

Two New Cardinalfish Species of the Genus *Apogon* from Easter Island

David W. Greenfield^{1,2} and John E. Randall³

¹ Research Associate, California Academy of Sciences, San Francisco, California and Emeritus Professor, University of Hawaii; ² Mailing address; Moss Landing Marine Laboratory 8272 Moss Landing Road, Moss Landing, CA95039; ³ Bernice P. Bishop Museum, Honolulu, Hawaii.

Three species of *Apogon* have been reported from Easter Island, two of which are here described as new: *Apogon kauteamea* (formerly *A. coccineus*), small, translucent red, with VI first-dorsal spines, a free edge of skin near the anterior nasal opening, and two rows of scales between the lateral line and the base of the third dorsal spine; and *Apogon rubrifuscus* (formerly *talboti*), distinct in having two predorsal bones and 12 pectoral-fin rays. It is similar to *A. deetsie* and *A. caudicinctus*, but has a much larger membranous preopercular flap, lacks any dark bars on the body, and attains larger size (101.5 mm SL).

Only three cardinalfish species have been recorded from Easter Island, *Apogon coccineus* Rüppell, *Apogon talboti* Smith, and *Apogon chalcus* Fraser and Randall (Fraser and Randall 1986; DiSalvo et al. 1988). Two, however, represented misidentifications. When Gon and Randall (2003) restricted *A. coccineus* to the Indian Ocean, the status of that species at Easter Island needed to be reevaluated. In 1986, Randall et al. collected a large (101.5 mm SL) *Apogon* specimen from a cave at a depth of 39.9 m that was reported by DiSalvo et al. (1988) as *A. talboti*. A closer examination of that specimen showed that it is not *A. talboti*. Both of these species were determined to be undescribed and are described here.

MATERIALS AND METHODS

All counts and measurements follow Hubbs and Lagler (1964) except that the last two fin rays of the dorsal and anal fins are not counted as one unless it is clear that they are joined at the base. Measurements were made to the nearest 0.1 mm using dial calipers and are expressed as percentage of standard length (SL) or in relation to each other. Data for the holotype are presented first, followed by values for all specimens in parentheses. Ranges given in the descriptions are followed by the mean for measurements or mode for counts. Length of dorsal-fin spines was measured by placing one end of the caliper tip at the base of the spine pushed against the posterior base of anterior spine and the other caliper tip at the spine tip. Gill-raker counts include rudiments. Because *A. rubrifuscus* appears to be most similar to *A. deetsie* Randall (1998), and *A. kauteamea* relates to the two complexes described by Greenfield (2001), the format for the description of each follows the format of each paper respectively to ease comparison. Institutional abbreviations are as listed in Leviton et al. (1985).

SPECIES DESCRIPTIONS

***Apogon kautamea* Greenfield and Randall, sp. nov.**

(Figs. 1–2; Tables 1–2)

Apogon coccineus (non Rüppell) Randall and Egaña, 1984.

