below lateral line to origin of anal fin 9 (8–9); gill rakers 7+21=28 (6–8+18–21=26–28, one paratype with 25); surpaneural (predorsal) bones 3; vertebrae 12+13.

Body moderately deep, depth 1.90 (1.65–1.89) in SL, and compressed, the width 3.29 (2.71–3.70) in body depth; head length 2.96 (2.82–3.14) in SL; dorsal profile of head with convexity anterior to eye and concavity dorsal to eye; snout shorter than orbit diameter, its length 3.57 (3.52–4.40) in head length; orbit diameter 2.27 (2.11–2.40) in head length; interorbital space convex, its width 2.73 (2.60–3.22) in head length; caudal-peduncle depth 2.35 (2.00–2.43) in head; caudal-peduncle length 3.33 (2.79–4.26) in head.

Mouth terminal, small, oblique, the upper jaw forming an angle of about 52º to horizontal axis of head and body; posterior edge of maxilla reaching slightly beyond a vertical at anterior edge of pupil, the upper jaw length 3.06 (2.85–3.24) in head; teeth multi-serial, an outer row of conical teeth in each jaw, largest anteriorly; about 30 upper and about 27 lower teeth on each side of jaw; a narrow band of villiform teeth lingual to outer row, in 2–3 irregular rows anteriorly, narrowing to a single row on side of jaws; tongue triangular with rounded tip; gill rakers long and slender, the longest on lower limb near angle about four-fifths length of longest gill filaments; nostril with a fleshy rim, more elevated on posterior edge and located at level of middle of pupil, slightly less than one-third distance from front of snout to base of upper lip.

Opercle ending posteriorly in a flat spine, the tip relatively obtuse and obscured by a large scale; margin of preopercle smooth, the posterior margin extending dorsally to level of upper edge of pupil; suborbital with free lower margin extending nearly to a vertical at posterior edge of pupil.

Scales finely ctenoid; anterior lateral line ending beneath rear portion of spinous dorsal fin (between 12th and 13th dorsal-fin spines); head scaled except lips, tip of snout, and a narrow zone from orbit to edge of snout containing nostrils; a scaly sheath at base of dorsal and anal fins, about two-thirds pupil diameter at base of middle of spinous portion of dorsal fin, progressively narrower on soft portion; a column of scales on each membrane of dorsal fin, narrowing distally, those on spinous portion of dorsal progressively longer, reaching about two-thirds distance to spine tips on posterior membranes; scales on anal-fin membrane in two columns, progressively smaller distally; small scales on caudal fin extending to about one-half distance to posterior margin; small scales on basal one-fifth of pectoral fins; a median scaly process extending posteriorly from between base of pelvic fins, its length about one-third that of pelvic spine; axillary scale above base of pelvic spine slightly more than one-third length of spine.

Origin of dorsal fin over third lateral-line scale, the pre-dorsal distance 2.35 (2.24–2.48) in SL; base of spinous portion of dorsal fin contained 2.32 (2.13–2.52) in SL; base of soft portion of dorsal fin contained 6.28 (5.59–7.56) in SL; first dorsal spine 10.27 (9.20–11.88) in SL; second dorsal spine 7.11 (5.91–7.43) in SL; third dorsal spine 5.55 (4.88–6.01) in SL; fourth dorsal spine 5.62 (4.68–5.55) in SL; fifth dorsal spine 5.50 (4.68–5.51) in SL; sixth dorsal spine 5.57 (4.68–5.68) in SL; last dorsal spine 7.05 (6.17–7.21) in SL; membranes of spinous portion of dorsal fin moderately incised; fourth dorsal soft ray longest, its length 4.25 (3.61–4.74) in SL; first anal spine 10.85 (9.93–12.43) in SL; second anal spine 3.80 (3.76–4.23) in SL; first anal soft ray the longest, its length 4.32 (3.69–4.87) in SL; caudal fin forked, its length 2.83 (2.45–2.99) in SL, the caudal concavity 4.49 (3.33–5.26) in SL; fourth pectoral-fin ray longest, 2.82 (2.55–2.92) in SL; pelvic spine 5.23 (4.62–5.85) in SL; first soft ray of pelvic fin filamentous, usually reaching to first or second anal-fin ray (when not broken or otherwise damaged), its length 2.84 (2.47–3.91) in SL.

