

CLARIFICATION OF THE WESTERN PACIFIC CARDINALFISH SPECIES *APOGON TRIMACULATUS* AND *A. RHODOPTERUS*, WITH DESCRIPTION OF A SIMILAR NEW SPECIES

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ABSTRACT. - Three similar western Pacific species of cardinalfishes (Apogonidae) have been confused: *Apogon trimaculatus* Cuvier, *A. rhodopterus* Bleeker (both in the subgenus *Pristicon*) and a new species (subgenus *Ostorhinchus*) that has been misidentified as *A. rhodopterus*. All three have a serrate preopercular edge, a forked caudal fin with broadly rounded lobes, and two dark bars on the body, one below each dorsal fin; all have either a dark spot on the opercle or one posteriorly on the lateral line, or both. *Apogon rhodopterus* Bleeker has generally been regarded as a junior synonym of *A. trimaculatus* Cuvier, but it is distinct from *A. trimaculatus* in having narrow dark edges on the scales, lacking a dark spot on the opercle and a dark bar below the front of the second dorsal fin, and in having a more coarsely serrate preopercular edge. The new species, *A. rufus*, is described from 23 specimens (largest 80 mm SL) from Palau, Fiji, Indonesia, Papua New Guinea, and the Ryukyu Islands in the depth range of 15-80 m. It is distinct in having 15-16 pectoral rays (13-15 in *trimaculatus* and *rhodopterus*, rarely 15), no serrae on the preopercular ridge, only a few weak ones on the posttemporal in specimens longer than 70 mm SL, a prominent dark band near base of the second dorsal and anal fins, black digestive tract, and brownish red ground color in life (light brown to grey or olivaceous in the other two species). *A. rhodopterus* (largest, 120 mm SL) is known from shallow protected reefs from Singapore (type locality), Indonesia, Philippines, Papua New Guinea, Palau, and Yap. *A. trimaculatus* (largest, 141.6 mm SL) occurs throughout the tropical and subtropical western Pacific from the Ryukyu Islands to Western Australia and the southern Great Barrier Reef, and east to Samoa and the Marshall Islands. An 89-mm specimen from Palau intermediate in color and the number of preopercular serrae to *A. rhodopterus* and *A. trimaculatus* is identified as a probable hybrid.

INTRODUCTION

The cardinalfish *Apogon trimaculatus* was described by Cuvier in Cuvier & Valenciennes (1828) from the Molucca Islands, Indonesia. It is the type species of the subgenus *Pristicon* (Fraser, 1972). *Apogon rhodopterus* was described by Bleeker (1852) from Singapore. Although it was regarded as a valid species by Fowler & Bean (1930), most other authors, such as Weber & de Beaufort (1929), Herre (1953), Shao & Chen (1986) and Shen (1993), have mistakenly treated it as a junior synonym of *A. trimaculatus*. A similar undescribed species from the Ryukyu Islands was misidentified as *A. rhodopterus* by Hayashi & Kishimoto (1983) and Hayashi in Masuda et al. (1984).

Fraser (1972) included *Apogon trimaculatus* and *A. unicolor* Döderlein in the same subgenus based on internal and external characteristics. *A. unicolor* is removed from this grouping based on the presence of a ventral fleshy unossified flap of the preopercle, small body scales, and a black stomach and intestine. This species may represent another line within *Apogon*.

The purpose of the present paper is to describe the new species and distinguish it from the other two fishes with similar color pattern.

MATERIAL AND METHODS

Specimens have been examined at or obtained on loan from the following institutions: American Museum of Natural History, New York (AMNH); Academy of Natural Sciences, Philadelphia (ANSP); Bernice P. Bishop Museum, Honolulu (BPBM); California Academy of Sciences (CAS, SU); Field Museum of Natural History, Chicago (FMNH); Museum of Comparative Zoology, Harvard University, Cambridge (MCZ); Muséum National d'Histoire Naturelle, Paris (MNHN); Nationaal Natuurhistorische Museum, Leiden (RMNH); J.L.B. Smith Institute of Ichthyology, Grahamstown (RUSI); University of the Ryukyus Museum, Okinawa (URM); U.S. National Museum of Natural History, Washington, D.C. (USNM); and Yokosuka City Museum, Kanagawa (YCM). Type specimens of the new species have been deposited in the Australian Museum, Sydney (AMS); the National History Museum, London (BMNH); Bernice P. Bishop Museum; California Academy of Sciences; University of the Ryukyus Museum; U.S. National Museum of Natural History; and Yokosuka City Museum.

Lengths recorded for specimens are standard length (SL), the straight-line distance from the tip of the snout in the median plane to the base of the caudal fin (end of hypural plate). Body depth is measured vertically from the origin of the pelvic fins; body width is the greatest width just posterior to the head. Head length is measured from the front of the upper lip in the median plane to the most posterior point of the opercular membrane; snout length is taken from the same anterior point to the fleshy edge of the orbit. Orbit diameter is the greatest fleshy diameter of the orbit, and interorbital width is the least bony width. Caudal-peduncle depth is the least depth, and caudal-peduncle length the horizontal distance between verticals at the rear base of the anal fin and the base of the caudal fin; lengths of spines and rays of fins are measured from their extreme bases in a straight line to their tips. Caudal concavity is the horizontal distance between verticals at the tips of the longest and shortest caudal rays. Pectoral-fin length is the length of the longest ray; pelvic-fin length is measured from the base of the spine to the tip of the longest ray.

Counts of pectoral rays include the splint-like uppermost ray. Counts of lateral-line scales are made to the base of the caudal fin (hence do not include four smaller pored scales that extend onto the fin base). Gill-raker counts include all rudiments; the count of lower-limb rakers contains the raker at the angle. Rudiments are defined as having less height than the diameter of their base. Preopercular serrae were counted on Bishop Museum specimens for Figure 1. Counts included even the smallest bump in the preopercular margin.

Meristic and morphometric data given in parentheses for the new species refer to paratypes. Table 1 provides meristic data for the three species, and Table 2 the measurements of type specimens of the new species as percentages of the standard length. Proportional measurements in the text are rounded to the nearest 0.05.

KEY TO APOGON TRIMACULATUS, A. RHODOPTERUS, AND A. RUFUS

1. Pectoral rays 13-15 (rarely 15); preopercular edge coarsely or finely serrate; ground color in life light grey to light brown; digestive tract pale; largest specimens, 120-145 mm SL 2
- Pectoral rays 15-16 (usually 15); preopercular edge very finely serrate (Fig. 1); ground color in life brownish red; digestive tract black; largest specimen, 80 mm SL (western Pacific east to Fiji) *rufus*, new species

2. A dark brown spot on opercle; a dark brown bar below origin of second dorsal fin (in addition to an initially oblique dark bar below rear base of fin, the two sometimes joining to form a V or Y shape); edges of scales not dark brown; preopercular edge finely serrate (Fig. 1) (western Pacific east to the Marshall Islands and Samoa Islands) *trimaculatus*
- No dark brown spot on opercle; no dark brown bar below origin of second dorsal fin; edges of scales narrowly dark brown; preopercular edge coarsely serrate (Fig. 1) (East Indies, Palau and Yap) *rhodopterus*

***Apogon trimaculatus* Cuvier**

Pl. 1, Figs. 1-3, Table 1

Apogon trimaculatus Cuvier in Cuvier & Valenciennes, 1828: 156, pl. 22 (type locality, Buru, Molucca Islands, Indonesia).

Apogon koilomatodon Bleeker, 1853: 134 (type locality, Ternate, Molucca Islands).

Amia koilomatodon Bleeker, 1874: 23; Bleeker, 1873-1876: 81, pl. 307, fig. 1).