MATERIAL EXAMINED.— HOLOTYPE: CAS 219899, 40.3 mm SL. Easter Island, west coast off Tahai, 18–20 m, 13 February 1985, rotenone, J.E. Randall, A. Cea Egaña, and L.H. Di Salvo. PARATYPES: BPBM 39186 (2, 33.3–39.2 mm), taken with holotype; CAS 219900 (3, 38.5–42.4 mm) Easter Island, off Motu Tautara, cave at 39.3 m, 10 February 1986, rotenone, J.E. Randall, A. Cea Egaña, L.H. Di Salvo, J.L. Earle, and M. Garcia; BMNH 2004.6.18.1 (1, 36.9 mm) Easter Island, west shore, wreck about 20 m offshore between Hanga Roa and Hanga Piko, 3.0–4.6 m, 27 January 1969, Chemfish, J.E. Randall and G.R. Allen; USNM 378013 (1, 37.9 mm) Easter Island, between Motu Tautara and Ara O Hara, cave with sand bottom, 16.8 m, 15 February 1985, J.E. Randall and A. Cea Egaña; FMNH 113713 (1, 39.8 mm) Easter Island, west coast, Tahai, large coral head on sand, 10.7 m, 18 February 1986, rotenone, J. E. Randall and M. Garcia ; AMS I.4330-001 (1, 40.8 mm) same locality as FMNH 113713; NSMT-P 68772 (1, 40.5 mm) same locality as CAS 219900; SAIAB (RUSI) 74299 (1, 39.8 mm) same locality as CAS 219900; BPBM 6634 (1, 25.4 mm), Easter Island, west coast, tidepools between Hanga Roa and Hanga Piko, 0.3–0.9 m, 25 January 1969, rotenone, G.R. Allen and B.A. Baker; BPBM 6635 (1, 41.3 mm), Easter Island, off Ahu akapu, 24.4 m, 5 February 1969 (color photo), J.E. Randall and G. A. Allen. *Apogon kautamea*-non-type material: BPBM 6632 (4, 20.0–44.0 mm) Easter Island, off Ahu Akapu, rock and sand, 10.7 m, 7 February 1969, rotenone, J.E. Randall, G.R. Allen and B.A. Baker. *Apogon campbelli*: Pitcairn, BPBM 16927(2); Oeno Atoll (Pitcairn Islands), BPBM 16499 (2), BPBM 16533 (4); Tuamotu Arch., Mangareva Group, Temoe Atoll, BPBM 13529 (2); Rangiroa Atoll, BPBM 10310 (5); Society Islands, Tahiti, BPBM 10286 (3), Moorea, BPBM 6170 (1); Rapa: BPBM 39423 (3); Cook Islands, Rarotonga, BPBM 13946 (3); Aitutaki, BPBM 5613 (5). *Apogon crassiceps*. Holotype, Fiji, Viti Levu, MC 28214, BPBM 5795 (25), BPBM 38996 (1), CAS 218904 (12); Tonga, BPBM 38241 (2).

DIAGNOSIS.— A small, usually less than 40 mm SL, semitranslucent, red species lacking stripes or bars or black edges on scales on body sides, with six spines in the first and one spine and 8–9 (almost always 9) rays in the dorsal fin; two spines and eight rays in the anal fin; usually a total of 16 or fewer gillrakers (rudiments included) on the first gill arch; 13–15 (almost always 14) pectoral-fin rays; two predorsal (supraneural) bones; a free edge of skin near the anterior nasal opening (Fig. 1F in Greenfield 2001); and two scales between the lateral line and the base of the third spine of the first dorsal fin.

DESCRIPTION.— Dorsal-fin elements VI-I,8 (VI-I,8-9, almost always I,9); anal-fin elements II,8 (II,8); all dorsal and anal soft rays branched, the last to base; pectoral-fin rays 14 (13–15, usually 14), the upper two and lower one unbranched; pelvic rays I,5; lateral line complete, the pored scales 24 (often plus one or two on caudal-fin base); predorsal scales 6; scales above lateral line to origin of first dorsal fin two; transverse scales 10 (9–10, usually 10); circumpeduncular scales 12; gill rakers 3 + 13 (3–4 + 12–14, usually 3 + 12 or 13), in holotype one developed on upper arch and 8 developed on lower arch, the remainder knobs.

Measurements based on holotype and 12 paratypes. Measurement for holotype presented first, followed by range for all types and the mean in parentheses all in percentage of SL. Counts based on 13 types plus three non-type specimens. Standard length 33.3–42.4 mm. Greatest body depth 36.7 (30.6–37.9: 35.6). Head length 39.0 (37.6–43.1: 39.5). Eye diameter 15.2 (13.4–15.8: 14.8).

