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A Review of the Cardinalfishes (Perciformes: Apogonidae) of the Red Sea

Ofer Gon and John E. Randall

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Margaret Mary Smith (1916 - 1987),
James Leonard Brierley Smith (1897 - 1968)
with their dog, Marlin

The publication series (Monographs, Bulletins & Special Publications) of the SAIAB (formerly the JLB Smith Insitute of Ichthyology), in its new format honors James Leonard Brierley Smith and Margaret Mary Smith with the name *Smithiana*, in recognition of their many years of devoted service to African aquatic biology. Their life's work, a team effort, established modern ichthyology in southern Africa and laid the groundwork for the expansion of aquatic biology throughout the region.

Front cover photograph: Scales of a preserved coelacanth specimen by James Stapley.

A Review of the Cardinalfishes (Perciformes: Apogonidae) of the Red Sea

Ofer Gon[1] & John E. Randall[2]

ABSTRACT

Twelve genera and 54 species of cardinalfishes are reported from the Red Sea. The Red Sea cardinalfishes include: *Apogon annularis* Rüppell, *A. apogonides* (Bleeker), *Apogon bryx* Fraser, *A. campbelli* Smith, *A. coccineus* Rüppell, *A. cookii* Macleay, *A. cyanosoma* Bleeker, *A. erythrosoma* n. sp., *A. exostigma* (Jordan & Starks), *A. fleurieu* (Lacepède), *A. fraenatus* Valenciennes, *A. guamensis* Valenciennes, *A. gularis* Fraser & Lachner, *A. heptastygma* Cuvier, *A. isus* Randall & Böhlke, *A. kallopterus* Bleeker, *A. leptacanthus* Bleeker, *A. multitaeniatus* Cuvier, *A. nigrofasciatus* Lachner, *A. pharaonis* Bellotti, *A. pselion* Randall, Fraser & Lachner, *A. pseudotaeniatus* Gon, *A. quadrifasciatus* Cuvier, *A. queketti* Gilchrist, *A. semiornatus* Peters, *A. smithi* (Kotthaus), *A. spilurus* Regan, *A. taeniatus* Cuvier, *A. talboti* Smith, *A. timorensis* Bleeker, *A. zebrinus* Fraser, Randall & Lachner, *Apogonichthys perdix* Bleeker, *Archamia bilineata* Gon & Randall, *Archamia fucata* (Cantor), *Archamia lineolata* (Cuvier), *Cercamia eremia* (Allen), *Cheilodipterus lachneri* Klausewitz, *C. lineatus* (Forsskål), *C. macrodon* Lacepède, *C. novemstriatus* (Rüppell), *C. pygmaios* Gon, *C. quinquelineatus* Cuvier, *Foa fo* Jordan & Seale, *Fowleria aurita* (Valenciennes), *F. marmorata* (Alleyne & Macleay), *F. vaiulae* (Jordan & Seale), *F. variegata* (Valenciennes), *Neamia octospina* Smith & Radcliffe, *Pseudamia gelatinosa* Smith, *Rhabdamia cypselura* Weber, *R. nigrimentum* (Smith), *R. spilota* Allen & Kuiter, *Siphamia permutata* Klausewitz, and *Sphaeramia orbicularis* (Cuvier). Twelve (22%) of the apogonid species are endemic. Seven species, i.e. *Apogon apogonides, A. campbelli, A. erythrosoma, A. talboti, Foa fo, Rhabdamia spilota* and *Sphaeramia orbicularis,* are new to the Red Sea. *Apogon coccineus* of previous authors is a complex of three species, including *campbelli* Smith and *erythrosoma* n. sp. The dark-striped species of *Apogon* of the Red Sea previously identified as *angustatus, endekataenia, fasciatus,* or *novemfasciatus* are *cookii* and *nigrofasciatus.* Red Sea apogonids identified by previous authors as *Apogon bandanensis, monochrous, nubilus* and *savayensis,* are *guamensis* and *zebrinus. Apogon micromaculatus* Kotthaus is *A. spilurus* Regan. The specimen of *Apogon kiensis* reported by Smith (1961) from the Red Sea is *A. bryx,* recently described from the Philippines. In the genus *Fowleria, polystigma* (Bleeker) and *punctulata* (Rüppell) are junior synonyms of *variegata* (Valenciennes). *F. abocellata* Goren & Karplus is a junior synonym of *vaiulae* (Jordan & Seale), and *isostigma* (Jordan & Seale) does not occur in the Red Sea. *Apogon cupreus* and *A. latus,* both of Cuvier, are unidentifiable. *A. hyalosoma* and *A. taeniophorus* are doubtful records.

[1] South African Institute for Aquatic Biodiversity, Private Bag 1015, Grahamstown, 6140 South Africa. E-mail: o.gon@ru.ac.za

[2] Bishop Museum, 1525 Bernice St., Honolulu, Hawaii 96817-2704, U.S.A. E-mail: jackr@hi.net

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INTRODUCTION

The first apogonid to be reported from the Red Sea, a species of *Cheilodipterus*, was described by Peter Forsskål (1775). It was one of 146 species comprising the earliest known collection of Red Sea fishes, made by members of a Danish expedition, the *Arabiske Rejse*, in 1762-63 (Klausewitz 1964). In the 19th century, Red Sea exploration was dominated by German naturalists who made significant collections. Christian G. Ehrenberg and Friedrich W. Hemprich of the German Academy of Sciences, Berlin, collected over 500 species of fishes during 1820-1826 (Klausewitz 1964), including six new cardinalfishes which were placed by Cuvier (1828) in the genus *Apogon* (i.e. *cupreus, latus, multitaeniatus, taeniatus, heptastygma,* and *lineolatus*). Eduard Rüppell of the Senckenberg Society of Natural History, Frankfurt, went on two expeditions to the Red Sea region (1822 and 1831-33) and described the fishes he collected in two series of well-illustrated publications (Rüppell 1828-30; 1835-38). Of the eight species of *Apogon* listed in these series, six were described as new (i.e. *annularis* in 1829; *novemstriatus, bifasciatus, enneastigma, punctulatus* and *coccineus* in 1838).