Material examined. - INDONESIA: Java, Pulau Seribu, USNM 213063, 86 mm. Karimundjawa Island, USNM 213062, 3: 81-109 mm. Bawean Island, USNM 313061, 2: 98-110 mm. Sulawesi, Toba Island, USNM 175727, 100 mm; Talisse Island, USNM 175700, 99 mm; Gulf of Boni, USNM 175697, 60 mm; Kapoposang Island, USNM 175662, 92 mm; Kabaena Island, USNM 213060, 101 mm; USNM 213059, 17: 26-102 mm; Teluk Bay, USNM 213191, 99 mm. Molucca Islands, Ambon, USNM 210536, 3: 65-67 mm; USNM 213190, 63 mm. Seram (Ceram), USNM 209659, 3: 75-96 mm; Makyan Island, USNM 175712, 122 mm; Halmahera, 266965, 2: 62-94 mm; USNM 266966, 53 mm; Banda Islands, USNM uncat. 2: 11-39 mm. MALAYSIA: Sabah, Manukan Island (5°58'N, 116°0'E), WAM 330397-036, 107 mm; vicinity of Darvel Bay, Bumbum Island, USNM 175721, 106 mm; USNM 175687, 102 mm; Danawan and Si Amil Islands, USNM 175664, 84 mm; Taganak Island, USNM 175688, 75 mm; Darvel Bay, USNM 212343, 21: 28-82 mm; Pulau Gaya, USNM 212341, 13: 31-90 mm; USNM 212343, 21: 29-82 mm; Pulau Bohidulong, USNM 212342, 3: 85-105 mm; Sandakan District, Kechil Island, FMNH 51858, 14: 18-100 mm; Bohaydulong Island (4°36'N, 118°47'E), WAM 30412-006, 5: 24-36 mm. SINGAPORE: SU 30414, 102 mm; SU 30419, 32 mm. GULF OF THAILAND: Koh Sac, CAS 83752, 17: 57-123 mm; CAS 74811, 3: 35-112 mm; Koh Kroi, CAS 86866, 8: 49-117 mm; Chumphon Province, CAS 86879, 5: 96-124 mm; Koh Samet, CAS 83750, 6: 48-127 mm; Rayong Province, Khorn Aho Bay, CAS 75207, 130 mm; Koh Tao, CAS 83754, 31: 43-111 mm. VIET NAM: Nhatrang, CAS 83753, 18: 42-125 mm. Khanh Hoa Province,

CAS 75308, 6: 63-100 mm. NEW GUINEA: Irian Jaya, Marchesa Bay, USNM 261637, 2: 66-94 mm; Waigi, FMNH 22198, 91 mm; SU 26656, 91 mm; SU 26664, 81 mm. PAPUA NEW GUINEA: Madang, USNM 212339, 37 mm; USNM 212340, 13: 30-87 mm; Bismarck Archipelago, New Britain, USNM 212351, 4: 59-107 mm; Keraward Island, USNM 212350, 2: 62-69 mm; Hermit Island, USNM 260923, 8: 21-94 mm; Ninigo Islands, USNM 260925, 6: 54-102 mm; Umboi Island, USNM 261635, 2: 22-25 mm. PHILIPPINES: Mindanao, Sacol Island (E of Zamboanga), USNM 175641, 2: 57-60 mm; Murcielagos Bay, USNM 175644, 3: 79-105 mm; Polloc, USNM 175653, 8: 58-98 mm; USNM 175726, 3: 83-102 mm; Opol, USNM 175648, 3: 93-115 mm; USNM 122268, 102 mm; Surigao, USNM 175691, 92 mm; USNM 212344, 95 mm; Generale Island, USNM 175729, 2: 76-91 mm; USNM 175690, 96 mm; Capunuyugan, USNM 175724, 84 mm; Inamucan Bay, USNM 175678, 111 mm; USNM 175684, 62 mm; Mompog Island, USNM 122266, 103 mm; USNM 175651, 3: 72-101 mm. Luzon: Pangasinan, USNM 262231, 3: 30-48 mm; USNM uncat. 83 mm; Maculabo Island, USNM 175669, 93 mm; Butuanan Island, USNM 175716, 101 mm; USNM 175655, 5: 73-98 mm; USNM 175710, 102 mm; USNM 175654, 5: 67-95 mm; Biri Channel, USNM 175720, 103 mm; Port Matalvi, USNM 175642, 2: 84-92 mm; USNM 175715, 86 mm; USNM 175682, 82 mm; Papagas Bay, USNM 175647, 4: 100-112 mm; Tilig, Lubang Island, USNM 175702, 104 mm; USNM 175668, 104 mm; Atulayan Island, USNM 175656, 100 mm; Ragay Gulf, Alibyan Island, USNM 175650, 2: 97-101 mm; Port Jamelo, USNM 175639, 2: 101 & 101 mm; USNM 175728, 2: 90-93 mm; Manila Bay, Limbones Cove, USNM 175733, 3: 71-110 mm; Catanduanes Island, USNM 175718, 99 mm; Sianga Bay, USNM 175665, 92 mm; Quinalasag Island, Masamat Bay, USNM 175689, 78 mm; USNM 175722, 96 mm; USNM 175666, 84 mm. Samar: Port Palapag, USNM 175652, 5: 89-108 mm; USNM 175701, 97 mm; Gigoso Point, Quinapundan Bay, USNM 175638, 2: 88-104 mm; USNM 175717, 78 mm; Nabatas Point, USNM 175698, 115 mm; USNM 175683, 95 mm. Palawan: Puerto Princesa; USNM 262292, 92 mm; USNM uncat. 95 mm; USNM uncat. 83 mm; USNM uncat. 2: 15-17 mm; Endeavor Strait, Malampaya Sound, USNM 175714, 66 mm; Machesi Island, USNM 175637, 2: 85-95 mm; Rasa Island, USNM 175643, 2: 90-98 mm; USNM 175705, 102 mm; USNM 175725, 72 mm; Rita Island, Ulugan Bay, USNM 175670, 105 mm; Bolalo Bay, USNM 175730, 2: 77-101 mm; USNM 175649, 2: 65-100 mm; USNM 175677, 104 mm; Port Langan, Dumarang Island, USNM 175692, 94 mm; Guntao Island, USNM 175663, 112 mm; USNM 175719, 93 mm. Burias Island, Alimango Bay, USNM 175703, 101 mm; USNM 175640, 2: 84-90 mm; Busin Harbor, USNM 175673, 112 mm. Balabac Strait, Candaraman Island, USNM 175646, 3: 82-99 mm; Caxisigan Island, USNM 175680, 104 mm; USNM 175731, 2: 100-101 mm; Bugsuk Island, USNM 175667, 97 mm; Balabac Island, Port Ciego, USNM 175661, 104 mm. Mindoro, Mansalay, USNM 175708, 102 mm; USNM 175697, 102 mm; USNM 175671, 89 mm; Sablayan, USNM 175675, 108 mm; USNM 175709, 79 mm; USNM 175694, 98 mm; Varadero Bay, USNM 175706, 90 mm; Paluan Bay, USNM 175699, 100 mm; USNM 175660, 103 mm. Malhon Island (between Samar and Leyte), USNM 175734, 2: 31-99 mm; Buang Bay, Talajit Island (between Samar and Masbate), USNM 175699, 122 mm; USNM 175674, 84 mm. Malapascua Island (N of Cebu), USNM 175761, 100 mm. Pandamon Island (between Cebu and Bohol), USNM 175732, 2: 105-118 mm; USNM 175645, 5: 55-116 mm. Bohol, Mantacao Island, USNM 175686, 101 mm. Balicasag Island, USNM 261636, 75 mm. Siquijor Island, USNM 261009, 2: 41-44 mm; USNM 261638, 5: 74-111 mm; USNM 268243, 3: 50-83 mm. Calamian Group: Busuanga Island, SU 38169, 92 mm; SU 38171, 105 mm. Cuyo Island, USNM 175659, 87 mm; USNM 261639, 14: 46-103 mm; USNM 262310, 20 mm. Panay, Lawigan, USNM 334529, 6: 16-97 mm. Negros, USNM 261008, 2: 95-108 mm; USNM 261640, 3: 39-95 mm; Dumaguete, SU 33452, 46 mm. Mayanpayan Island, Port Uson, USNM 175713, 90 mm. Singaan Island (between Jolo and Tarvi Tarvi), USNM 175704, 93 mm. Marinduque Island, Port Banalacan, USNM 175707, 81 mm; Chica Island, Capulaan Bay, USNM 175658, 106 mm. Masbate Island: Cataingan Bay, USNM 175723, 34 mm; USNM 171094, 83 mm. Caminquin Island (vicinity of Batanes), USNM 175681, 102 mm. Linapacan Island, Malcochin Harbor, USNM 175676, 76 mm. Batan Island, Caracaran Bay, USNM 175685, 82 mm. HONG KONG: Pratas Reef, CAS 86877, 4: 87-105 mm. JAPAN: Ryukyu Islands, Ishigaki, BPBM 7400, 96 mm; USNM uncat. 2: 21-22 mm. AUSTRALIA: Great Barrier Reef, Lizard Island, BPBM 15962, 108 mm; USNM 218092, 69 mm; WAM 24720-001, 62 mm; Escape Reef (15°50'S, 145°50'E), WAM 27480-017, 5: 82-110 mm; Green Island, ANSP 122294, 117 mm; SU 28507, 96 mm; Big Hope Island, ANSP 123341, 7: 53-96 mm; ANSP 123340, 4: 21-104 mm; ANSP 123342, 6: 53-108 mm; Little Hope Island, ANSP 123443, 5: 47-104 mm; ANSP 123320, 9: 20-108 mm; Endeavour Reef, ANSP 123409, 9: 13-60 mm; ANSP 123438, 10: 14-83 mm; ANSP 123330, 16: 13-59 mm; ANSP 123393, 4: 15-21 mm; ANSP 123370, 97 mm; ANSP 123369, 16: 16-100 mm; ANSP 123444, 22: 13-103 mm; One Tree Island, USNM 212345, 127 mm; USNM 212346, 2: 121-127 mm; USNM 212347, 5: 40-122 mm; Northern Territory, Yirrhala, USNM 173834, 116 mm; Western Australia, Middle Island (12°17'S, 123°1'E), WAM 29058-002, 110 mm; Long

