Records of the Australian Museum (2004) Vol. 56: 231–234. ISSN 0067-1975

Cheilodactylus (Goniistius) francisi, A New Species of Morwong (Perciformes: Cirrhitoidea) from the Southwest Pacific

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ABSTRACT. A new morwong, *Cheilodactylus (Goniistius) francisi*, is recognized from southwest Pacific Islands (Lord Howe Island, Middleton Reef, Kermadecs, and probably Elizabeth Reef, Norfolk Island, and New Caledonia). Distinguishing features from *C. (G.) vittatus* (Hawaiian Islands) comprise gill-raker counts, caudal-fin coloration, and notable molecular divergence.

BURRIDGE, CHRISTOPHER P., 2004. *Cheilodactylus (Goniistius) francisi*, a new species of morwong (Perciformes: Cirrhitoidea) from the Southwest Pacific. *Records of the Australian Museum* 56(2): 231–234.

Morwongs are cirrhitoid fishes of subtropical and temperate marine nearshore waters, occurring throughout the Southern Hemisphere, northwest Pacific, and Hawaiian Islands (Smith, 1980; Randall, 1983). They are usually solitary, occurring demersally over reef substrates and feeding on small benthic invertebrates (Sano & Moyer, 1985; Cappo, 1995; McCormick, 1998). The taxonomy of morwongs and other cirrhitoids is highly contentious at the levels of species recognition, generic assignment, and familial allocation (Allen & Heemstra, 1976; Smith, 1980; Randall, 1983; Lamb, 1990; Greenwood, 1995; Burridge, 1999; Burridge & White, 2000; Burridge & Smolenski, 2004).

Cheilodactylus (Goniistius) vittatus Garrett, 1864, thought endemic to the Hawaiian Islands, was provisionally recognized from New Caledonia and Lord Howe Island in the southwest Pacific based on photographs of live specimens viewed by Randall (1981, 1983), although he noted that positive identification should await a direct comparison of specimens. This species was later documented at the Kermadec Islands by Francis *et al*. (1987), but based on the key developed by Randall (1983), that may not be sensitive to any morphological distinctiveness of southwest Pacific specimens. A recent study of molecular variation within *Goniistius* Gill, 1862 revealed that divergence of Hawaiian *C. (G.) vittatus* from a putatively conspecific southwest Pacific individual was equivalent to that observed during interspecific comparisons within the subgenus (Burridge & White, 2000). Consequently, the first morphological comparison of Hawaiian and southwest Pacific "*vittatus*" individuals has been conducted, and additional molecular data have been collected to further assess the taxonomic significance of genetic divergence observed across the equator; a new species from the southwest Pacific is described herein.

Materials and methods

To my knowledge, only seven specimens of southwest Pacific "*vittatus*" have been deposited in museum collections. One Kermadec Islands individual is deposited in Te Papa Tongarewa (Museum of New Zealand, NMNZ P17846). Two specimens have been obtained from Middleton Reef (Australian Museum, Sydney, AMS I.27134-003, AMS I.27139-006). One specimen has been obtained from Lord Howe Island (AMS I.17357-001). This was one of two specimens from Lord Howe Island reported

as *C. gibbosus* Richardson, 1841 by Allen *et al*. (1976), but was subsequently incorrectly reidentified as *C. (G.) vestitus* (Castelnau, 1879); the other AMS specimen actually is *C. vestitus* (J.M. Leis, pers. comm.). Three specimens were recently collected from Lord Howe Rise, southeast of the Island, as part of the NORFANZ expedition (AMS I.42728-001, NMNZ P39102, CSIRO H6034-10). The fate of the two Noumea Aquarium specimens described by Randall (1981, 1983) could not be traced.

Measurements of specimens follow the methods employed by Randall (1983) during the most recent revision of *Goniistius*. Counts and proportions of the paratypes, where different from the holotype, are given in parentheses along with the modal value, as appropriate. Collection of partial mitochondrial cytochrome *b* DNA sequence data from additional Hawaiian *C. (G.) vittatus* individuals was performed following Burridge & White (2000), to better assess the magnitude of molecular divergence from the only southwest Pacific individual available for DNA analysis.

Cheilodactylus (Goniistius) francisi n.sp.