**TABLE 6.** Proportional measurements (%SL) and counts of *Chromis earina*, new species. Values separated by a pipe "|" are left|right or upper|lower.

| | Holotype | | Paratypes | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | MNHN 2007-1921 | BMNH 2007.10.31.5 | BPBM 37674 | BPBM 37714 | BPBM 37714 | BPBM 37714 | BPBM 37714 | BPBM 40720 | BPBM 40720 | CAS 225759 |
| standard length (mm) | 63.8 | 62.5 | 54.0 | 48.7 | 60.4 | 64.5 | 67.5 | 59.7 | 64.4 | 59.6 |
| body depth | 52.71 | 55.55 | 60.56 | 55.73 | 57.70 | 57.81 | 55.99 | 54.69 | 53.34 | 57.99 |
| body width | 16.00 | 17.74 | 19.02 | 18.87 | 18.94 | 18.19 | 18.27 | 17.92 | 17.38 | 17.22 |
| head length | 33.82 | 33.98 | 32.76 | 35.22 | 33.63 | 33.53 | 33.24 | 34.24 | 32.14 | 34.09 |
| snout length | 9.48 | 8.46 | 7.44 | 8.91 | 8.71 | 8.39 | 8.03 | 9.18 | 7.83 | 9.41 |
| orbit diameter | 14.91 | 14.46 | 15.02 | 15.69 | 13.99 | 14.26 | 14.03 | 15.19 | 14.84 | 15.31 |
| interorbital width | 12.41 | 12.24 | 12.26 | 11.75 | 11.94 | 12.29 | 12.04 | 12.91 | 11.88 | 12.91 |
| caudal-ped. depth | 14.44 | 13.95 | 16.37 | 14.89 | 15.68 | 15.60 | 14.98 | 14.24 | 14.16 | 15.23 |
| caudal-ped. length | 10.16 | 9.92 | 8.70 | 10.68 | 12.04 | 10.12 | 8.30 | 8.89 | 7.55 | 9.70 |
| upper jaw length | 11.07 | 11.70 | 10.69 | 11.27 | 11.16 | 11.21 | 11.17 | 11.44 | 9.91 | 12.01 |
| predorsal length | 42.60 | 42.75 | 44.74 | 41.99 | 44.11 | 43.16 | 42.00 | 41.69 | 40.34 | 42.03 |
| spinous dorsal-fin base | 43.09 | 45.74 | 44.76 | 44.15 | 42.60 | 47.02 | 45.50 | 42.06 | 42.56 | 44.67 |
| soft dorsal-fin base | 15.92 | 15.42 | 17.24 | 15.81 | 17.90 | 16.29 | 16.53 | 15.06 | 14.38 | 17.15 |
| 1st dorsal spine | 9.73 | 10.35 | 10.37 | 8.99 | 10.22 | 9.55 | 9.50 | 8.94 | 8.42 | 10.08 |
| 2nd dorsal spine | 14.06 | 15.15 | 16.74 | 15.17 | 14.70 | 15.50 | 14.96 | 13.82 | 13.46 | 16.75 |
| 3rd dorsal spine | 18.01 | 18.98 | 20.48 | 19.32 | 18.84 | 18.99 | 18.76 | 18.41 | 16.63 | 20.49 |
| 4th dorsal spine | 17.79 | 20.74 | 20.94 | 20.18 | 20.36 | 20.09 | 19.64 | 19.92 | 18.01 | 21.39 |
| 5th dorsal spine | 18.18 | 21.09 | 21.37 | 20.37 | 20.71 | 19.91 | 20.58 | 19.75 | 18.14 | 21.26 |
| 6th dorsal spine | 17.96 | 20.75 | 20.70 | 20.41 | 20.36 | 20.60 | 19.59 | 18.39 | 17.61 | 21.39 |
| last dorsal spine | 14.18 | 16.02 | 16.15 | 16.18 | 16.09 | 16.14 | 16.19 | 15.19 | 13.93 | 16.21 |