Reef (13°48'S, 125°39'E), WAM 30308-012, 125 mm; Fenelon Island (14°9'S, 125°39'E), 2: 34-122 mm; Clerke Reef (17°18'S, 119°22'E), WAM 27669-004, 6: 67-102 mm; South Murion Island (21°41'S, 114°20'E), WAM 25819-011, 37 mm. CORAL SEA: Chesterfield Islands, BPBM 33533, 69 mm. SOLOMON ISLANDS: Shortland Island, ANSP 91702, 47 mm; BPBM 1192, 103 mm; Malaita, FMNH 22187-89, 3: 95-99 mm; SU 25326, 3: 96-106 mm; Isabel Island, Tenibuli, FMNH 22190, 94 mm; SU 25371, 2: 85-103 mm; New Georgia, FMNH 22191, 108 mm; SU 25311, 2: 96-106 mm; Guadalcanal, BPBM 16167, 3: 30-106 mm. VANUATU: Espiritu Santos Harbor, USNM 212355, 46 mm; USNM 212354, 2: 34-43 mm; Éfaté, CAS 67612, 5: 48-78 mm; Malo Island, FMNH 22058, 77 mm; Banks Island, USNM 347427, 20 mm. NEW CALEDONIA: Nouméa, RUSI 3326, 116 mm; USNM 212353, 3: 31-95 mm. FIJI: Viti Levu, BPBM 28643, 5: 31-97 mm; Vuro Island, CAS 86864, 114 mm; Great Astrolabe Reef, USNM 212349, 21: 74-99 mm; Malamala Island, USNM 243999, 5: 37-101 mm; Totoya Island, USNM 260922, 60 mm. TONGA: Vava'u, USNM 212352, 6: 61-104 mm; Ha'apai Group, Lifuka Island, USNM 341794, 129 mm; Tongatapu, USNM 334710, 2: 121-123 mm. SAMOA ISLANDS: USNM 51733, 2: 60-93 mm. PALAU: Babelthuap, CAS uncat., 11: 66-93 mm; CAS 69438, 2: 85-98 mm; CAS 68778, 78 mm; CAS 86875, 99 mm; Urukthapel, BPBM 9950, 35 mm; CAS 72467, 91 mm; CAS 86861, 18: 31-95 mm; Koror, CAS 86862, 102 mm; CAS 83748, 104 mm; Iwayama Bay, CAS 74813, 10: 14-58 mm; Malakal Island, BPBM 9245, 6: 53-77 mm; Auluptagel, CAS 86857, 7: 81-110 mm; CAS 86859, 14: 32-105 mm; Gnadarak, CAS 68700, 52 mm; Aurapushekaru, CAS 72463, 70 mm. CAROLINE ISLANDS: Yap, CAS 68324, 74 mm; CAS uncat., 102 mm; CAS 86860, 6: 73-110 mm; CAS 83751, 9: 98-111 mm; CAS 68308, 2: 98-104 mm; CAS 86869, 113 mm; Ulithi Atoll, CAS 75577, 119 mm; Ifaluk Atoll, CAS 86867, 7: 72-119 mm; CAS 69438, 2: 85-98 mm; CAS 75432, 2: 87-106 mm; Kapingamarangi Atoll, CAS 86876, 2: 54-102 mm; CAS 72472, 4: 23-64 mm; CAS 72471, 3: 26-30 mm; CAS 74812, 6: 21-93 mm; CAS 86836, 2: 84-102 mm; CAS 86874, 21 mm; CAS 72462, 88 mm; CAS 74817, 3: 99-114 mm; CAS 86855, 44: 24-105 mm; CAS 71219, 6: 28-87 mm; CAS 74814, 22 mm; CAS 67675, 22 mm; CAS uncat., 4: 25-87 mm; CAS 74815, 25 mm; CAS 86868, 4: 90-110 mm; CAS 74578, 4: 19-32 mm; CAS 72461, 2: 19-22 mm; Chuuk (Truk), BPBM 7480, 63 mm; BPBM 7490, 89 mm; Phonpei (Ponape), CAS 72468, 2: 30-44 mm; CAS 71745, 2: 45-47 mm; CAS 72464, 16: 30-101 mm; USNM 224297, 4: 27-101 mm; Kosrae, BPBM 28219, 3: 102-108 mm; BPBM 28221, 39 mm. MARIANA ISLANDS: Saipan, CAS 86863, 2: 90-118 mm. MARSHALL ISLANDS: Enewetak Atoll, BPBM 7366, 32 mm; Majuro Atoll, USNM 179406, 86 mm; Taka Island, USNM 212348, 116 mm.

Diagnosis. - Dorsal rays VI + I,9; anal rays II,8; pectoral rays 13-15 (rarely 13 or 15, never with both sides 13 or 15); lateral-line scales 24; predorsal scales 4 or 5; gill rakers 5-6 + 14-17 (usually 5 + 16), including 1 or 2 upper and lower rudiments.

Body moderately deep, the depth 2.45-2.7 in SL; head length 2.3-2.6 in SL; snout length 8.2-11.0 in SL; orbit diameter 6.3-9.6 in SL; interorbital width 10.5-13.4 in SL; caudal-peduncle depth 5.5-6.7 in SL; caudal-peduncle length 3.5-4.0 in SL.

Mouth terminal, oblique, and large, the upper-jaw length 4.55-5.15 in SL; dentition as described for the subgenus *Pristicon*.

Preopercular ridge smooth to a SL of about 60 mm, then becoming progressively more serrate (a 63-mm specimen has 5 tiny serrae at the angle of the preopercular ridge); preopercular edge finely serrate, the serrae ranging from 30 in a 33-mm specimen to 74 in a 107-mm specimen (Fig. 1); posttemporal serrae varying from 3-19; upper edge of suborbital shelf irregularly serrate, the lower edge above posterior end of maxilla with a few small serrae on large adults.

First dorsal spine short, 9.15-13.5 in SL; second dorsal spine longest, 3.75-4.4 in SL; spine of second dorsal fin 4.6-5.5 in SL; first and second dorsal soft rays longest, 3.0-3.75 in SL; first anal spine very small; second anal spine 4.6-5.55 in SL; caudal fin forked with very broadly rounded lobes; pectoral fins 3.25-3.95 in SL; pelvic fins reaching from slightly beyond anus to slightly posterior to origin of anal fin, their length 3.3-3.9 in SL.

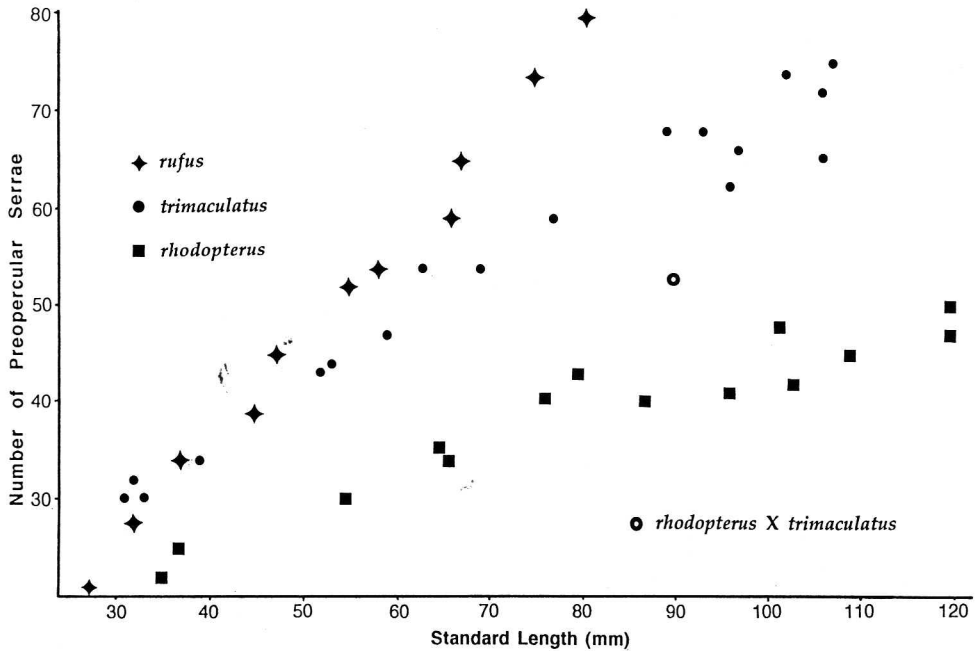


Fig. 1. Number of preopercular serrae of three species of *Apogon* and of a probable hybrid as related to standard length.