Fig. 1

Goniistius gibbosus.—*non* Richardson, 1841 (Allen *et al*., 1976, Lord Howe Island)

Cheilodactylus vittatus.—*non* Garrett, 1864 (Randall, 1981, 1983, Lord Howe Island and New Caledonia; Francis *et al*., 1987, Kermadec Islands; Gill & Reader, 1992, Elizabeth and Middleton Reefs).

Cheilodactylus sp.—Francis, 2001 (Kermadec Islands).

Type material. HOLOTYPE, AMS I.17357-001, 199.8 mm SL, Lord Howe Island, 100 m off Phillip Point (31°32'S 159°04'E), 20–25 m depth, poison and spear, G.R. Allen, B. Goldman, D.F. Hoese, J.E. Randall, B.C. Russell, W.A. Starck, 5–16 February 1973. PARATYPES: NMNZ P17846, 233.6 mm SL, Kermadec Islands, northeast corner of Cheeseman Island (30°30'S 178°34'W), spear, M.P. Francis, 14 October 1985; AMS I.27134-003, 256.4 mm SL, Middleton Reef, shallow reef front (29°27.2'S 159°06.8'E), 9 m depth, rotenone, S.E. Reader, A.C. Gill, D. Leadbitter, M. Cordell, 4 December 1987; AMS I.27139-006, 95.0 mm SL, outer western edge of Middleton Reef (29°29.2'S 159°04.1'E), 6 m depth, rotenone, A.C. Gill, S.E. Reader, D. Leadbitter, M. Cordell, 4 December 1987; NMNZ P39102, 273.7 mm SL, off Ball's Pyramid, Lord Howe Rise (31°48.60'–46.70'S 159°20.74'–21.02'E), 66–88 m depth, Orange Roughy Trawl, NORFANZ expedition team, 25 May 2003; AMS I.42728-001, 255.5 mm SL, same collection details as previous; CSIRO H6034-10, 257.5 mm SL, same collection details as previous.

Diagnosis. Dorsal-fin rays XVI,31 (XVI–XVII,31–34, usually XVII,33); anal-fin rays III,8; lateral-line scales 62 (64–66, usually 64); gill-rakers 6+14 (5–6+15–16, usually 5+15); depth of body 2.83 (2.57–2.76) in SL; head length 3.57 (3.48–3.65) in SL; fourth dorsal spine highly pronounced, 1.13 (0.83–1.61) in head length; third dorsal spine 4.76 (2.98–6.31) in fourth dorsal spine; pectoral fins 3.47 (2.94–3.57) in SL; pelvic fins reaching but not extending beyond anus (not reaching, reaching, or extending beyond anus), 5.55 (4.55–5.81) in SL; prominent bony knobs present anteriorly on maxilla and prefrontal; coloration dominated by dark diagonal bands, three on the head, one from the anterior origin of the dorsal fin to the pelvic fin, and one from behind the fourth dorsal spine to the lower lobe of the caudal fin; upper lobe of caudal fin with black tip.

Description. Dorsal-fin rays XVI,31 (XVI–XVII,31–34, usually XVII, 33); anal-fin rays III,8; pectoral-fin rays 13 (13–14, usually 14), the upper two unbranched, the next 6 (5–6, usually 6) branched, and the lower 5 (5–6, usually 6) simple, thickened, and elongated beyond the fin membrane (i.e. ii, 5–6, v–vi); pelvic-fin rays I,5; principal caudal-fin rays 17, the uppermost and lowermost unbranched, branched rays 8+7; lateral-line scales 62 (64–66, usually 64); scales above lateral line to middle of spinous portion of dorsal fin 10; scales below lateral line to origin of anal fin 18 (17–19, usually 18); gill-rakers 6+14 (5–6+15–16, usually 5+15); fourth dorsal spine highly pronounced, 1.13 (0.83–1.61) in head length; third dorsal spine 4.76 (2.98–6.31) in fourth dorsal spine; pectoral fins 3.47 (2.94–3.57) in SL; coloration dominated by dark diagonal bands, three on the head, one from the anterior origin of the dorsal fin to the pelvic fin, and one from behind the fourth dorsal spine to the lower lobe of the caudal fin; upper lobe of caudal fin with black tip; circumpeduncular scales 28 (25–27, usually 27); branchiostegal rays 6.