| longest dorsal ray | 23.53 | 24.67 | 23.59 | 27.64 | 27.68 | 24.90 | 25.04 | 24.14 | 21.09 | 22.58 |
| preanal length | 70.41 | 69.38 | 68.46 | 72.94 | 72.02 | 69.47 | 70.96 | 73.03 | 72.13 | 73.20 |
| 1st anal spine | 9.22 | 9.06 | 9.61 | 9.22 | 10.07 | 9.75 | 9.36 | 8.39 | 8.04 | 9.23 |
| 2nd anal spine | 26.30 | 25.86 | 26.11 | 25.32 | 26.62 | 25.55 | 24.03 | 25.18 | 23.65 | 26.48 |
| Longest anal ray | 23.15 | 23.17 | 23.59 | 27.06 | 24.07 | 21.49 | 23.72 | 23.25 | 20.54 | 23.97 |
| caudal length | 35.31 | 33.39 | – | – | 39.74 | 39.77 | 39.94 | 36.43 | 34.52 | 37.52 |
| caudal concavity | 22.27 | 19.02 | – | – | 21.75 | 24.70 | 20.96 | 20.90 | 20.00 | 28.12 |
| longest pectoral ray | 35.41 | 39.15 | 34.20 | 37.08 | 36.39 | 37.33 | 36.50 | 37.30 | 34.46 | 38.71 |
| prepelvic length | 41.46 | 42.90 | 41.11 | 49.24 | 43.44 | 42.43 | 41.64 | 48.36 | 45.54 | 46.25 |
| pelvic-spine length | 19.14 | 21.58 | 20.28 | 21.17 | 21.62 | 20.25 | 19.85 | 19.87 | 17.10 | 21.39 |
| 1st pelvic soft ray | 35.19 | 35.47 | – | 40.41 | 34.70 | 32.64 | 31.76 | 32.91 | 32.64 | 25.56 |
| dorsal rays | XIII,12 | XIII,12 | XIII,12 | XIII,12 | XIII,12 | XIII,12 | XIII,12 | XIII,12 | XIII,12 | XIII,12 |
| anal rays | II,12 | II,12 | II,12 | II,12 | II,12 | II,12 | II,12 | II,12 | II,12 | II,12 |
| pectoral rays | 18 | 18 | 17 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| pelvic rays | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 | I,5 |
| principal caudal rays | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 | 8+7 |
| procurrent caudal rays | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 | 2\|2 |
| spiniform caudal rays | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 |
| tubed l.l. scales | 15\|15 | 14\|15 | 15\|15 | 13\|14 | 16\|15 | 14\|13 | 13\|13 | 14\|13 | 14\|14 | 14\|14 |
| pored ped. scales | 8\|8 | –\|– | 7\|8 | 5\|5 | 8\|5 | 6\|6 | 7\|4 | 7\|5 | 4\|5 | 5\|5 |
| scales above l.l. | 3\|3 | 3\|3 | 3\|3 | 3\|3 | 3\|3 | –\|– | 3\|3 | 3\|3 | 3\|3 | 3\|3 |
| scales below l.l. | 9 | – | 8 | 9 | 9 | 8 | 8 | 9 | 9 | |
| circumped. scales | – | – | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| gill rakers | 7+21 | 7+20 | 7+21 | 6+21 | 7+19 | 8+18 | 7+19 | 7+20 | 7+19 | 6+20 |
| supraneural bones | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| vertebrae | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 | 12+13 |