Color in alcohol: light brown, the centers of the scales darker than edges, with a narrow dark brown bar extending ventrally from base of second to fourth dorsal spines; a second short dark bar from below origin of second dorsal fin, and a third bar extending diagonally downward and forward from last two dorsal soft rays to below lateral line where it sometimes meets second dark bar, thus forming a V (or a Y if continuing farther ventrally); third bar on small specimens may continue ventrally to end at rear base of anal fin; a short saddle-

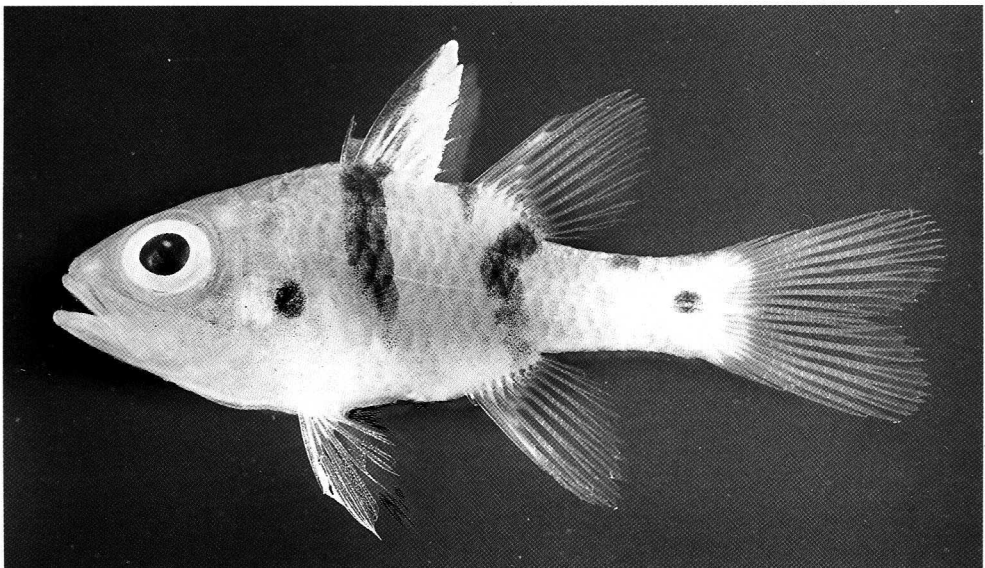


Fig. 2. *Apogon trimaculatus*, juvenile, BPBM 7366, 32 mm SL, Enewetak Atoll, Marshall Islands.

like dark brown bar in middle of caudal peduncle present or absent; a small dark brown spot present or absent posteriorly on lateral line just before base of caudal fin (if present, half or less pupil diameter); a dark brown spot above rear base of anal fin present or absent; a dark brown spot about as large as pupil on opercle; a thin dark brown line often present on cheek passing ventroposteriorly from below eye; anterior part of first dorsal fin dusky to blackish; base of second dorsal and anal fins sometimes with a narrow dark brown band; upper and lower edges of caudal fin narrowly blackish; peritoneum slightly dusky; digestive tract pale.

Color in life light grey or olivaceous to light brown with dark markings as described; at night some iridescent green may be present dorsally on head, body, and dorsal spines.

Remarks. - *Apogon trimaculatus* is large for a cardinalfish; the largest specimen is the holotype, MNHN 8692, 141.6 mm SL; it was examined by the junior author. Bauchot & Desoutter (1986: 64) noted that it was redescribed in Lesson (1830-1831: 237).

Bleeker (1853) described *Apogon koilomatodon* from a single specimen 142 mm total length from Ternate in the Molucca Islands. We examined three Bleeker specimens at the Nationaal Natuurhistorische Museum in Leiden, RMNH 5575, 102-121 mm SL, and concluded that the specimen of middle size, 106 mm SL, 141 mm total length, is the holotype.

As noted above, Fowler & Bean (1930) correctly distinguished *Apogon trimaculatus* (as *Amia koilomatodon*) from *Apogon rhodopterus*; they provided color descriptions of both from Philippine specimens collected during the expedition on the steamer "Albatross" in 1907-1910.

Apogon trimaculatus ranges south from the Ryukyu Islands to Western Australia and the southern Great Barrier Reef and east to the Marshall Islands and Samoa Islands (Fig. 3). It occurs on inshore coral reefs (Bishop Museum specimens collected from 1-18 m; one

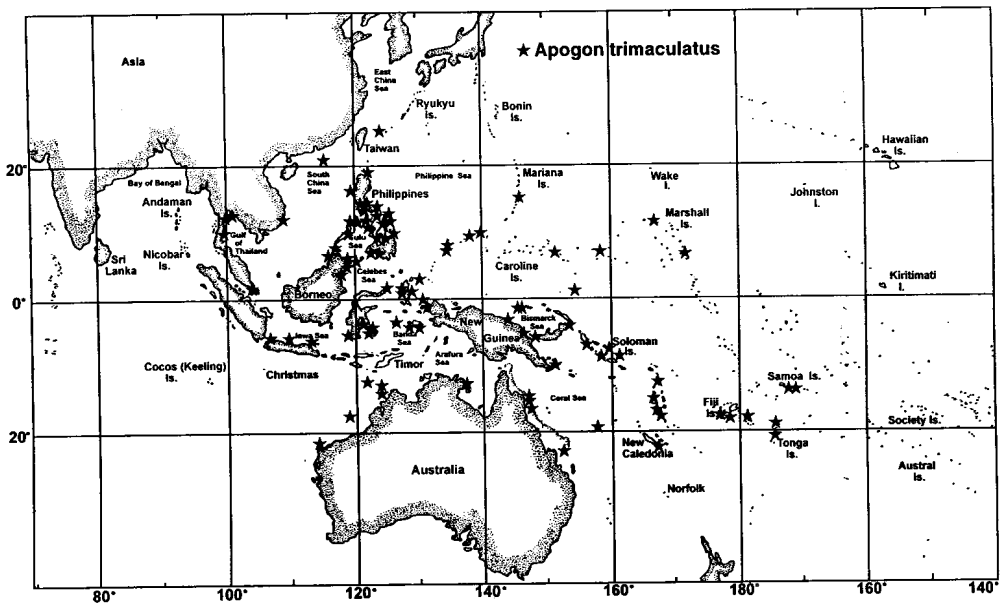


Fig. 3. Distribution map of collections of *Apogon trimaculatus*.

specimen from Fiji was collected at 30-34 m), and is generally seen in the open only at night. Buccal ova were present in the 100-mm specimen of USNM 175711 from Cebu.

***Apogon rhodopterus* Bleeker**

Pl. 2, Figs. 1, 4; Table 1

Apogon rhodopterus Bleeker, 1852: 62 (type locality, Singapore).

Amia rhodopterus Bleeker, 1874: 22; Bleeker, 1873-1876: 81, pl. 312, fig. 1.