Body deep, greatest depth 2.83 (2.57–2.76) in SL, and compressed, width 3.18 (2.64–3.34) in depth; head length 3.57 (3.23–3.65) in SL; nape strongly elevated; dorsal profile of snout forming angle slightly greater than 45° to the horizontal, snout length 3.20 (2.24–3.23) in head; orbit diameter 4.15 (3.67–4.77) in head; interorbital space broadly flat medially, the edges convex, the least width 4.21 (3.43–4.72) in head; caudal peduncle slender, the least depth 3.21 (3.22–3.70) in head, and long, the peduncle length 1.13 (0.90–1.15) in head.

Mouth small, somewhat ventral on head, the upper lip projecting, the maxilla reaching a vertical through posterior nostril (or between posterior nostril and centre of orbit); lips thick, fleshy, and smooth; small slender villiform teeth in bands in jaws; pair of bony knobs anterior to orbit, one above each posterior nostril, and a second shorter pair, anteriorly on snout just above upper lip; opercle with a single flat feeble spine posteriorly; nostrils large, both anterior to centre of orbit; anterior nostril elliptical, the upper part covered by a flap from posterior margin and the lower part covered by a flap from the anterior margin, fringed with 8 (up to 11) and 3 (up to 3) cirri respectively; posterior nostril round, diagonally above and behind anterior nostril; pores of lateralis system on head inconspicuous; gill-rakers short, the longest about half the length of the longest gill filament on first arch.

Scales cycloid; scales on head very small, the height of the exposed part about one-sixth height of largest scales on side of body; scales dorsally on head extending forward to above anterior nostril; scales on cheeks extending anteriorly nearly to corner of mouth; snout, lips and ventral part of head naked; lateral line slightly arched above pectoral fin, becoming progressively closer to dorsal contour of body posteriorly, at rear base of dorsal fin it is separated from fin by only 2 scale rows; lateral-line scales small, the exposed part about one-third height of adjacent scales; scaly sheath at base of dorsal fin about half the height of last dorsal spine, comprising 2 scale rows except near the junction of spinous and soft rayed sections, where 3 rows are present; scaly sheath at base of anal fin comprising 1 scale row anteriorly and 1–2 scale rows posteriorly; small scales basally on pectoral fins; no scales in axil of pectoral fins; a few rows of small scales basally on pelvic fins.

Origin of dorsal fin on a vertical from posterior edge of orbit; anterior three dorsal spines short, 12.17 (10.12–13.10),

Fig. 1. Holotype of *Cheilodactylus (Goniistius) francisi* n.sp. (AMS I.17357-001, 199.8 mm SL), collected from Lord Howe Island. Scale 1 cm.

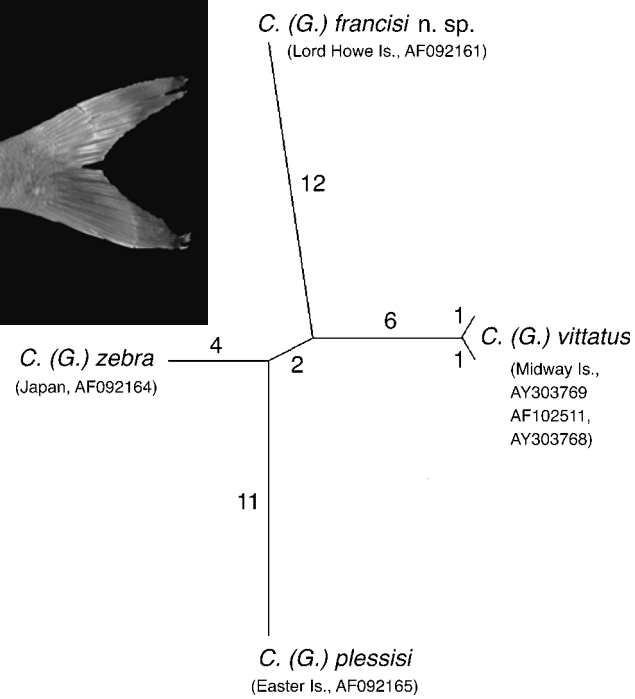

Fig. 2. One of two equally-most parsimonious trees (length = 37 steps) depicting molecular divergence among *C. (G.) francisi* n.sp., *C. (G.) vittatus*, and related species of *Goniistius*, based on partial mitochondrial cytochrome *b* DNA sequences (402 bp). Numbers on branches reflect the frequency of character-state changes, and GenBank accession numbers are listed for each sequence.