The next naturalist to work in the Red Sea was Carl B. Klunzinger, a German doctor who lived in the small Egyptian town of Quseir during 1864-69 and 1873-76. In the interim between Rüppell (1838) and Klunzinger's (1870) synopsis of Red Sea fishes, numerous new apogonid species were described from elsewhere in the Indo-Pacific region, particularly by the Dutch naturalist Pieter Bleeker. Consequently, Klunzinger (1870) was able to identify several apogonids not found by his predecessors, and he increased the number of Red Sea species to 15. Klunzinger (1884) found two undescribed apogonids in the Zoological Museum, Berlin, that had been collected by Ehrenberg and named them *Apogon igneus* and *A. sphenurus*.

The opening of the Suez Canal in 1869 made the Red Sea easily accessible for ship-based European scientists and naturalists. Consequently, numerous expeditions, particularly by Germans and Italians, collected fishes there (Klausewitz 1964). A survey of published results of these later efforts shows that 1-4 apogonid species were collected per expedition, and only two new species were described: *Apogon pharaonis* Bellotti, 1874, and *A. suezii* Sauvage, 1883.

SCUBA diving for scientific research in this area was probably first used by J.-Y. Cousteau's *Calypso* expedition in 1951-52. Dynamite was used for fish collecting, and of the six apogonid species collected, *Apogon infuscus* was described as new (Roux-Estève and Fourmanoir, 1955). Two other species, i.e. *Apogon erdmani* (Lachner, 1951) and *Cheilodipterus lachneri* (Klausewitz, 1959), were described in the 1950s. Smith (1961) described *Rhabdamia nigrimentum* from fish collected in Eritrea. In 1962 the Israel South Red Sea Expedition made collections at the Dahlak Archipelago. Some apogonids obtained during this expedition were sent to J.L.B. Smith in South Africa, resulting in the description of *Apogon spongicolus* (Smith, 1965).

Smith (1961) did the last review of Red Sea cardinalfishes, including 27 species. From the 1960s to the present, ichthyologists using SCUBA and rotenone steadily increased the number of apogonid species from the region. Ben-Tuvia (1976) reported 36 species of the family in the collection of the Hebrew University, Jerusalem. Randall (1983) estimated "over 35 species", and Dor (1984) recorded 41 species of apogonids in his *Checklist of Fishes of the Red Sea*. In the decade that followed Dor's work, the number of species increased to 51, making the Apogonidae the third largest of 157 families of Red Sea fishes (Goren & Dor, 1994).

In the present paper we report seven species previously unknown from the Red Sea, resurrect one species previously included in the synonymy of *Apogon coccineus* and describe a new species in the *coccineus* species group, thus bringing the total of apogonid species in the Red Sea to 54. Twelve (22%) of these species are considered endemic to the sea, although some of these may eventually be found in the western Indian Ocean.

MATERIALS AND METHODS

Acronyms of the following institutions are used in the text: Australian Museum, Sydney (AMS); Academy of Natural Sciences of Philadelphia (ANSP); Museum of Natural History, London (BMNH); Bernice P. Bishop Museum, Honolulu (BPBM); California Academy of Sciences, San Francisco (CAS); Hebrew University, Jerusalem (HUJ); Museum of Comparative Zoology, Harvard University (MCZ); Muséum National d'Histoire Naturelle, Paris (MNHN); Museo Civico di Storia Naturale, Milano (MSNM); Lembaga Oseanologi Nasional, Jakarta (NCIP); Naturhistorisches Museum, Vienna (NMW); Queensland Museum, Brisbane (QM); Nationaal Natuurhistorische Museum, Leiden (RMNH); J.L.B. Smith Institute of Ichthyology, Grahamstown (RUSI); South African Museum, Cape Town (SAM); Natur-Museum und Forschungsinstitut Senckenberg, Frankfurt (SMF); Staatliches Museum für Naturkunde, Stuttgart (SMNS); Tel-Aviv University, Ramat-Aviv (TAU); U.S. National Museum of Natural History, Washington D.C. (USNM); Western Australian Museum, Perth (WAM); Zoological Museum, Amsterdam (ZMA); Museum für Naturkunde, Humboldt-Universität, Berlin (ZMB); Zoological

Institute and Museum, University of Hamburg (ZMH); Zoological Museum, University of Copenhagen (ZMUC); Zoologische Staatssammlung, München (ZSM); Zoological Museum, University of Tokyo (ZUMT).

Measurements were taken to the nearest 0.1 mm. Ratios of body proportions in the diagnoses below were rounded to the nearest 0.05. Standard length (SL) is from the tip of the upper jaw to the end of the hypural plate. Body depth is measured at the pelvic-fin origin; body width is the widest point anterior to the pectoral-fin bases. Head length is from the tip of the upper jaw to the most posterior edge of opercular membrane. Snout length is from the tip of the snout to the front edge of the eye. Eye diameter is the fleshy orbit diameter measured horizontally. Interorbital width is the least bony width. Lengths of the upper and lower jaw is from the tip of the jaws to the rear edge of the maxilla and the angular bone, respectively. Maxilla depth is measured vertically at the rear end of the bone (excluding the supramaxilla). Length of median fin rays and spines is taken from the front of the base to the tip of these elements. Caudal-peduncle depth is the least depth; caudal-peduncle length is measured between verticals at the rear end of the anal-fin base and the end of the hypural plate. Pectoral and pelvic fin lengths are from the uppermost and anteriormost points of the fin bases, respectively, to the tip of the longest fin rays. Predorsal, preanal, and prepelvic distances are from tip of upper jaw to the origin of the dorsal, anal, and pelvic fins, respectively. Caudal spot diameter is the vertical diameter.

Pectoral-fin ray counts include the upper and lowermost rudimentary rays. The lateral-line scale count is given in two parts: pored scales to the end of the hypural plate followed by pored scales beyond this point. A developed gill-raker is higher than the width of its base. The number of rakers on the upper limb is followed by the number on the lower limb, including the raker at the angle of the gill arch. The gill-rakers on the ceratobranchial are counted on the first gill arch and include the raker occasionally found at the joint between this bone and the hypobranchial.