Material examined. - INDONESIA: Java, Batavia (Jakarta), MCZ 9734, 2: 104-105 mm; Pulau Seribu, USNM 213069, 8: 14-92 mm; USNM 213070, 23: 64-101 mm; USNM 213071, 94 mm; USNM 339762, 30 mm. Karimundjawa Island, USNM 212067, 13: 33-99 mm; USNM 213068, 2: 38-84 mm. Sulawesi, Gulf of Tomini, Togiah Island, USNM 171194, 2: 46-76 mm; USNM 180369, 2: 63-73 mm; Kabaena Island, Tallabassi Bay, USNM 213064, 9: 34-77 mm. Banda Sea, Banda Islands, USNM 212065, 7: 64-112 mm; USNM 213066, 100 mm. Timor Sea, Hibernia Reef, WAM P-31378-002, 8: 21-92 mm. Irian Jaya, Batanta Island, USNM uncat, 180: 14-95 mm. SINGAPORE: RMNH 5574, 102 mm (holotype of *Apogon rhodopterus*); BPBM 21857, 100 mm; BPBM 38396, 5: 103-120 mm. PAPUA NEW GUINEA: Madang, BPBM 32582, 2: 35-65 mm; USNM 212339, 37 mm; USNM 212340, 13: 39-87 mm; Kranket Island, USNM 260924, 14: 26-99 mm; Nagada Harbour, USNM 296744, 7: 60-84 mm. Manus Island, WAM P.27827-001, 4: 47-68 mm. MALAYSIA: Sabah, Darnel Bay, Pulau Baya, USNM 212337, 46: 33-72 mm; USNM 212338, 46: 34-93 mm. PHILIPPINES: Tawi Tawi Group, Tataan Island, USNM 171192, 42 mm; USNM 180349, 101 mm; Simaluc Island, USNM 180361, 99 mm. Sulu Archipelago, Sitankai Island, SU 27405, 87 mm; Jolo Island, Tutu Bay, USNM 171184, 84 mm; USNM 180344, 96 mm; Romblon Harbor, USNM 180357, 88 mm; Romblon Reefs, USNM 180362, 97 mm; USNM 180363, 25 mm. Balabac Island, Candaraman Island, USNM 180346, 98 mm. Mindanao, Murcielagos Bay, USNM 171186, 89 mm. Palawan, Puerto Princesa, USNM 262291, 90 mm; Ulugan Bay, USNM 171190, 2: 96-98 mm; USNM 180365, 2: 88-103 mm; Endeavor Strait, USNM 171193, 71 mm; USNM 180358, 92 mm; Bolalo Bay, USNM 122270, 91 mm; USNM 180368, 96 mm. Calamian Group, Busuanga Island, Coron Island, FMNH 40487, 89 mm; SU uncat. 5: 40-94 mm; Saboon Island, USNM 171189, 3: 94-102 mm. Cuyo Islands, Barain Island, USNM uncat. 40: 34-100 mm. Bohol, USNM 180367, 2: 48-49 mm. Samar, Quinapundan Bay, Gigoso Point, USNM 180364, 54 mm. Panay, Capiz, SU 38170, 2: 17-39 mm. Masbate, Cataingan Bay, USNM 171187, 81 mm. Burias Island, USNM 171182, 2: 90-112 mm; Busin Harbor, USNM 175671, 101 mm; USNM 180345, 93 mm; USNM 180351, 103 mm; USNM 180360, 104 mm. Mindoro Strait, Tara Island, USNM 171183, 103 mm; USNM 180347, 86 mm; USNM 180354, 100 mm; USNM 180370, 2: 99 & 99 mm. Pinas Island, Port Uson, USNM 122263, 79 mm; USNM 171185, 3: 71-92 mm; USNM 180366, 4: 72-99 mm. Luzon, Biri Channel, USNM 171191, 88 mm; USNM 180350, 86 mm; USNM 180359, 79 mm; Port Matalvi, USNM 171188, 6: 67-94 mm; USNM 180352, 92 mm;

Table 1. Counts of pectoral rays, predorsal scales, and gill rakers for three species of *Apogon*.

	Pectoral rays*						Predorsal scales				
	13	14	15	16	4	5					
<i>Apogon trimaculatus</i>	3	73	2				24	22			
<i>Apogon rhodopterus</i>	4	56	2				25	10			
<i>Apogon rufus</i>			41	5			12	11			
	Gill rakers (including rudiments):										
	Upper		Lower				Total				
	5	6	14	15	16	17	19	20	21	22	23
<i>tri</i>	50	6	1	9	31	15	1	7	30	17	1
<i>rho</i>	33	13	-	4	31	8	-	3	23	11	3
<i>ruf</i>	21	2	3	13	5	2	-	14	7	1	1

* pectoral fin-rays of both sides counted.

USNM 180359, 74 mm; Port Palapag, USNM 180348, 88 mm; Ragay Gulf, Saboon Island, USNM 180355, 92 mm; USNM 180356, 86 mm. PALAU: CAS 68395, 90 mm; Babelthuap, CAS uncat., 34: 16-91 mm; CAS uncat., 28 mm; CAS uncat., 4: 61-91 mm; CAS 68389, 85 mm. Koror, BPBM 31350, 37 mm; CAS uncat., 38: 17-92 mm; CAS 68374, 86 mm; CAS 68376, 17: 22-94 mm; CAS 68378, 65: 14-88 mm; CAS 68390, 2: 74-88 mm; CAS 68398, 2: 55-84 mm; CAS 68399, 16: 16-87 mm. Iwayama Bay, CAS 68372, 11: 30-62 mm; CAS 68382, 46: 17-90 mm; CAS 68383, 86: 14-98 mm; CAS 68388, 72: 16-98 mm; CAS 68392, 30: 31-97 mm; CAS 68393, 19: 34-95 mm; CAS 68400, 15: 31-81 mm. Auluaptagel Island, BPBM 31402, 3: 54-95 mm; CAS 68379, 59: 21-91 mm; CAS 68394, 8: 43-86 mm; CAS 68395, 12: 24-100 mm; CAS 68396, 8: 33-73 mm; CAS 68397, 6: 24-88 mm; CAS 683401, 16: 74-95 mm. Aurapushikaru Island, CAS 68372, 7: 69-89 mm; CAS 68373, 2: 88-90 mm. Urukthapel Island, CAS 68375, 26: 19-81 mm. Arakabesan Island, BPBM 9247, 4: 66-87 mm; CAS 68380, 9: 22-83 mm; CAS 68391, 76 mm. CAROLINE ISLANDS: Yap, CAS 68381, 6: 61-81 mm; CAS 68386, 89 mm; CAS 68387, 5: 85-101 mm.

Diagnosis. - Dorsal rays VI + I,9; anal rays II,8; pectoral rays 13-15 (rarely 13 or 15, never with both sides 13 or 15); lateral-line scales 24; predorsal scales 4 or 5; gill rakers 5-6 + 15-17 (usually 5 + 16), including 1 or 2 upper and lower rudiments.

Body moderately deep, the depth 2.3-2.9 in SL; head length 2.3-2.6 in SL; snout length 8.5-9.4 in SL; orbit diameter 5.7-8.65 in SL; interorbital width 11.3-13.0 in SL; caudal-peduncle depth 5.4-6.7 in SL; caudal-peduncle length 3.85-4.3 in SL.

Mouth terminal, oblique, and large, the upper-jaw length 4.55-5.2 in SL; dentition as described for the subgenus *Pristicon*.

Preopercular ridge smooth to a SL of about 53 mm (a 54-mm specimen with 2 tiny serrae near the angle of the preopercular ridge), then becoming progressively more serrate; preopercular edge finely serrate, the serrae ranging from 21 in a 27-mm specimen to 47 and 50 in two 120-mm specimens (Fig. 1); posttemporal serrae varying from 2 in a 37-mm specimen to 11 in a 120-mm one; upper edge of suborbital shelf irregularly serrate, the lower edge above posterior end of maxilla with a few small serrae on large adults.

First dorsal spine short, 9.0-12.5 in SL; second dorsal spine longest, 4.0-5.55 in SL; spine of second dorsal fin 4.65-5.7 in SL; first and second dorsal soft rays longest, 3.3-3.7 in SL; first anal spine very small; second anal spine 5.0-5.9 in SL; caudal fin forked with very broadly rounded lobes; pectoral fins 3.35-3.85 in SL; pelvic fins reaching from slightly beyond anus to slightly posterior to origin of anal fin, their length 3.35-3.9 in SL.