**TABLE 6 (continued).** Proportional measurements (%SL) and counts of *Chromis earina*, new species. Values separated by a pipe "|" are left|right or upper|lower.

| | Paratypes | | |
|---|---|---|---|
| | MNHN 07-1926 | USNM 391140 | WAM P.32902 |
| standard length (mm) | 35.68 | 66.27 | 53.92 |
| body depth | 55.04 | 52.87 | 54.75 |
| body width | 14.93 | 19.52 | 16.73 |
| head length | 35.43 | 31.86 | 32.86 |
| snout length | 8.24 | 9.05 | 8.20 |
| orbit diameter | 16.86 | 14.18 | 13.99 |
| interorbital width | 12.75 | 12.25 | 10.20 |
| caudal-ped. depth | 15.24 | 14.66 | 15.29 |
| caudal-ped. length | 12.10 | 9.47 | 10.78 |
| upper jaw length | 11.79 | 11.09 | 10.39 |
| predorsal length | 43.42 | 43.57 | 41.71 |
| spinous dorsal-fin base | 39.75 | 45.34 | 42.39 |
| soft dorsal-fin base | 14.85 | 15.35 | 13.23 |
| 1st dorsal spine | 10.87 | 10.03 | 8.63 |
| 2nd dorsal spine | 16.92 | 15.70 | 14.40 |
| 3rd dorsal spine | 19.52 | 18.67 | 17.81 |
| 4th dorsal spine | 20.56 | 19.83 | 19.33 |
| 5th dorsal spine | 20.39 | 19.74 | 18.89 |
| 6th dorsal spine | 20.20 | 20.21 | 19.35 |
| last dorsal spine | 13.87 | 15.67 | 15.38 |
| longest dorsal ray | 25.29 | 24.52 | 27.66 |
| preanal length | 71.32 | 71.48 | 73.43 |
| 1st anal spine | 8.88 | 9.29 | 9.07 |
| 2nd anal spine | 24.54 | 25.37 | 24.64 |
| Longest anal ray | 22.89 | 21.83 | 23.28 |
| caudal length | 39.05 | 40.80 | 40.32 |
| caudal concavity | 23.73 | 30.00 | 25.57 |
| longest pectoral ray | 38.74 | 37.74 | 35.40 |
| prepelvic length | 46.16 | 42.82 | 47.57 |
| pelvic-spine length | 21.01 | 20.47 | 19.29 |
| 1st pelvic soft ray | 32.52 | 34.16 | 35.57 |
| dorsal rays | XII,11 | XIII,12 | XIII,12 |
| anal rays | II,12 | II,12 | II,12 |
| pectoral rays | 18 | 17 | 17\|18 |
| pelvic rays | I,5 | I,5 | I,5 |
| principal caudal rays | 8+7 | 8+7 | 8+7 |
| procurrent caudal rays | 2\|2 | 2\|2 | 2\|2 |
| spiniform caudal rays | 3\|3 | 3\|3 | 3\|3 |
| tubed l.l. scales | 14\|– | 14\|15 | 15\|15 |
| pored ped. scales | –\|4 | 8\|7 | 6\|4 |
| scales above l.l. | 3\|3 | 3\|3 | 3\|3 |
| scales below l.l. | 8 | – | 9 |
| circumped. scales | 14 | 14 | 14 |
| gill rakers | 7+19 | 6+20 | 6+19 |
| supraneural bones | 3 | 3 | 3 |
| vertebrae | 12+13 | 12+13 | 12+13 |

Color of adults and juveniles when fresh pale slate blue (bright pale green in life), slightly darker dorsally and slightly lighter on thorax; a white spot roughly the size of a scale mid-laterally, approximately below the tenth dorsal-fin spine and two scale rows below the lateral line, size and shape of spot variable, occasionally as two small spots in vertical orientation; malachite green area above orbit and in interorbital space, extending diffusely onto nape; bright band of pale turquoise blue below orbit extending across upper lip; spinous portion of dorsal fin color of body, with bright distal border of pale turquoise blue; soft dorsal-fin membrane pale blue, becoming translucent on distal half; caudal fin pale slate blue, becoming lighter and distally translucent on inner rays; caudal fin tips dark, almost black; anal fin pale slate blue, with pale turquoise blue anterior distal border; pectoral fin translucent; yellowish spot about scale size at upper pectoral axil; pelvic fin spine and first-ray filament pale turquoise blue, membranes translucent; iris dark gray with white inner border.

Color in alcohol olive-brown with whitish margins on median fins; white spot on side of body not visible.

**Distribution.** Collected or observed throughout the tropical western Pacific, from Puluwat westward to Palau, south to Papua New Guinea, Vanuatu and Fiji. It was not observed at Rarotonga (Cook Islands), Kiritimati (Line Islands), or American Samoa during brief surveys of deep reefs at those localities. A single specimen was also recently collected by Mark Erdmann (Conservation International) in 75 m depth at Misool Island, Raja Ampat Islands, Indonesia (G. Allen, pers. comm.).

**Etymology.** Named *earina*, a Latinized form of the Greek adjective *earinos* (meaning "the color of spring", *i.e.*, green), in reference to the pale green color of this species in life.

**Remarks.** This species inhabits the same general habitat as the other new species described herein: steep outer reef slopes and drop-offs with rocky outcrops and small caves and holes, often in association with limestone talus. It is often observed in pairs or small groups, feeding low in the water column, and is generally abundant where it is found.

Similarities with other species are discussed in the Remarks section under the account of *C. brevirostris*.