Stripes are horizontal colour bands, and bars are vertical ones. The "caudal spot" is a dark brown to black spot usually mid-lateral on the caudal peduncle at or near the caudal-fin base. The "cheek mark" is an oblique dark brown streak from the lower margin of the eye to the angle or ventral part of the preopercular ridge. The "basal stripe" is a dark stripe, varying in width and intensity, along the proximal third of the second dorsal and anal fins. Unless specified otherwise, the length of specimens listed throughout this paper is the standard length (SL).

The synonyms listed in the species accounts are limited to names of species either described from or associated with the Red Sea (Dor 1984; Goren and Dor 1994). The size (SL) of the largest specimen refers to specimens seen by us and may include fishes collected outside the Red Sea not listed in our material examined. The size of the smallest mature specimens is based on visual examination and may not correspond to the size at sexual maturity from histological preparations. We have endeavoured to use photographs of Red Sea specimens, but have included illustrations of extralimital fishes if necessary, provided they do not vary in colour. The photographs were taken by D. Eichler (DE), H. Fricke (HF), O. Gon (OG), R.H. Kuiter (RHK) and J.E. Randall (JER). The sizes given in the captions of underwater photographs are visual estimates by the photographers.

Species accounts are presented below in alphabetical order by genus and species.

KEY TO THE APOGONIDAE OF THE RED SEA

1a. A striated silvery stripe from isthmus to underside of caudal peduncle and a striated silvery area extending from lower end of pectoral-fin base into gill chamber and mouth ..... *Siphamia permutata*
1b. Striated silvery stripe absent 2

2a. Anal-fin rays 9-17 3
2b. Anal-fin rays 8 10

3a. Preopercle edge smooth or with 1-4 minute angular serrae at, or just above angle; body moderately elongate, the depth 3.3-5.0 in SL 4
3b. Preopercle edge serrate, at least on ventral part and around angle; body not elongate, the depth 1.9-3.3 in SL 7

4a. Pectoral-fin rays 10; caudal peduncle length 3.0-3.6 in SL; palatine teeth absent ..... *Cercamia eremia*
4b. Pectoral-fin rays 12-17; caudal peduncle length 4.0-4.9 in SL; palatine teeth present (rarely absent in *spilota*) [genus *Rhabdamia*] 5

5a. Anal-fin rays 9; total gill-rakers 17-18; longitudinal dark streak on each caudal-fin lobe; oval lens of light organ surrounded by black skin on rear of gill cavity lateral to lower end of cleithrum and covered by operculum ..... *R. cypselura*
5b. Anal-fin rays 10-12; total gill-rakers 21-33; no dark streak on caudal lobes; no light organ under operculum 6

6a. Dorsal-fin VII + I,10-12; pectoral-fin rays 16-17; total gill-rakers 21-23 ..... *R. nigrimentum*
6b. Dorsal fin VI + I,9; pectoral-fin rays 12-13; total gill-rakers 30-33 ..... *R. spilota*

7a. Anal-fin rays 9; total gill-rakers 27-33; caudal spot absent; first dorsal fin higher than second dorsal fin ..... *Apogon (Zoramia) leptacanthus*
7b. Anal-fin rays 12-17; total gill-rakers 18-21; caudal spot present (sometimes diffuse); first dorsal fin shorter than second dorsal fin [genus *Archamia*] 8

8a. Two narrow dark stripes, one from top of snout to

below second dorsal-fin base, the second stripe mid-lateral from tip of snout through eye to just before dark caudal spot; pectoral-fin rays usually 13; rear (vertical) edge of maxilla straight; body depth 3.1-3.3 in SL ..... *Ar. bilineata*

8b. Body with many narrow dark bars; pectoral-fin rays usually 14; rear edge of maxilla indented; body depth 2.3-2.9 in SL 9

9a. Body with about 10-13, narrow dark brown bars; anal-fin rays 12-14 ..... *Ar. lineolata*

9b. Body with 21-23 narrow, orange bars (bars brown and usually indistinct in preserved specimens); anal-fin rays 15-17 ..... *Ar. fucata*

10a. First dorsal-fin spines 7-8 11

10b. First dorsal-fin spines 6 39

11a. Pored lateral-line scales ending under second dorsal fin; anterior nostril on, or less than a nostril diameter above, ventral edge of snout 12

11b. Pored lateral-line scales reaching to caudal-fin base; anterior nostril more than a nostril diameter above edge of snout (except *heptastygma*), usually about mid-way between rear nostril and upper lip 16

12a. Palatine teeth present; pectoral-fin rays 12; median predorsal scales 3; no ocellated dark spot on opercle ..... *Foa fo*

12b. Palatine teeth absent; pectoral-fin rays 13-15 (rarely 12); median predorsal scales 4-6; large ocellated dark spot on opercle usually present (absent in *vaiulae*) [genus *Fowleria*] 13

13a. Pectoral-fin rays 12-14; median predorsal scales 4 (rarely 5); body without distinct dark bars (*F. variegata* may have irregular dark bars) 14

13b. Pectoral-fin rays 15 (rarely 14); median predorsal scales 6; body with 10-12 dark bars, broader than pale interspaces ..... *F. marmorata*

14a. Dark ocellated spot on opercle; dark bars on body, if present, 10-12 15

14b. No dark ocellated spot on opercle; body usually with 5-8 broad dark bars ..... *F. vaiulae*

15a. Body with small brown blotches overlaid with dark brown dots; blotches and dots sometimes align to form about 12 irregular bars; fins (except pectorals) with numerous dark brown spots ..... *F. variegata*

15b. Body brown to dark brown, without blotches and dark brown dots; no dark spots on fins ..... *F. aurita*

16a. Pored lateral-line scales 26-31 (23-25 to caudal-fin base); scales around caudal peduncle 12-14; dark stripes, if present on body, fewer than 9 17

16b. Pored lateral-line scales 36-40 (about 30 to caudal-fin base); scales around caudal peduncle 16-18; more than 12 dark lines following scale rows in deepest part of body ..... *Apogon (Lepidamia) multitaeniatus*

17a. First dorsal-fin spines 8; pectoral-fin rays 18-19; head and body whitish, often with 3 brown bands radiating posteriorly from eye ..... *Neamia octospina*