Color in alcohol: light brown, the edges of the scales narrowly dark brown; a narrow dark brown bar extending ventrally from base of second to fourth dorsal spines to below pectoral fin (bar broken into a long upper and short lower part except in occasional small juveniles), a second dark bar extending diagonally downward and forward from last three dorsal soft rays to lateral line; a small dark brown spot on lower side of body directly below end of diagonal bar, and another at rear base of anal fin (very small in large adults; in juveniles these spots joined with dorsal segment to form a continuous dark bar); a dark brown spot about half diameter of pupil centered on penultimate lateral-line scale; no dark bar below front of second dorsal fin, no short dark bar dorsally on caudal peduncle, and no dark brown spot on opercle; two or three narrow dusky bands extending obliquely across cheek (faint on some specimens); first two interspinous membranes of dorsal fin and lower part of third membrane blackish; rest of fin dusky; base of second dorsal fin sometimes with an indistinct narrow dark band; caudal fin dusky, the upper and lower edges narrowly blackish; remaining fins pale to slightly dusky; peritoneum slightly dusky; digestive tract pale.

Color in life similar, the dark markings more evident. At night there is usually some blue-green iridescence, especially dorsally.

Remarks. - Bleeker (1852) described *Apogon rhodopterus* from a single specimen, 132 mm total length, taken in the sea at Singapore. Bleeker (1874) reported three specimens 115-140 mm total length from Singapore. These are located at the Nationaal Natuurhistorische Museum in Leiden as RMNH 5574 and were examined by both authors. The mid-sized specimen (102 mm SL, 130 mm TL) is identified as the holotype.

This cardinalfish belongs in the subgenus *Pristicon*, and it is also large; the largest specimen examined, 120 mm SL, from Singapore. It is otherwise known only from Indonesia, Philippines, Papua New Guinea, Palau, and Yap (Fig. 4). It is generally found on shallow protected reefs of lagoons or harbors. The six lots of Bishop Museum specimens were collected in 10 m or less. Forty-two USNM and CAS lots of *A. rhodopterus* taken with rotenone included specimens of *A. trimaculatus*.

Apogon rhodopterus X *A. trimaculatus*

Material examined. - BPBM 38395, 89 mm, Palau, Arakabesan Island, NE side, coral, coral rubble, and silty sand, 0.7-1.5 m, rotenone, J. E. Randall and E. S. Helfman, 5 Jun.1968.

Remarks. - This specimen was collected with four typical specimens of *Apogon rhodopterus*, but it is intermediate in color to that species and *A. trimaculatus*. It has the barred pattern of *A. trimaculatus* (except the short bar dorsally on the caudal peduncle is poorly formed), but lacks the dark spot on the opercle, and there are three faint oblique bands on the cheek instead of a dark line as found on *trimaculatus*. Other characters such as pale peritoneum and digestive tract, serrate preopercular edge and ridge, and serrate posttemporal are consistent with the proposed parent species. The counts of 14 pectoral rays and 5 + 15 gill rakers could apply to either species, but the count of 53 preopercular serrae is precisely intermediate to

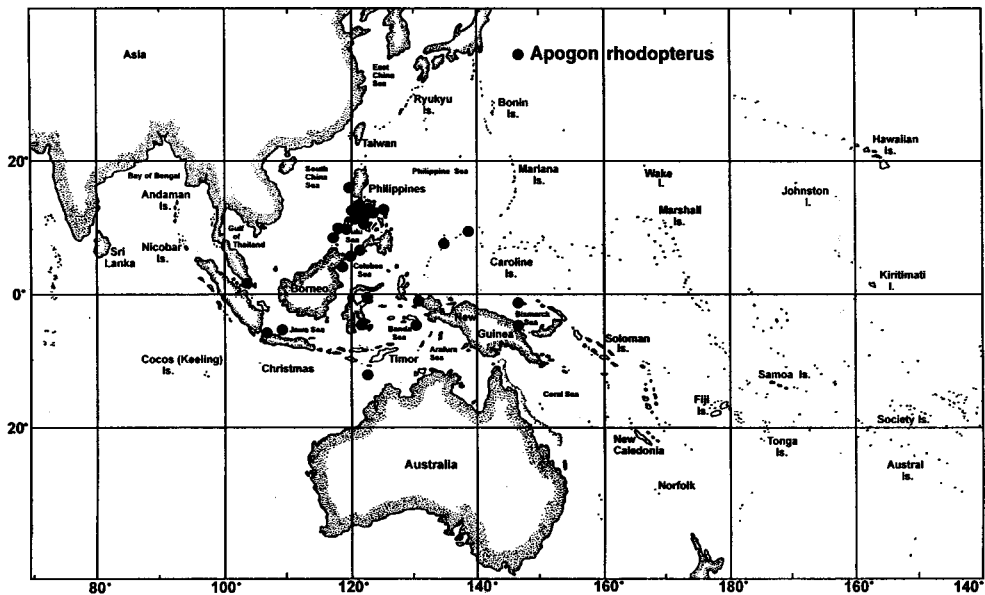


Fig. 4. Distribution map of collections of *Apogon rhodopterus*.

rhodopterus and *trimaculatus* of that size (see Fig. 1). We conclude that this specimen is a probable hybrid of *A. trimaculatus* and *A. rhodopterus*.

***Apogon rufus*, new species**

Pl. 3, Figs. 1, 5; Tables 1, 2

Apogon rhodopterus (*non* Bleeker) Hayashi & Kishimoto, 1983: 35, fig. 37 (Ryukyu Islands).

Apogon rhodopterus (*non* Bleeker) Hayashi in Masuda et al., 1984: 148, pl. 132, fig. K (Ryukyu Islands).

Material examined. - Holotype: BPBM 9558, female, 67.5 mm, Palau, 0.4 km southwest of entrance to Malakal Pass, coral reef, 37 m, rotenone, J.E. Randall & A.R. Emery, 17 Apr.1970.

Paratypes: URM P.1964, 45.9 mm, Ryukyu Islands, Okinawa, Sesoko Island, outer reef slope, 20 m, quinaldine, T. Yoshino & G.R. Allen, 21 Mar.1976; BPBM 22291, 55.0 mm, Ryukyu Islands, Okinawa, Sesoko Island, west side, small caves at base of reef front, 18 m, rotenone, J. E. Randall & T. Yoshino, 12 Sep.1977; URM P.1963, 5: 32.8-75.7 mm, AMS I.38794-001, 32.4 mm, BMNH 1998.5.5.1, 36.3 mm, CAS 200056, 58.1 mm, and USNM 348990, 66.4 mm (X-ray), same data as preceding; USNM 349036, 42.2 mm, Philippines, Palawan, Puerto Princesa, 12-18.5 m, R.E. Schroeder, 13 Jul.1979 (X-ray); URM-P.2819, 73.5 mm, Ryukyu Islands, Okinawa, Sesoko Island, 30 m, quinaldine, T. Yoshino & K. Shimada, 24 Oct.1980; URM P.2821, 80.0 mm, same data as preceding; USNM 260920, 2: 49.9-72.8 mm, Fiji, Lau Group, Matuku Island (19°9'38"S, 179°45'23"E), 17-26 m, rotenone, V.G. Springer, 23 Apr.1982 (X-ray); USNM 260921, 2: 48.9-71.8 mm, Fiji, Charybdis Reef (17°12'S, 178°0'E), 30.5-37 m, rotenone, V.G. Springer, 29 May 1982 (X-ray); BPBM 30241, 27.5 mm, Papua New Guinea, Port Moresby, off Bootless Inlet, Horseshoe Reef (a barrier reef), ocean side, 37 m, P.L. Colin, 23 Jan.1984; BPBM 32082, 47.2 mm, Indonesia, Flores, north coast, off Pertamina oil storage site, Waipare Reef (8°37'46"S, 122°16'35"E), coral reef, 30 m, rotenone, J.E. Randall, 15 Sep.1987; YCM-P.36244, 79.3 mm, Ryukyu Islands, Amami O-shima Group, Nishikomi, 24 m, quinaldine, M. Hayashi, 22 Aug.1995; USNM 346183, 64.6 mm, Philippines, Guimaras Island (10°28'25"N, 122°28'E), 20 m, rotenone, J. T. Williams, 28 Sep.1995 (X-ray); BPBM 36900, 50 mm, Papua New Guinea, D'Entrecasteaux Islands, off Normanby Island, Pohle's Reef (9°52'42"S, 150°46'14"E), rubble slope, 80 m, rotenone, R.L. Pyle & J.L. Earle, 6 Dec.1995.