7.89 (7.20–9.31), and 5.38 (4.35–5.32) in head; fourth dorsal spine longest, about three times the length of the third spine, length 1.13 (0.83–1.61) in head; remaining dorsal spines progressively shorter, the last 6.36 (4.17–9.31) in head; first dorsal ray almost twice length of last dorsal spine, the ninth (seventh-tenth, usually ninth) dorsal ray longest, 3.50 (3.11–3.87) in head; origin of anal fin below base of ninth or tenth dorsal ray, less than orbit width from anus; first, second and third anal spines 10.98 (9.85–16.23), 3.50 (3.33–4.97), and 3.24 (3.19–4.13) in head, respectively, longest spine about one-third longest anal fin ray; anterior part of soft portion of anal fin about three times longer than posterior, the second ray longest, 1.42 (1.51–1.86) in head; caudal fin 1.08 (0.89–1.53) in head; strongly forked, caudal concavity 2.04 (1.72–2.72) in head; tenth pectoral ray longest (ninth or tenth, usually tenth), 3.47 (2.94–3.56) in SL; upper margin of pectoral fin 6.17 (5.09–6.45) in SL; origin of pelvic fin below base of eleventh or twelfth dorsal spine; pelvic fins reaching but not extending beyond anus (not reaching, reaching, or extending beyond anus), 5.55 (4.55–5.81) in SL.

Preserved coloration of holotype (Fig. 1) and paratypes in ethanol is pale to light brown with dark brown bands; head with two dark bands across interorbital, two on cheek (one from orbit, towards pectoral fin base, the other from below eye to ventroanterior part of thorax); area around upper and lower jaws dark brown; body with one band from nape through axil of pectoral fin to pelvic fin, a second band from first 3 spines of dorsal fin, beneath distal part of pectoral fin, to ventral surface between origin of pelvic fins and anus, and a third band from the fifth dorsal spine to lower lobe of caudal fin, somewhat discontinuous; dorsal fin pale except for the two dark bands extending into spinous portion; anal fin and pectoral fins pale; pelvic fins dark brown; caudal fin upper lobe pale except for black tip, lower lobe entirely dark brown.

Live coloration depicted in Francis (2001, pl. 98).

In addition to the holotype and paratypes of *C. (G.) francisi* n.sp., counts of gill-rakers (6 + 16), dorsal (XVI, 34), anal (III, 8), and pectoral (14, probably ii, 6, vi) fin rays from a 176 mm SL specimen collected at Lord Howe Island (22 April 1997), but not retained, were made by M.P. Francis (NIWA, Wellington, New Zealand). DNA from this specimen was compared against Hawaiian *C. (G.) vittatus* during this study and that of Burridge & White (2000).

Comparisons. Based on data presented by Randall (1983) for *C. (G.) vittatus* from the Hawaiian Islands, and concurrent examination of five such individuals (Bernice P. Bishop Museum, BPBM 5584, 8778, 10061, 11983, 20883; holotype lost according to Randall, 1983), *C. (G.) francisi* n.sp. differs from *C. (G.) vittatus* in the number of upper limb gill-rakers, with the former having 5–6 and the latter 6–8. Only one of 16 *C. (G.) vittatus* specimens examined by Randall (1983) had 6 upper limb rakers, and all of the specimens examined during this study had 7, except one with 8 (BPBM 11983). In contrast to the statement by Randall (1981, 1983), the colour of southwest Pacific "*vittatus*" individuals is not the same as that for the Hawaiian *vittatus*, and this is apparent from the live photographs presented by Randall *op cit*. A black tip to the upper lobe of the caudal fin distinguishes *C. (G.) francisi* n.sp. According to Randall (1983) the tip "may be dusky" in *C. (G.) vittatus*, but such was not observed among the Hawaiian specimens examined herein, or photographs of live individuals viewed by the author, and it is clearly black in *C. (G.) francisi* n.sp. (Randall, 1983, figs. 11 & 12; Francis, 2001, pl. 98). Similarly, the most posterior diagonal dark band on *C. (G.) francisi* n.sp. extends across the caudal peduncle and covers the entire lower lobe of the caudal fin (Fig. 1; Randall, 1983, figs. 11, 12; Francis, 2001, pl. 98), whereas in *C. (G.) vittatus* this band terminates posteriorly at the peduncle (e.g., Jordan & Evermann, 1973, pl. 54). *Cheilodactylus (G.) francisi* n.sp. differs from the other members of *Goniistius* in the features used by Randall (1983) to distinguish *C. (G.) vittatus*.