17b. First dorsal-fin spines 7; pectoral-fin rays 12-17; colour not as in 17a 18

18a. Fourth dorsal-fin spine longer than (rarely equal to) 3rd spine; no first dorsal-fin spine distinctly more robust than other spines; pectoral-fin rays 16-17 [genus *Apogon*, subgenus *Jaydia*] 19

18b. Third dorsal-fin spine distinctly longer than 4th spine, and more robust than other spines of first dorsal fin; pectoral-fin rays 12-16 20

19a. Preopercle edge and ridge smooth; developed gill-rakers on upper limb 2; large dark spot on rear part of first dorsal fin; body with dark brown spot on scales, forming longitudinal rows; peritoneum pale ..... *A. queketti*

19b. Preopercle edge serrate, at least on ventral part; preopercle ridge serrate at angle; only 1 developed gill-raker on upper limb; no large spot on first dorsal fin; no dark brown spot on body scales; peritoneum with dark spots ..... *A. smithi*

20a. Preopercle edge and ridge smooth, the edge poorly ossified (membranous); no teeth on palatines; caudal fin rounded ..... *Apogonichthys perdix*

20b. Preopercle edge serrate; preopercle ridge smooth or serrate; palatine teeth present; caudal fin emarginate (truncate in *pharaonis*) [genus *Apogon*] 21

21a. Preopercle ridge serrate; pectoral-fin rays 12-15; a single dark stripe, mid-lateral on head and body, ending before a small dark caudal spot [subgenus *Pristiapogon*] 22

21b. Preopercle ridge smooth (if serrate, then pectoral-fin rays 15-16); colour not as in 21a (except live *pselion* with a faint dark mid-lateral stripe) [subgenus *Ostorhinchus*] 24

22a. Pectoral-fin rays usually 13; caudal spot above, or mostly above lateral line 23

22b. Pectoral-fin rays usually 14; caudal spot centred on lateral line ..... *A. fraenatus*

23a. Dark stripe on body strongly tapering posteriorly; caudal spot distinct, its diameter 4.5-8.4 in peduncle depth; body depth 2.95-3.5 in SL ..... *A. exostigma*

23b. Dark stripe on body not tapering; caudal spot diffuse in adults, the diameter 3.8-4.0 in peduncle depth; body depth 2.55-2.95 in SL ..... *A. kallopterus*

24a. Body with 2-6 dark brown or orange-yellow stripes; no oblique dark cheek mark, and no dark bars on body or caudal peduncle 25

24b. No stripes on body; oblique dark cheek mark, and dark bars or saddles on body and caudal peduncle present or absent 28

25a. Body with 6 orange-yellow stripes (usually faded or absent in preserved specimens); developed gill-rakers 18-22 ..... *A. cyanosoma*
25b. Body with 2-6 dark brown stripes; developed gill-rakers 10-19 26

26a. Body with 2 dark brown stripes, the upper stripe above lateral line, ending behind base of second dorsal fin, the mid-lateral stripe reaching end of caudal fin; pectoral-fin rays 15-16; preopercle ridge serrate in adults ..... *A. quadrifasciatus*
26b. Body with 5-6 dark brown stripes; pectoral-fin rays 13-15; preopercle ridge smooth 27

27a. Pectoral-fin rays 15 (rarely 14); developed gill-rakers 10-13; dark line runs from upper edge of eye to middle of body between 2nd and 3rd major dark stripes; caudal spot distinct, its diameter 2.6-2.9 in peduncle depth ..... *A. cookii*
27b. Pectoral rays usually 14; developed gill-rakers 15-19; no dark line posteriorly from upper edge of eye; caudal spot indistinct (a widening of mid-lateral stripe at caudal-fin base) ..... *A. nigrofasciatus*

28a. Pectoral-fin rays usually 13; total gill-rakers 25-30; dark oblique cheek mark present 29
28b. Pectoral rays 14-15 (rarely 13); total gill-rakers 15-23; dark cheek mark present or absent 31

29a. Dark oblique cheek mark triangular, the wide end near eye; a dark saddle or complete dark bar on caudal peduncle; upper and lower edges of caudal fin blackish or submarginally dusky 30
29b. Dark cheek mark linear; diffuse caudal spot on upper part of peduncle (spot distinct and midlateral in juveniles); upper and lower edges of caudal fin not blackish or submarginally dusky ..... *A. guamensis*

30a. Body with alternating narrow dark and pale bars, the dark bars wider; dark saddle on caudal peduncle extending below lateral line in adults ..... *A. zebrinus*
30b. No narrow bars on body; dark bar around caudal peduncle broadly pale-edged in life ..... *A. annularis*

31a. Dark bar (sometimes faint) under each dorsal fin; a narrow dark bar or dark spot on peduncle 32
31b. No dark bars under dorsal fins; dark bar on caudal peduncle, if present, wide; caudal spot absent (except in *A. heptastygma* and juvenile *A. fleurieu*) 35

32a. Dark body bars distinct; caudal spot distinct or partly covered by narrow peduncular bar; total gill-rakers 17-21, ceratobranchial rakers 8-9 33
32b. Dark bars on body faint; no caudal spot; total gill-rakers 15-17, ceratobranchial rakers usually 7 (rarely 8) ..... *A. timorensis*

33a. Caudal spot nearly covered by narrow dark bar; median predorsal scales 2; first dark bar on body with a large ocellus ..... *A. pharaonis*
33b. Caudal spot distinct, not covered by dark bar; median predorsal scales usually 3; first dark body bar with or without an ocellus 34

34a. Pectoral-fin rays 14 (rarely 15); large ocellus usually present in first dark bar on body just below lateral line (may be faded or absent in preserved fish); dusky stripes on body following scale rows (most evident posteriorly); caudal spot large, its diameter 3.4-3.8 in peduncle depth ..... *A. taeniatus*
34b. Pectoral rays 15; no ocellus in dark body bar; no dusky stripes on body; caudal spot small, its diameter 4.6-6.1 in peduncle depth ..... *A. pseudotaeniatus*

35a. Total gill-rakers 19-23; body unmarked, or with dark bar or small dark saddle on caudal peduncle 36
35b. Total gill-rakers 15-17; dark spot usually present above pectoral-fin base, at origin of first dorsal fin, at origin and rear base of second dorsal fin, and mid-posteriorly on caudal peduncle ..... *A. heptastygma*