Diagnosis. - Dorsal rays VI + I,9; anal rays II,8; pectoral rays 15-16 (usually 15); lateral-line scales 24; predorsal scales 4 or 5; gill rakers 5-6 + 15-17 (most often 5 + 15), including 1 or 2 upper and lower rudiments; body moderately deep, the depth 2.55-2.9 in SL; preopercular ridge smooth, the edge very finely serrate; upper edge of suborbitals smooth; caudal fin slightly forked, the lobes broadly rounded. Pale in alcohol, the scales with a brown submarginal band, with a dark bar below each dorsal fin, a black spot on opercle and another posteriorly on lateral line; a dark line on cheek from lower edge of orbit to corner of preopercle; anterior two membranes of first dorsal fin blackish, the rest of fin dusky except for pale margin; a pale-edged blackish band basally in second dorsal and anal fins; upper and lower edges of caudal fin blackish; peritoneum slightly dusky; digestive tract black. Ground color in life brownish red.

Description. - Dorsal rays VI-I,9; anal rays II,8; all dorsal and anal soft rays branched, the last to base; one spine supranumerary on first pterygiophore of dorsal fin, and one on first spine of anal fin; pectoral rays 15 (15-16, usually 15), the upper 2 and the lower 2 or 3 unbranched; pelvic rays I,5; principal caudal rays 17, the upper and lower unbranched; procurent caudal rays 6, the last 2 segmented; caudal skeleton with 5 hypurals, 1 parhypural, 3 epurals, 1 pair of uroneurals, and 2 autogenous haemal spines; lateral line complete, the pored scales 24 (plus 4 progressively smaller pored scales on caudal-fin base, the last pointed); predorsal scales 5 (4-5), the last scale notched posteriorly (two lateral scales, one on each

side, overlap between last and penultimate predorsal scales); scales above lateral line to origin of first dorsal fin 2; scales above lateral line to base of dorsal fins 2; scales below lateral line to origin of anal fin 5 (5-6, depending on row counted); circumpeduncular scales 12; gill rakers 5 + 15 (5-6 + 15-17) (total 20-23; see Table 1); pseudobranchial filaments 17 (9 in smallest paratype to 20 in largest); branchiostegal rays 7; vertebrae 10 + 14, with epipleurals on all but last pleural rib; supraneural (predorsal) bones 3.

Body depth 2.6 (2.55-2.9) in SL; body moderately compressed, the width 1.85 (1.75-2.1) in depth; head length 2.45 (2.35-2.5) in SL; dorsal profile of head smoothly convex; snout length 9.0 (3.7-9.5) in SL, 3.7 (3.6-4.05) in head; orbit diameter 7.5(6.5-8.05) in SL, 3.1 (2.8-3.3) in head; interorbital width 12.8 (11.8-13.2) in SL, 5.3 (4.85-5.55) in head; caudal-peduncle depth 5.7 (5.5-6.2) in SL, 2.35 (2.2-2.55) in head; caudal-peduncle length 3.95 (3.75-3.95) in SL, 1.6 (1.55-1.65) in head.

Mouth moderately large, the maxilla extending to or slightly beyond a vertical at posterior edge of pupil, the upper-jaw length 5.1 (4.65-5.15) in SL, 2.1 (1.95-2.05) in head; supramaxilla absent; posterior end of maxilla truncate with rounded corners; mouth terminal or slightly inferior and slightly oblique, the gape forming an angle of about 20° to horizontal axis of body; supramaxilla not present; a broad band of villiform teeth in upper jaw (maximum of about 11 rows of teeth in holotype), narrowing only posteriorly in jaw; a symphyseal gap without teeth at front of upper jaw narrow, about one-eighth pupil diameter; lower jaw of holotype with a maximum of 7 rows of villiform teeth anteriorly, gradually narrowing to 1 to 2 rows posteriorly; villiform teeth in 2 irregular rows on vomer and palatines, those on vomer forming a V-shape. Tongue rounded anteriorly. Longest gill raker, the first on lower limb adjacent to raker at angle, its length 2.5 in orbit diameter in holotype.

Opercular spine small, flat, obtuse, at level of center of eye, followed by pointed flap of opercular membrane; edge of preopercle very finely and nearly fully serrate, the serrae varying from 21 in smallest paratype to 65 in holotype and 73 in 80-mm paratype (Fig. 1); preopercular

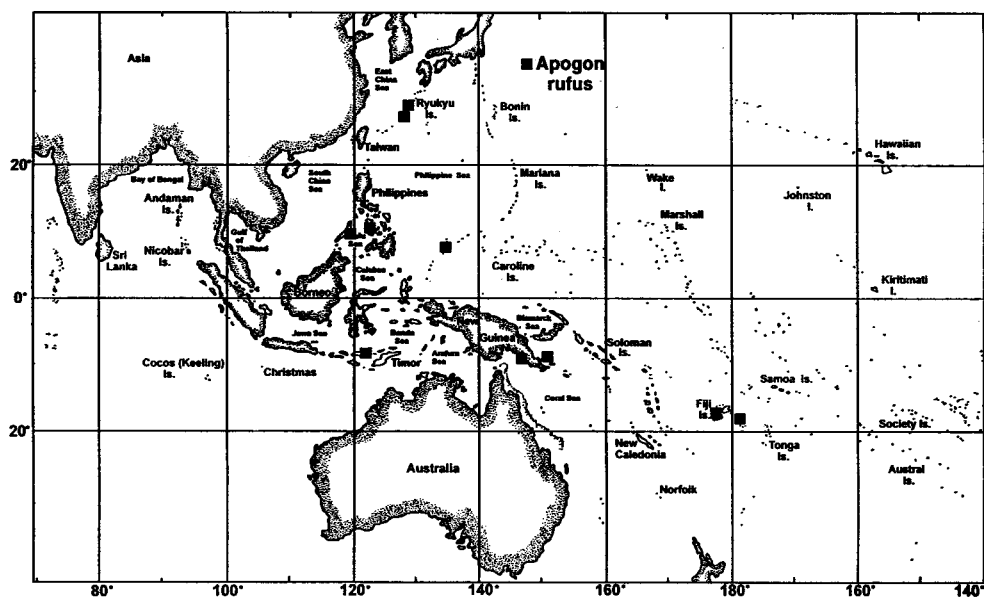


Fig. 5. Distribution map of collections of *Apogon rufus*.

ridge smooth; edge of posttemporal smooth except for a few weak serrae in specimens longer than 70 mm SL; edge of suborbitals smooth. Anterior nostril a short membranous tube (a little higher posteriorly) at level of lower edge of pupil, 1 to 1.5 nostril diameters from groove at base of upper lip; posterior nostril a small vertically ovate aperture nearly at level of center of eye; internarial distance nearly pupil diameter; nasal chamber cavernous, the skin over the roof thin. Lateralis system of head with many very small pores (especially numerous dorsally on head); a large oblique elliptical pore on side of snout below nostrils.

Scales weakly ctenoid and thin; scales present on nape, opercle, and preopercle, those on opercle larger than scales of body; no scales on occiput, interorbital, snout, or ventrally on head; no scales on fins except for small scales on about basal half of caudal fin and a scaly process of 2 large rounded scales extending midventrally from base of pelvic fins to half length of pelvic spine.

Origin of first dorsal fin over base of third lateral-line scale, the predorsal distance 2.25 (2.15-2.25) in SL; fin spines strong and sharp; first dorsal spine 11.35 (10.75-13.5) in SL, 4.7 (4.35-5.8) in head; second dorsal spine longest, 4.55 (4.5-5.1) in SL, 1.85 (1.85-1.95) in head; second dorsal fin separated from first dorsal fin by 2 broadly overlapping median scales (indented posteriorly) and a pair of lateral scales that are contiguous middorsally; origin of second dorsal fin above ninth lateral-line scale; spine of second dorsal fin 6.05 (5.75-6.3) in SL, 2.5 (2.35-2.65) in head; first and second dorsal soft rays longest, 3.95 (3.6-3.85) in SL, 1.6 (1.45-1.6) in head; origin of anal fin below base of first dorsal soft ray; first anal spine short, 22.7 (19.2-24.0) in SL, 9.6 (7.8-9.9) in head; second anal spine 6.15 (5.6-6.3) in SL, 2.5 (2.3-2.6) in head; first and second anal soft rays longest, 4.15 (3.85-3.95) in SL, 1.7 (1.6-1.65) in head; last dorsal and anal soft rays clearly shorter than penultimate rays; caudal fin slightly forked with broadly rounded lobes, its length 3.05 (2.8-2.95) in SL; caudal concavity 15.4 (11.1-15.9) in SL, 6.35 (4.65-6.55) in head; pectoral fins pointed, the fifth or sixth rays longest, 3.55 (3.4-3.7) in SL, 1.45 (1.4-1.55) in head; pelvic spine 6.15 (5.7-6.25) in SL, 2.5 (2.4-2.6) in head; pelvic fins reaching or extending slightly beyond origin of anal fin, the first soft ray longest, 4.1 (3.8-4.0) in SL, 1.7 (1.5-1.7) in head.