Snout length 7.3 (5.8–8.7: 7.2). Bony interorbital width 9.3 (8.1–9.4: 8.9). Upper jaw length 20.4 (19.7–21.8: 20.7). Caudal peduncle depth 13.7 (11.5–14.2: 13.1). Caudal peduncle length 31.3 (27.9–31.8: 30.2). First dorsal-fin base length 15.9 (15.0–17.5: 15.9). Second dorsal-fin base length 15.2 (14.1–15.9: 14.7). Anal-fin base length 16.1 (13.2–16.3: 15.2). Pectoral-fin length 24.8 (23.7–29.7: 26.6). Pelvic-fin length 26.8 (23.6–28.8: 26.0). First dorsal-fin spine length 5.0 (4.8–7.6: 5.9). Second dorsal-fin spine length 22.9 (21.6–24.1: 22.8). Third dorsal-fin spine length 17.7 (17.5–20.3: 18.9). Fourth dorsal-fin spine length



FIGURE 1. Holotype of *Apogon kautamea*, CAS 219899.



FIGURE 2. Fresh color of paratype of *Apogon kautamea*, BPBM 6635.

14.5 (14.2–16.6: 15.3). Fifth dorsal-fin spine length 10.2 (9.4–11.7: 10.6). Sixth dorsal-fin spine length 5.2 (4.7–7.0: 5.9). Length spine of second dorsal fin 14.1 (13.2–14.8: 14.0). Longest dorsal ray (1–3, usually 3rd) 21.9 (21.4–24.0: 22.5). First anal-fin spine length 4.6 (3.6–4.9: 4.2). Second anal-fin spine length 12.9 (11.8–13.2: 12.8). Longest anal ray (1–3, usually 2nd) 21.1 (18.9–23.9: 22.1). Upper caudal-fin lobe length 32.5 (32.1–35.8: 34.3). Lower caudal-fin lobe length 29.1 (29.1–39.2: 32.8).

Color of fresh specimen (from 35mm transparency of BPBM 6635). Head and body translucent, overlaid with a wash of red that is more concentrated on anterior and dorsal portions of body. Scales on nape strongly outlined in red and black pigment on predorsal scales. Scales on upper half of body outlined in red with a concentration of red along both dorsal-fin bases. Snout and side of head washed in light red, ventral surface of head white. Black area where brain is located showing through body. Back-bone showing through body as a red line, hypural plates also red. Red along anal-fin base. Dorsal and ventral edges of caudal peduncle with a concentration of red. Iris of eye gold, pupil black. Dorsal-fin spines and rays reddish, membranes clear. Rays of other fins with reddish tinge, membranes clear.

Color in alcohol: Head and body straw colored. Area over brain brown. Predorsal scales and scales along base of first dorsal fin with brown pigment. Scales on dorsal surface of caudal peduncle with scattered brown pigment spots. A few scattered brown pigment spots on scales at caudal-fin base. Iris of eye black, pupil dark straw. All fins clear.

ETYMOLOGY.— The specific epithet is a compound adjective from the Old Rapanui language of Easter Island, combining ‘*ku’ata*’ meaning transparent and *mea* meaning red, referring to the transparent red coloration of the species.

COMPARISONS.— The distinctive nasal flap places *A. kautamea* in the *Apogon coccineus* complex; however, it has two scales between the lateral line and the dorsal-fin base that is typical of the *Apogon erythrinus* complex as defined by Greenfield (2001). The nasal flap is more complex than adding an additional scale row, and thus we consider *A. kautamea* to belong to the *Apogon*

coccineus complex. Two other members of the *A. coccineus* complex are known from the Pacific Ocean, *A. campbelli* and *A. crassiceps*. Both of these species have a single scale row between the lateral line and the dorsal-fin base. These two species are morphologically very similar, but differ in the number of pectoral-fin rays and gill rakers (Tables 1 and 2). *Apogon campbelli* appears to be an antitropical species, whereas *A. crassiceps* is more tropical. *Apogon kautamea* is morphologically similar to both species, and has counts similar to *A. campbelli*, but differs from both by having the unique combination of a nasal flap and two scales between the lateral line and dorsal-fin base.

REMARKS.— With the discovery of *A. kautamea*, it is necessary to modify the definition of the *A. coccineus* complex as defined by Greenfield (2001). The single remaining character defining the *A. coccineus* and *A. erythrinus* phenetic complexes is the structure of the snout below the anterior nostril.