36a. Dark bar or small spot on caudal peduncle; pelvic-fin length 3.6-4.4 in SL 37
36b. No dark bar or saddle on caudal peduncle; pelvic-fin length 4.5-4.9 in SL ..... *A. apogonides*

37a. Dark bar or mid-lateral dark spot (juvenile *fleurieu*) on caudal peduncle; edges of scales pale (dusky above lateral line in some *pselion*) 38
37b. Dark spot pupil-size or smaller on upper rear part of caudal peduncle; edges of dorsal body scales dusky to dark ..... *A. spilurus*

38a. Body depth 2.5-2.9 in SL; no dusky stripe on body; dark spot on underside of each lateral-line scale (may be absent in preserved fish); gill arches and rakers of adults dusky to blackish; median predorsal scales 5 ..... *A. fleurieu*
38b. Body depth 2.8-3.4 in SL; dusky mid-lateral stripe on body (indistinct in preserved fish); no dark spots under lateral-line scales; gill arches and rakers pale; median predorsal scales 4 ..... *A. pselion*

39a. Body deep, the depth 1.9-2.0 in SL; second anal-fin spine 1.7-2.0, and spine of second dorsal fin 1.6-1.7 in head length; dark brown bar from first dorsal-fin origin to underside of abdomen; dark brown spots posteriorly on body ..... *Sphaeramia orbicularis*
39b. Body more slender, the depth more than 2.0 in SL; second anal spine more than 2.0, and spine of second dorsal fin more than 1.7 in head length; colour not as in 39a 40

40a. Scales cycloid and small, 39-43 in longitudinal series; 2 inconspicuous lateral lines, one dorsal and one ventral (only a few upper lateral-line scales with pores); dorsal-fin rays 8; caudal fin rounded ..... *Pseudamia gelatinosa*
40b. Scales ctenoid and large, 26-29 in longitudinal

series; a single, continuous and conspicuous lateral line; dorsal-fin rays 9; caudal fin emarginate to forked 41

41a. Some teeth enlarged, caniniform; body with 2-16 dark brown stripes [genus *Cheilodipterus*] 42
41b. Jaws with minute, villiform teeth, no canines; no dark stripes on body (except *A. bryx*) 47

42a. Large canines at symphysis of lower jaw; pectoral-fin rays 13-14 (rarely 12); dark stripes on body of adults and sub-adults 7-16 (fewer in juveniles) 43
42b. No large canines at symphysis of lower jaw; pectoral-fin rays 10-12 (rarely 13); dark stripes on body 4-5 (fewer in small juveniles) 45

43a. Pectoral rays usually 13; ceratobranchial gill-rakers 6-7; stripes on body of adults 7-10 ..... *C. macrodon*
43b. Pectoral rays usually 14; ceratobranchial gill-rakers usually 8-9; stripes on body of adults 9-16 44

44a. Dark stripes on body of adults 13-16; caudal spot diameter 3.45-4.65 in peduncle depth; upper jaw length 1.75-2.0 in head length ..... *C. lineatus*
44b. Dark stripes on body of adults 9-13; caudal spot diameter 1.3-2.8 in peduncle depth; upper jaw 1.9-2.2 in head length ..... *C. lachneri*

45a. Midlateral caudal spot large (diameter 1.6-2.9 in peduncle depth); small dark spot on dorsal (and sometimes on ventral) surface of peduncle at caudal-fin base 46
45b. Midlateral caudal spot diameter 3.7-5.3 in peduncle depth; no dark spot on dorsal or ventral surface of caudal-fin base; ..... *C. quinquelineatus*

46a. Pectoral-fin rays usually 12; fifth (lowermost) dark body stripe curving upward in front of pelvic-fin insertion ..... *C. novemstriatus*
46b. Pectoral-fin rays 10-11; fifth (lowermost) dark body stripe a straight line between isthmus and anal-fin base ..... *C. pygmaios*

47a. Ventral part of preopercle edge poorly ossified, membranous and sometimes crenulate; life colour primarily red 48
47b. Ventral part of preopercle edge well ossified and serrate; life colour not red 53

48a. Total gill-rakers 19-22 49
48b. Total gill-rakers 14-19 50

49a. Pectoral-fin rays 12; scales around caudal peduncle 16; a black spot followed by a white spot at rear end of second dorsal-fin base; intestine black ..... *A. isus*
49b. Pectoral-fin rays 13; scales around caudal peduncle 12; no black and white spots at end of second dorsal-fin base; intestine pale ..... *A. talboti*

50a. Anterior nostril about mid-way between upper lip and rear nostril; skin flap covering first supraorbital pore extending laterally beyond anterior nostril (Fig. 1A); pectoral-fin rays usually 14 ..... *A. campbelli*
50b. Front nostril distinctly closer to upper lip than to rear nostril; skin flap covering first supraorbital pore ending at medial edge or under middle of front nostril (Fig. 1B, C); pectoral-fin rays 12-13 51

51a. Scales between lateral line and first dorsal fin 1½; developed upper gill-rakers 2-3; diffuse, dark mid-lateral stripe on rear of body and caudal fin present or absent; no dark band from eye to anal fin 52

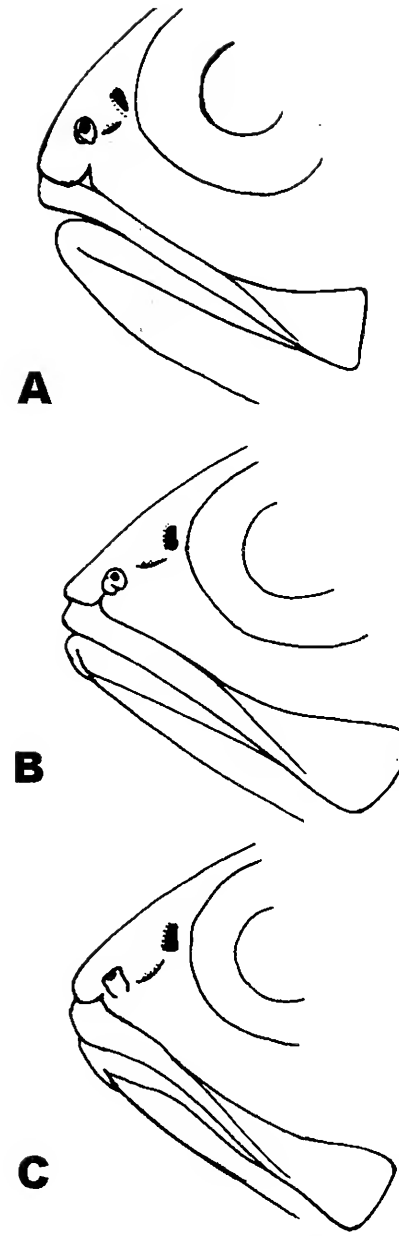

Figure 1. A) *Apogon campbelli*, 33 mm SL;
B) *Apogon coccineus*, 29.3 mm SL;
C) *Apogon erythrosoma*, 37.5 mm SL.