Color of holotype in alcohol light brown, the edges of scales with a brown submarginal band; a dark brown bar below second to fourth dorsal spines, ending beneath pectoral fin; a second dark brown bar below base of second dorsal fin, narrowing below lateral line and fading on lower side (bars the result of heavier pigmentation of dark submarginal band of scales, hence centers of scales within bars are paler); a dark brown spot on last two lateral-line scales about three-fourths size of pupil; a dark brown spot of similar size on opercle; a narrow dusky line from below orbit to corner of preopercle; a narrow dusky streak on maxilla; first two membranes of first dorsal fin dark brown; rest of fin dusky, pale at distal margin with a dark brown submarginal spot; remaining fins pale except for a dusky band near base of second dorsal and anal fins and dark upper and lower edges of caudal fin; peritoneum slightly dusky, especially ventrally; digestive tract black.

Color notes made of holotype shortly after capture: light reddish brown, the edges of scales darker than centers; two faint blackish bars on body, one beneath each dorsal fin; a small blackish spot midposteriorly on caudal peduncle; a faint blackish spot of about the same size on opercle, with a faint pale area around it, and a faint dark marking above; a thin blackish streak extending posteriorly and slightly downward from lower edge of eye; first dorsal fin light brown with a broad blackish anterior margin and a pale bluish posterior margin; second dorsal and anal fins light brownish red with a basal band of yellowish dark brown edged

Table 2. Proportional measurements of type specimens of *Apogon rufus* expressed as percentage of standard length.

	Holotype		Paratypes					USNM 348990	USNM 260921	URM P.0218
	BPBM 9558	AMS 1.38794	BMNH 1998.5.5.1	BPBM 32082	BPBM 36900	BPBM 22291	CAS 200056			
Standard length (mm)	67.5	32.4	36.3	47.2	50.0	55.0	58.1	66.4	72.8	80.0
Body depth	38.2	36.4	36.7	34.4	34.3	38.3	38.0	38.6	38.4	39.5
Body width	20.7	20.6	19.0	18.9	18.5	18.2	18.9	20.4	18.6	19.5
Head length	41.2	42.3	41.3	42.8	41.7	41.5	40.5	40.3	40.7	41.3
Snout length	11.2	11.5	11.0	10.6	10.5	11.2	11.2	10.7	10.5	11.3
Orbit diameter	13.3	15.1	14.8	15.4	15.0	14.0	13.9	13.5	12.8	12.4
Interorbital width	7.8	8.4	8.5	7.7	7.6	8.3	8.2	7.6	8.0	7.8
Caudal-peduncle depth	17.6	17.2	16.8	17.2	16.2	17.9	17.2	18.1	16.6	17.2
Caudal-peduncle length	25.4	26.2	26.7	25.3	26.0	25.5	26.0	25.8	24.5	25.0
Predorsal length	44.4	44.5	45.2	44.5	45.4	45.0	44.8	46.4	44.0	46.3
Preanal length	63.5	62.5	61.2	64.2	61.5	61.8	61.5	60.3	64.3	61.8
Prepelvic length	38.8	40.3	38.2	38.5	39.2	39.4	37.9	37.7	42.2	39.9
Upper jaw length	19.6	21.0	20.6	21.0	21.2	20.0	20.4	20.0	19.4	20.1
First dorsal spine	8.8	8.6	8.8	7.4	9.0	8.3	9.3	8.3	7.5	8.4
Second dorsal spine	22.0	22.0	22.0	21.8	22.1	21.3	21.0	20.9	19.6	21.5
Third dorsal spine	19.5	20.1	21.1	21.2	21.2	20.7	20.1	19.9	18.7	20.8
Spine of second dorsal fin	16.5	16.6	16.6	16.1	17.4	15.9	17.2	16.2	16.7	17.3
Longest dorsal ray	25.4	27.7	26.1	28.0	27.7	26.4	27.5	26.5	broken	26.0
First anal spine	4.4	5.1	5.1	4.3	5.0	4.2	5.0	5.2	4.3	4.9
Second anal spine	16.3	16.7	16.5	16.4	17.9	15.8	15.9	16.4	16.4	16.6
Longest anal ray	24.2	25.4	25.4	25.8	26.3	26.0	25.6	broken	broken	25.4
Caudal fin length	32.7	35.5	broken	37.4	36.0	34.0	35.7	broken	broken	33.5
Caudal concavity	6.5	7.6	—	—	9.0	7.7	6.9	—	—	6.3
Pectoral fin length	28.2	29.3	28.0	27.6	27.2	28.2	27.9	28.6	28.4	28.8
Pelvic spine length	16.6	17.6	16.5	16.5	16.0	16.0	16.1	16.2	16.5	16.3
Pelvic fin length	24.3	26.4	25.4	25.2	26.4	26.4	26.3	26.7	25.8	25.9

with pale bluish; caudal fin light reddish brown, the upper and lower edges dark brown; pectoral fins light red; pelvic fins with clear membranes, the rays orange-yellow, the lateral edge brownish; iris mainly yellow.

Remarks.- When this species was collected by the author and Tetsuo Yoshino in Okinawa, Ryukyu Islands in 1977, it was suspected of being undescribed. Hayashi & Kishimoto (1983), however, identified it as *Apogon rhodopterus* Bleeker, and further consideration of the specimens as a possible new species ceased. However, our recent study of these similar species has revealed that *A. rhodopterus* is a different species, closely allied to *trimaculatus*, and found on shallow protected reefs. The Ryukyu Islands specimens of the new species, and others we now have from Palau, Fiji, Indonesia, and Papua New Guinea, are readily distinguished in having 15 or 16 pectoral rays (13-15, rarely 15 in *trimaculatus* and *rhodopterus* and never 15 on both sides), a more finely serrate preopercle, black digestive tract, a prominent dark band near base of second dorsal and anal fins (faint or absent in the other two species), and brownish red life color. It has a dark spot on both the opercle and the base of the caudal fin, whereas the opercular spot is lacking on *rhodopterus*, and the basicaudal spot is often missing from *trimaculatus*.

Apogon rufus also differs from *A. trimaculatus* and *A. rhodopterus* in lacking serration on the preopercular ridge, the edge of the suborbitals, and the posttemporal margin (except a few weak serrae in the largest specimens). As noted above, specimens of *trimaculatus* less than about 65 mm SL and those of *rhodopterus* less than about 53 mm SL lack serrae on the preopercular ridge. Our largest specimen of *rufus* measures 80.0 mm SL.

Apogon rufus can be distinguished from all known six-spined species of *Apogon* with black alimentary tracts by its color pattern, particularly the opercular spot, two dark saddles on the body, and the dark basicaudal spot. None of the six-spined species appear closely related to *A. rufus*. Among the seven-spined species, *A. darnleyensis*, *A. opercularis*, *A. timorensis*, and *A. rueppelli* show some potential to be investigated for relationships.

The habitat for *A. rufus* is different, in general, from that of the other two species. Specimens of *A. rufus* have been taken on exposed coral reefs in the depth range of 15-80 m.

Etymology. - We name this species *rufus* from the Latin for reddish, in reference to the ground color in life.

ACKNOWLEDGEMENTS

We thank the curatorial personnel of the museums we visited for their able assistance in our study of apogonid fishes. Mark McGrouther of the Australian Museum and Gerald R. Allen of the Western Australian Museum confirmed identifications of some specimens in their care. Kok Peng Lim of the National University of Singapore provided a gift of specimens of *Apogon rhodopterus* from Singapore, the type locality. Masayoshi Hayashi transferred loan material of *Apogon rufus* from the University of the Ryukyus Museum (acting at the request of Tetsuo Yoshino and Takeshi Kon of URM) which are here designated as paratypes. He also loaned specimens from the Yokosuka City Museum collected in the Amami Oshima Group of the Ryukyu Islands. David G. Smith took X-ray photographs of some of the USNM specimens of *Apogon rufus*. We also acknowledge with gratitude the many collectors of the apogonid specimens of this study.



Pl. 1. *Apogon trimaculatus*, about 100 ml SL, underwater photograph taken at night, Flores, Indonesia.



Pl. 2. *Apogon rhodopterus*, BPBM 21875, 100 mm SL, Singapore.



Pl. 3. Holotype of *Apogon rufus*, BPBM 9558, 67.5 mm SL, near entrance to Malakal Pass, Palau.

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