**Acknowledgements**

The following individuals or companies provided logistic and/or financial support for field collections: the Discovery Channel (Palau, 1997); David W. Greenfield through a grant from the University of Hawai'i (DEB-0102745) (Fiji, 2002); Philippe Bouchet through a grant from the Sloan Foundation (Vanuatu, 2006); and the British Broadcasting Corporation (BBC) (Caroline Islands, 2007). Additional support for deep-diving activities was provided by the Association for Marine Exploration. Claudia R. Rocha performed the DNA sequencing of tissue samples necessary to generate the COI Barcodes (as well as other sequences). The sequencing work was supported by a grant to Brian W. Bowen from the National Science Foundation (OCE-0453167). We wish to thank the Commissioners of the International Commission on Zoological Nomenclature (ICZN), particularly Dr. Miguel A. Alonso-Zarazaga, for providing very useful insights concerning etymology. Arnold Suzumoto of the Bishop Museum fish collection provided curatorial assistance, and helped to complete portions of the manuscript. Loreen O'Hara created radiographs of type specimens. Neal Evenhuis provided a large-format scanner for digitizing radiographs. Certain informatics components of this document were supported by the Pacific Basin Information Node (PBIN) of the U.S. National Biological Information Infrastructure (NBII) through a cooperative agreement with Bishop Museum. The following individuals contributed substantially to the process of generating online resources and/or markup documents associate with this article: Donat Agosti, Terry Catapano, Ann Devenish, Chris Freeland, Gregor Hagedorn, Robert Hanner, Julian Humphries, Roger Hyam, Jessie Maisano, Kevin Richards, Luiz Rocha, Katja Seltmann, Dirk Steinke, Anna Weitzman, Robert Whitton and Zhi-Qiang Zhang. David Catania, James Maclaine, Sue Morrison, Patrice Pruvost, Shirleen Smith, and Jeffry T. Williams assisted with catalog numbers for type specimens and with ensuring online accessibility of type-specimen data.

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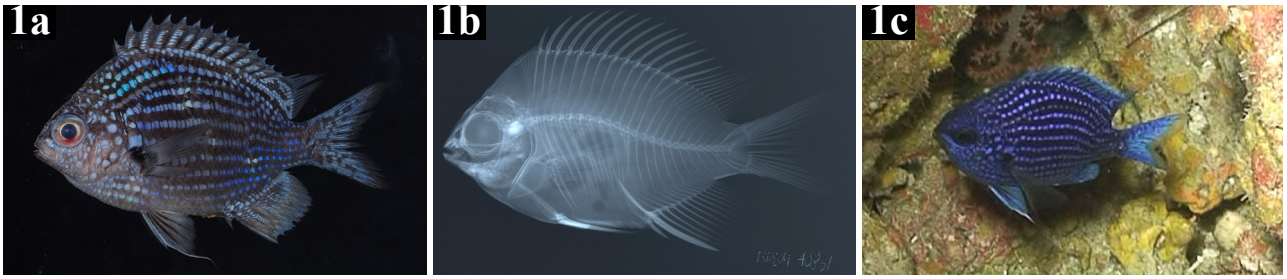


**FIGURE 1.** *Chromis abyssus*: Color photo (a[181], R. Pyle) and radiograph (b[182], L. O'Hara) of BPBM 40861, Holotype, 109.8 mm TL; frame from underwater video at 120 m (c[183], J. Earle).

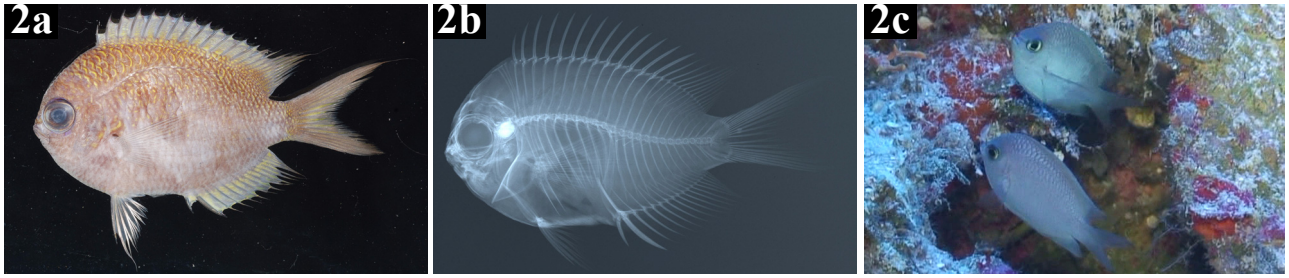


**FIGURE 2.** *Chromis brevirostris*: Color photo (a[184], R. Pyle) and radiograph (b[185], L. O'Hara) of BPBM 40804, Holotype, 103.8 mm TL; frame from underwater video at 90 m (c[186], J. Earle).