***Apogon rubrifuscus* Greenfield and Randall, sp. nov.**

(Figs. 3, 4B)

Apogon talboti (non Smith) DiSalvo et al., 1988.

MATERIAL EXAMINED.— Holotype: BPBM 39346, 101.5 mm SL. Easter Island off Motu Tautara, cave at 39 m. Taken with rotenone by J.E. Randall, A. Cea Egaña, L.H. Di Salvo, J.L. Earle, and M. Garcia. 10 February 1986. *Apogon caudicinctus*: BPBM 35192 (4), Ogasawara Archipelago; CAS 219830 (2), Fiji. *Apogon deetsie*: BPBM 13983 (1), Hawaii. *Apogon postero-fasciatus*: CAS 219901(3), Fiji; CAS 219902 (1), Fiji.

Diagnosis.—Dorsal-fin elements VI-I,9; anal-fin elements II,8; pectoral-fin rays 12; lateral-line scales 24; predorsal scales 6; gill rakers 5 + 15; body depth 2.9 in SL; upper preopercular edge serrate, the corner and lower edge with a protruding, crescentic membranous lobe with a crenulated margin that almost reaches the edge of the sub and interopercles; preopercular ridge smooth; caudal fin forked with rounded lobes; color pinkish red anteriorly with posterior two thirds dusky gray with black scale edges.

DESCRIPTION.— Dorsal-fin elements VI-I,9; anal-fin elements II,8; all dorsal and anal soft rays branched, the last to base; pectoral-fin rays 12, the upper two and lower one unbranched; pelvic rays I,5; principal caudal rays 17, the upper and lower unbranched; procurrent caudal rays three upper and three lower; lateral line complete, the pored scales 24 (plus two smaller pored scales on caudal-fin base); predorsal scales 6; scales above lateral line to origin of first dorsal fin one; scales below lateral line to origin of anal fin 6; circumpeduncular scales 12; gill rakers 5 + 15, all developed; pseudobranchial filaments 14; branchiostegal rays 7; vertebrae 10 + 14; supraneural (predorsal) bones two.

Body depth 2.9 in SL; body moderately compressed 2.2 in depth; head length 2.4 in SL; dorsal profile of head straight (except for rounded front of snout); snout length 5.2 in head; eye diameter 2.9 in head; interorbital width 5.5 in head; caudal peduncle depth 4.1 in head; caudal peduncle length 3.4 in SL. Mouth slightly inferior and relatively large, maxilla extending to between the

TABLE 1. Gill-raker counts from both sides of species of *Apogon*

	Upper limb		Lower limb			Total rakers			
	3	4	12	13	14	15	16	17	18
<i>A. campbelli</i>	24	9	21	2	—	17	13	3	—
<i>A. crassiceps</i>	8	18	7	16	3	5	7	11	3
<i>A. kautamea</i>	30	2	15	14	3	15	13	3	1

TABLE 2. Pectoral-fin ray counts of species of *Apogon*.

	12	13	14	15
<i>A. campbelli</i>	—	3	29	—
<i>A. crassiceps</i>	1	25	—	2
<i>A. kautamea</i>	—	1	28	—

posterior pupil margin and posterior orbit edge; upper jaw length 2.0 in head; mouth slightly oblique, the gape forming an angle of about 40° to horizontal axis of body; supramaxilla not present; a band of villiform teeth in jaws (maximum of about 12 rows in upper jaw and five in lower jaw); a single row of about 17 very small, conical teeth on palatine; small conical teeth forming a V-shaped patch on vomer, two rows anteriorly and two rows posteriorly (vomerine teeth larger than those in jaws). Anterior part of tongue slender and spatulate. Largest gill raker at angle and adjacent to angle on lower limb, its length one-third eye diameter.



FIGURE 3. Fresh color of holotype of *Apogon rubifuscus*, BPBM 39346.