Based on partial mitochondrial cytochrome *b* DNA sequences, the level of molecular divergence (proportion of differences among 402 nucleotide characters) between one Lord Howe Island individual of *C. (G.) francisi* n.sp. and three Hawaiian individuals of *C. (G.) vittatus* was 4.48–4.73%. This level of divergence is similar in magnitude to that observed between either of these species and their phylogenetically-nearest relatives within *Goniistius*, *C. (G.) zebra* Döderlein, 1883 and *C. (G.) plessisi* Randall 1983, representing 2.98–5.72% (phylogenetic relationships according to Burridge & White, 2000). In contrast, divergence among the three Hawaiian individuals of *C. (G.) vittatus* was an order of magnitude smaller, 0.25–0.50%. Genetic variation among these taxa is depicted in Fig. 2. Thus, the levels of molecular divergence between *C. (G.) francisi* n.sp. and *C. (G.) vittatus* are consistent in magnitude with other interspecific comparisons within *Goniistius*, and much higher than intraspecific divergence within *C. (G.) vittatus* (see also Johns & Avise, 1998, for a wider perspective of interspecific cytochrome *b* variation among congeneric fishes). Despite the low availability of material from these species, it is unlikely that the intraspecific variation detected for *C. (G.) vittatus* is sufficiently underestimated such that the divergence from *C. (G.) francisi* n.sp. is insignificant. All three individuals of *C. (G.) vittatus* were collected from Midway Island, located at the northwest extremity of the Hawaiian Island chain. Given the comparatively high abundance of *C. (G.) vittatus* at this locality, the greater geological age of the northwestern islands in the Hawaiian chain, and their oceanographically "upstream" placement relative to the southeast Hawaiian islands, it is likely that Midway Island represents one of the greatest sources of genetic variation within *C. (G.) vittatus*.

Etymology. This species is named in recognition of the contributions made by Malcolm Francis to the biogeography of southwest Pacific fishes, and for the provision of tissue samples from this rarely encountered taxon for my genetic research.

Distribution. *Cheilodactylus (G.) francisi* n.sp. is known from the type localities, Lord Howe Island, Lord Howe Rise, Middleton Reef, and the Kermadec Islands, and probably also represents the reports of *C. (G.) vittatus* from New Caledonia (Randall, 1981, 1983) and Norfolk Island (Francis, unpublished) based on live photographs, and Elizabeth Reef based on visual observations (Gill & Reader, 1992). The species appears to be common at the Kermadecs (Francis *et al.*, 1987) and Elizabeth and Middleton Reefs (Gill & Reader, 1992).

Remarks. Although placement of non-South African taxa within *Cheilodactylus* Lacepède, 1803 appears invalid based on morphological and molecular characters (Burridge & Smolenski, 2004), such an assignment is followed for *C. (G.) francisi* n.sp. pending revision of these and other cirrhitoids.

ACKNOWLEDGMENTS. I thank Mark McGrouther at the Australian Museum, Sydney, Andrew Stewart at Te Papa Tongarewa (Museum of New Zealand), Wellington, Alastair Graham, CSIRO Marine Research, Hobart, and Arnold Suzumoto, Bernice P. Bishop Museum, Honolulu, for facilitating the loan of specimens, and Di Bray and Martin Gomon (Museum Victoria, Melbourne) for access to laboratory facilities. Martin Gomon, Jeff Leis (Australian Museum, Sydney), and three anonymous reviewers are thanked for constructive criticisms that improved the manuscript.

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Manuscript received 6 February 2003, revised 19 January 2004 and accepted 9 February 2004.

Associate Editor: J.M. Leis.