51b. Scales between lateral line and first dorsal fin 2½; one developed upper gill-raker; mid-lateral dark stripe on rear of body and caudal fin; dark band from eye to origin of anal fin ..... *A. semiornatus*

52a. Pectoral-fin rays usually 13; second dorsal-fin spine 1.6-2.4 in head length; caudal-peduncle depth 1.6-2.3 (usually less than 2.0) in peduncle length; a dusky stripe at least along rear part of peduncle; edges of body scales usually dusky ..... *A. coccineus*
52b. Pectoral-fin rays 12; second dorsal-fin spine 1.3-1.7 in head; caudal-peduncle depth 2.0-2.9 in peduncle length; caudal peduncle with some dark spots near or at middle of caudal-fin base, but no dusky stripe; body scales pale, except some median predorsal scales, some scales at base of dorsal fins and (sometimes) on top of caudal peduncle ..... *A. erythrosoma* n. sp.

53a. Anus much closer to pelvic fin origin than to urogenital opening, which is 2 scale rows in front of anal-fin origin; blackish stripe from front of snout through eye, but not to middle of body .....*A. gularis*
53b. Anus and urogenital papilla adjacent and close to anal-fin origin; 3 dark brown stripes: the first from dorsal part of snout to top of caudal peduncle, the second stripe wider, mid-lateral from front of snout to end of caudal fin, a faint narrow dark stripe from upper edge of operculum parallel and just above mid-lateral dark stripe ..... *Apogon bryx*

Apogon annularis
Plate 1A

Apogon annularis Rüppell, 1829: 48 (El Tûr, Egypt; lectotype, SMF 1774).
Apogon erdmani Lachner, 1951: 595 (Jeddah, Saudi Arabia; holotype, USNM 147518).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13; lateral-line scales 24 + 2-4 (usually 27); median predorsal scales 2-3; total gill-rakers 6-8 + 19-22 = 26-30; developed rakers 6-7 + 19-22 = 25-29; ceratobranchial rakers 12-13. Preopercle ridge smooth, the edge serrate. Body depth 2.1-2.2, and head length 2.4-2.6 in SL; snout length 5.2-6.3, eye diameter 2.2-2.5, interorbital width 3.5-3.9, and upper-jaw length 1.9, all in head length; caudal-peduncle depth 1.3-1.4 in its length, and peduncle length 4.1-4.3 in SL. Largest specimen, 61 mm; smallest mature female, 51.8 mm.

Colour in alcohol: body pale brown to brown; dark oblique cheek mark triangular, wide at ventral edge of eye and gradually tapering toward angle of preopercular ridge; dark brown bar encircling peduncle; bar sometimes darker above lateral line; dorsal and caudal fins dusky; upper and lower edges of caudal fin narrowly pale, with a narrow dusky submarginal band; small dark spots inside mouth; peritoneum pale; intestine dark.

Colour in life: metallic copper brown to bronze with cheek mark and peduncular bar as described; bar broadly edged in white; leading edges of fins white.

DISTRIBUTION: Known only from the Red Sea and Gulf of Aden (Fraser et al. 1999).

REMARKS: In two of Rüppell's paralectotypes (SMF 4679, 4681) the dark caudal band is not circumpeduncular, having a pale area on the ventral surface; this may be due to fading. A third paralectotype (SMF 4680) has only 22 developed gill rakers and is either an aberrant fish or a specimen of *zebrinus*. The colour pattern of *Apogon annularis* is similar to that of *zebrinus* and *guamensis*. Unlike these two species, *annularis* has no narrow light and dark bars on the central part of the body. In *zebrinus* there is no circumpeduncular band, but a dark bar that may extend some distance below the lateral line. Young *guamensis* have a small caudal spot centred on the lateral line; this spot changes to a diffuse spot above the lateral line in adults. In addition, *guamensis* has the oblique cheek mark uniformly narrow.

Klunzinger (1870) identified "*Apogon annularis*", which he described as having a blue stripe from snout to opercle and blue spots on the opercle and anterior part of the body. Evidently, his specimens were *A. fleurieu* (see Remarks for *fleurieu* below). Bleeker (1874) considered *annularis* a synonym of *aureus* Lacepède. Klunzinger (1884) followed Bleeker, but questioned his decision. Klausewitz (1959) identified Red Sea material of *Apogon annularis* as *A. aureus annularis* and distinguished it from *A. aureus aureus*, not realizing that *annularis* is a species of the *Apogon bandanensis* complex. Rüppell's (1829) failure to mention the cheek mark, and his reference to Lacepède's (1801) illustration of *fleurieu* may have contributed to these misidentifications.

We agree with Klausewitz (1959), Smith (1961) and Fraser et al. (1999) that *Apogon erdmani* Lachner is a junior synonym of *A. annularis* Rüppell.

Occurs on coral or rocky reefs, down to 15 m.