A single, acute, sharp, opercular spine at level of center of eye; upper edge of preopercle serrate, with 17 serrae; corner and ventral part of preopercular edge with a large, crescentic, protruding lobe with a crenulated margin that almost reaches edge of sub and interopercles and extends posterior of serrate edge; lateralis system of head with numerous close-set pores having slightly elevated rims; two longitudinal rows of pores from front of snout to occiput, crossed by 24 transverse rows; a suborbital row of pores with same transverse pore system. Anterior nostril a short membranous tube at level of bottom of pupil, about a nostril diameter from groove at base of upper lip; posterior nostril a larger triangular aperture, apex towards snout, directly in front of center of eye, the internarial distance about half pupil diameter; nasal chamber cavernous, the skin over the roof thin. Scales weakly ctenoid and thin; scales present on nape, opercle, and preopercle, those on opercle larger than scales on body; no scales on occiput, interorbital, snout, or ventrally on head; no scales on fins except for small scales on about basal fourth of caudal fin. Origin of first dorsal fin over third lateral-line scale; predorsal distance 2.4 in SL; fin spines strong and sharp; first dorsal spine 45.6 in head; second dorsal spine 2.1 in head; third dorsal spine slightly longest, 2.1 in head; second dorsal fin separated by two median scales (postermost indented posteriorly) from first dorsal fin, its origin above ninth lateral-line scale; spine of second dorsal fin 2.3 in head; third soft dorsal ray longest, 1.5 in head; origin of anal fin slightly posterior to second dorsal-fin origin; first anal-fin spine short, 16.9 in head; second anal spine 2.5 in head; fourth soft ray longest, 1.8 in head; caudal fin forked with broadly rounded lobes; pectoral fins long and rounded, seventh ray longest, 3.0 in SL; pelvic fins reach to second anal-fin spine, 1.6 in head.

FRESH COLOR.— Background color of head and anterior part of body pinkish red; scale edges from first dorsal fin back to caudal fin black, and background color of caudal peduncle gray, making the posterior two thirds of the body much darker than the anterior third. Lateral-line scales on caudal peduncle paler than other scales, forming a distinct gray line down center of caudal peduncle sides. Preopercle and maxilla with silvery reflections. Pupil of eye black, iris silver. Spines and soft rays of dorsals, anal, caudal and pelvic fins pink to dark red, membranes dusky, so that the fins are dark. Pelvic-fin rays pink, membranes clear.

COLOR IN ALCOHOL.— Head and body straw yellow, with scale edges outlined in dark brown, particularly in posterior two thirds of body; fins pale except for outer edges of dorsals, anal, pelvics, and caudal fins; pectoral fins clear; iris of eye black with white pupil.

ETYMOLOGY.— The specific epithet is a compound adjective from the Latin *ruber* (red) and *fuscus* (dark colored) in reference to the red body color overlaid by black pigment on the posterior two thirds of the body.

COMPARISONS.— Within the genus *Apogon* there are several species that have the same general body shape, one that is typical of *Apogon talboti* Smith. Because of this similarity, a number of specimens reside on museum shelves identified as *A. talboti*, but they are not. *Apogon talboti* has three predorsal bones and 13 pectoral-fin rays, whereas another group of specimens we refer to as “*talboti* look-alikes” have only two predorsal (supraneural) bones and 12 pectoral-fin rays. *Apogon rubrifuscus* belongs to this look-alike group.