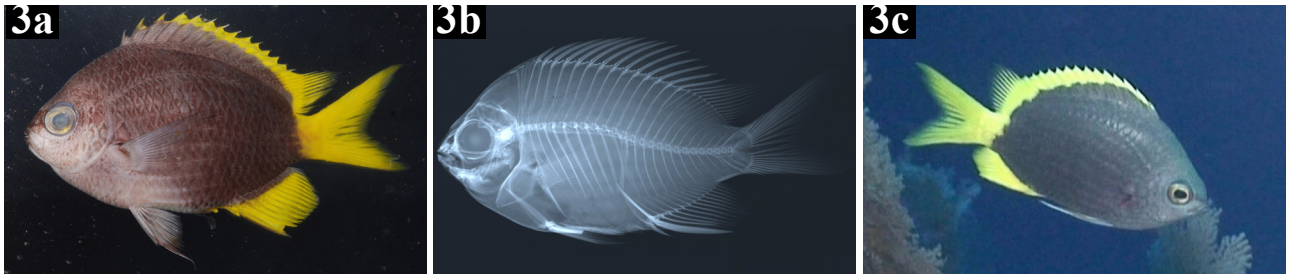


**FIGURE 3.** *Chromis circumaurea*: Color photo (a[187], R. Pyle) and radiograph (b[188], L. O'Hara) of BPBM 40836, Holotype, 129.1 mm TL; frame from underwater video at 110 m (c[189], J. Earle).

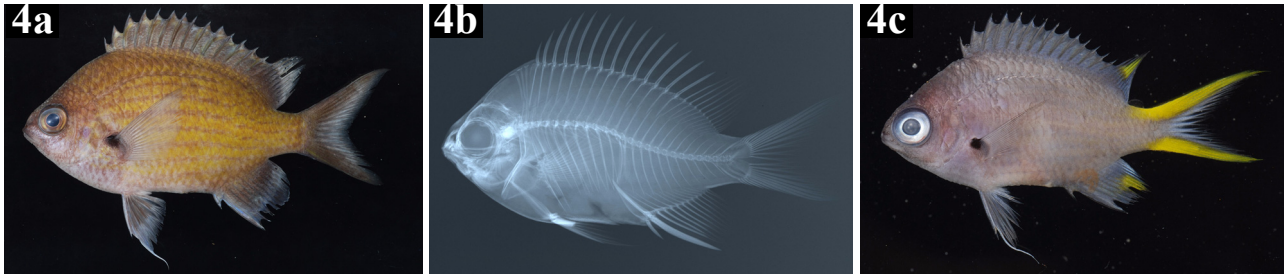


**FIGURE 4.** *Chromis degruyi*: Color photo (a[190], R. Pyle) and radiograph (b[191], L. O'Hara) of BPBM 40842, Holotype, 109.5 mm TL; BPBM 40803, juvenile, 54.5 mm TL (c[192], R. Pyle).

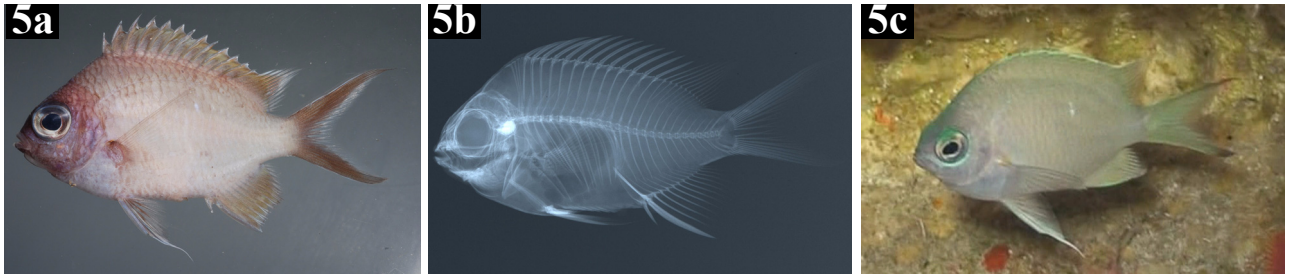


**FIGURE 5.** *Chromis earina*: Color photo (a[193], B. Greene) and radiograph (b[194], L. O'Hara) of MNHN 2007-1921, Holotype, 86.4 mm TL; frame from underwater video at 98 m (c[195], J. Earle).

## Appendix: Embedded external hyperlinks

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