MATERIAL EXAMINED: 28 specimens, 14-61 mm. Gulf of Aqaba (Jordan and Egypt), Aqaba, SMF 16161, 2: 31.2-31.5 mm; SMF 16162, 29.1 mm; SMF 16163, 50.7 mm; El Hamira, BPBM 21513, 3: 32-54 mm. Egypt, Gulf of Suez, El Tûr, SMF 1774, 61 mm, lectotype of *A. annularis*; SMF 4679-4681, 3: 37.1-51.8 mm, paralectotypes of *A. annularis*; Hurghada (=Al Ghardaqa), SMF 4682, 50.3 mm; TAU 5620, 58 mm. Sudan, Suakin, BPBM 20373, 3: 25-36 mm. Saudi Arabia, Khor Obhur, ANSP 163226, 2: 51.9-52.1 mm; Yanbu, BPBM 30386, 4: 14-18 mm. Eritrea, Dahlak Archipelago, TAU 11405, 2: 38.5-41.0 mm; Yemen, Zubayr Islands, BPBM 35701, 4: 18-22 mm.

Apogon apogonides
Plate 1B

Cheilodipterus apogonides Bleeker, 1856a: 37 (Manado, Sulawesi; holotype, RMNH 5607).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 14; lateral-line scales 24-25; median predorsal scales 4-5; total gill-rakers 5 + 15-16 (2 upper rudiments and 1 lower). Preopercle ridge smooth, the edge serrate. Body depth 2.7-3.0 in SL; body moderately compressed, the width 1.85-2.0 in depth; head length 2.45-2.6 in SL; snout length 3.9-4.2, eye diameter 2.9-3.7, interorbital width 4.5-4.8 and upper-jaw length 1.7-2.0, all in head length; teeth on side of lower jaw as small inward-projecting canines; caudal-peduncle depth 1.6-2.0 in peduncle length, and peduncle length 3.7-4.2 in SL; caudal fin slightly forked. Largest specimen, 103 mm, from the northern Red Sea.

Colour in alcohol: brown, shading to pale brown ventrally; a broad dark brown stripe on side of snout extending to upper lip; anterior part of first dorsal fin dark brown; remaining fins pale; peritoneum dusky, the digestive tract black.

Colour in life: coppery red dorsally, shading to golden yellow on abdomen and ventrally on head; dark stripe on snout with bright blue line on each edge, these lines passing through eye and continuing across operculum, thence onto body as two rows of small blue spots. Kuiter (1998) photographed this species in the Maldive Islands.

DISTRIBUTION: Red Sea to Durban, also known from the Seychelles, Maldives, Chagos Archiplago, and east to the islands of French Polynesia; in the western Pacific it occurs from Japan to the Great Barrier Reef; curiously, it remains unrecorded from the islands of Micronesia.

REMARKS: Our single specimen of *Apogon apogonides* represents the first record for the Red Sea. It was speared by the second author on an artificial reef of tyres at North Beach, Eilat at a depth of 7 m.

Eschmeyer et al. (1998) noted that the original description of this species (Bleeker 1856a) includes two different spellings of the species name: *apogonoides* appears twice in the lists of species at the beginning of the paper (p. 3 & 11), and *apogonides* is at the heading of the species description (p. 37). The spelling of *apogonoides* also appears in Bleeker (1860: 30) and in Günther (1859: xxiv, 249, 509). In subsequent papers Bleeker (1874, 1875-76) used *apogonides*. We concur with recent authors (e.g., Smith 1961, Fraser 1972, Hayashi 1984, Gon 1986a, Randall et al. 1990a, Shen et al. 1993, Winterbottom and Anderson 1997) in using *apogonides*.

MATERIAL EXAMINED: Gulf of Aqaba, Israel, Eilat, BPBM 31873, 103 mm. South Africa, KwaZulu-Natal, RUSI 9181, 10 (of 57): 32.1-87.1 mm.

Apogon bryx
Fig. 2

Apogon bryx Fraser, 1998: 987, Fig. 1 (Balayan Bay, Luzon, Philippines; holotype, CAS 34408).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 14; scales mostly missing; total gill-rakers 7 + 18; developed rakers 5 + 18; ceratobranchial rakers 12. Body depth 2.8 and head length 2.3 in SL; snout length 4.2, eye diameter 3.3, interorbital width 5.9, and upper-jaw length 2.3, all in head length; caudal-peduncle depth 1.9 in its length, and peduncle length 4.3 in SL.

Colour in alcohol: body pale brown, with 3 dark brown stripes; first stripe from dorsal part of snout, above eye, to upper part of caudal peduncle; second stripe wider, from tip of snout, through middle of eye and along mid-lateral part of body to end of mid-caudal rays; 3rd dark stripe faint and narrow, from upper end of operculum, parallel to and just above mid-lateral stripe to base of caudal fin (not visible on our single faded specimen); dorsal body scales with dark edges; peritoneum with dark spots of various sizes; intestine dark brown.

Colour in life: "silvery grey, with dark stripes as in

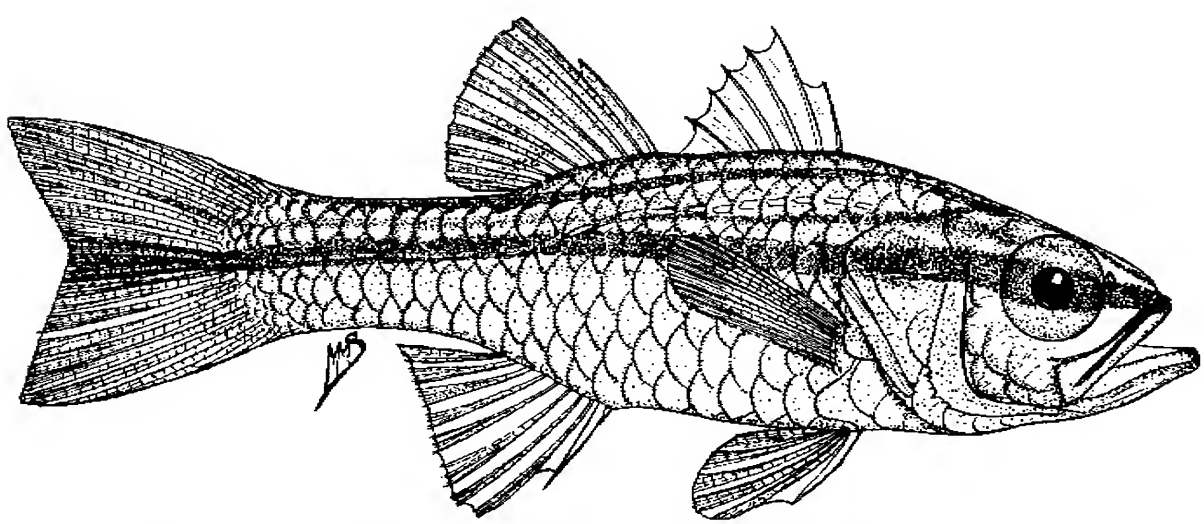

Figure 2. *Apogon bryx* (52 mm TL, from Smith, 1961: Fig. 5 "*Apogon kiensis* Jordan & Snyder, 1901").

fig. 5. Fins faint pink." (Smith, 1961: 388).