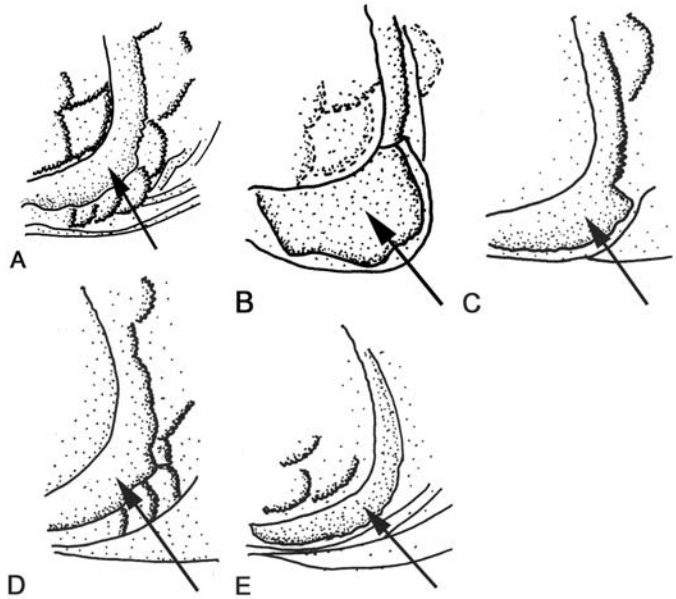


FIGURE 4. Preopercle and membranous flap indicated by arrow: (A) *Apogon talboti*, USNM 213228, Taiwan; (B) Holotype of *Apogon rubrifuscus*, BPBM 39346, Easter Island; (C) *Apogon deetsie*, BPBM 13983, Oahu, Hawaiian Islands; (D) *Apogon posterofasciatus*, CAS 219901, Fiji; (E) *Apogon caudicinctus*, BPBM 35192, Ogasawara Archipelago.

In addition to the three predorsal bones and 13 pectoral-fin rays, *A. talboti* has a distinctive, small, crenulated membranous flap at the lower corner and along the lower margin of the preoperculum (Fig. 4A). In their description of *A. posterofasciatus*, Allen and Randall (2002) state that it is most closely related to *A. deetsie* Randall (1998) and *A. caudicinctus* Randall and Smith (1988), and that “This trio is characterized by a membranous flap at the lower corner and along the ventral margin of the preopercle.” Two of these species, *A. deetsie* and *A. caudicinctus*, have two predorsal bones, whereas *A. posterofasciatus* has three. Ofer Gon (pers. commun. Oct. 2004) believes that *A. posterofasciatus* is a member of the *A. talboti* group and not associated with *A. deetsie* or *A. caudicinctus*. *Apogon rubrifuscus* also has this membranous flap, and it is larger than that found in those three species (Fig. 4B). *Apogon rubrifuscus* and *A. deetsie* have a crenulated membranous flap below the suborbital bones, whereas it is smooth in *A. posterofasciatus* and *A. caudicinctus* (Fig. 4C–E). The preopercular margin of *A. caudicinctus* is more weakly serrate than in the other species, or smooth. The posterior end of the maxilla is concave in both *A. rubrifuscus* and *A. deetsie* whereas it is straight in both *A. posterofasciatus* and *A. caudicinctus*. *Apogon rubrifuscus* differs from *A. deetsie* by having more gill rakers (5 + 15 versus 3–4 + 12–13) and in coloration. *Apogon deetsie* has two dusky bars on the body, one below the basal half of the second dorsal fin and a broader bar posteriorly on the caudal peduncle and extending slightly onto the caudal-fin base. *Apogon rubrifuscus* lacks those bars, but rather has the entire caudal peduncle dusky as is a portion of the body anterior to the caudal peduncle. In preserved material, *A. rubrifuscus* has distinct dark scale margins whereas they are lacking in *A. deetsie*. Among the species considered here, *A. rubrifuscus* and *A. deetsie* appear to be most similar.

KEY TO THE EASTER ISLAND CARDINALFISHES

- 1a. Seven spines in first dorsal fin; overall life color golden yellow *Apogon chalcicus*
 1b. Six spines in first dorsal fin; overall life color mainly red 2
- 2a. Corner and lower preopercular edge with protruding, crescentric membranous lobe with a crenulated margin that almost reaches edge of sub and interopercles; posterior two thirds of body dusky gray with black scale edges; five rakers on upper gill arch, all developed
 *Apogon rubrifuscus*
 2b. Corner and lower preopercular edge without large membranous lobe; body light without dark scale edges; three to four, usually 3 rakers on upper gill arch, only one developed
 *Apogon kautamea*

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