DISTRIBUTION: From Red Sea and east coast of Africa to the Philippines and north to Taiwan.

REMARKS: This species was misidentified by Smith (1961) as *Apogon kiensis*, which has 19-22 total gill-rakers (16-18 developed).

Fraser (1998) described *Apogon bryx* from a preserved specimen with no colour pattern. He noted that the only difference between this species and Smith's *kiensis*-like species is the preserved colour pattern. Subsequent to the description of *bryx* he discovered that this striped Red Sea and west Indian Ocean species is in fact widespread in the Indo-west Pacific region (T.H. Fraser, pers. comm.) Since the holotype of *bryx* was collected over 30 years ago, we presume that the original dark stripes have faded.

MATERIAL EXAMINED: Eritrea, HUJ 11765, 44.7 mm.

Apogon campbelli
Fig. 3

Apogon campbelli Smith, 1949a: 100 (Maputo Bay, Mozambique; syntypes, RUSI 348, USNM 112207).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 13-14; lateral-line scales 24 + 1-2;median predorsal scales 6-8; scales between lateral line and first dorsal-fin base 1½; total gill-rakers 3-4 + 11-13; developed gill-rakers 1 + 6–9; ceratobranchial rakers 7–8 (usually 7).

Preopercle ridge smooth; posterior preopercle edge serrate, the angle and ventral part crenulate and membranous. Body depth 2.6-2.9 and head length 2.3-2.7 in SL; snout length 4.5-6.9, eye diameter 2.7-3.1, interorbital width 4.3-5.0, upper-jaw length 1.75-2.1, second dorsal spine 1.6-1.9, all in head length. Anterior nostril about mid-way between upper lip and posterior nostril; skin flap forming dorsal edge of first supraorbital pore extending laterally beyond anterior nostril (Fig. 1A). Caudal-peduncle depth 1.8-2.5 in its length, and peduncle length 3.4-4.1 in SL. Largest specimen, 38.6 mm; smallest mature male and female, 25.9 and 24.7 mm, respectively.

Colour in alcohol: pale, usually with little pigment on body; edge of several predorsal scales, and/or of scales along dorsal fin bases and/or dorsal surface of caudal peduncle may have a variable amount of dark brown pigment; some dark brown to blackish spots usually present on middle of caudal peduncle in front of caudal-fin base; dark spots sometimes present on cheek, behind rear end of maxilla; fins usually pale, rarely tips of posterior dorsal-fin rays, and distal half of upper and lower caudal rays with fine blackish spots; peritoneum with small blackish spots overlaid with scattered larger ones; intestine pale.

Colour in life: transparent reddish pink, sometimes with dark-edged scales as described.

DISTRIBUTION: Red Sea and east coast of Africa to Maputo, Mozambique. The full range of *Apogon campbelli* is uncertain due to the taxonomic confusion within the *A. coccineus* species group.

REMARKS: This species is easily distinguished from the other two species of the *coccineus* group by the position of its anterior nostril (closer to upper lip than to rear nostril in *coccineus* and *erythrosoma*), the lateral extent of the skin flap of the first supraorbital pore (not extending beyond anterior nostril in *coccineus* and *erythrosoma*), and in having only 1 developed upper-limb gill-raker (2-3 developed upper rakers in *coccineus* and *erythrosoma*).

Apogon campbelli is very similar to *A. crassiceps* Garman, described from Fiji. The holotype of *crassiceps* (MCZ 28314) is in poor condition; all the fins are broken and its skin stiff and shrivelled. To verify the pectoral fin count (the rays are short and frayed) we compared the holotype with specimens from Taiwan and the Coral Sea that agree with it in all other characters. The holotype of *crassiceps* has a midlateral row of small dark brown spots extending anteriorly a short distance from the middle of the caudal-fin base and posteriorly to the end of the broken middle caudal rays. In some of the other Pacific specimens this appears as a diffuse elongate caudal spot or a short stripe, usually extending

Figure 3. *Apogon campbelli*, HUJ 18408, 26.4 mm SL, Gulf of Aqaba, Red Sea.

onto the middle caudal rays, but sometimes expanding to cover most of the caudal fin. None of our specimens of *campbelli* has this pattern on the caudal peduncle and fin. The colour description and illustration of *Amia fusca* from Samoa in Jordan and Seale (1906: 244, Fig. 38) agrees with *crassiceps*. Their *crassiceps* (p. 239, Fig. 32) is another species, similar to *caudicinctus* Randall and Smith, 1988.

MATERIAL EXAMINED: 19 specimens, 20.7-38.6 mm. Gulf of Aqaba (Israel and Egypt), Eilat, TAU P.9917, 29.6 mm; Marsa Ktana, HUJ 18408, 4: 20.7-33.0 mm; TAU P.11329, 2: 26.7-29.1 mm; Nuweiba, TAU P.8668, 4: 23.2-31.1 mm; Wasset, TAU P. 10075, 2: 26.3-28.2 mm; Dahab, TAU P.10007, 28.1 mm; TAU P.10009, 20.8 mm; Nabek, TAU P.11332, 2: 25.2-25.9 mm. Gulf of Suez, south of Ras Garra, TAU P.9571, 27.2 mm. Mozambique, Maputo Bay (= Delagoa Bay), RUSI 348, 38.6 mm and USNM 112207, 33.7 mm (both syntypes of *A. campbelli*).

Apogon crassiceps: Taiwan, RUSI 35742, 8: 31.1-42.0 mm; Coral Sea, Chesterfield Bank, BPBM 33702, 2: 28-30 mm; Fiji, MCZ 28314, 25.7 mm (holotype).

Apogon coccineus

Fig. 4, Plate 1C

Apogon coccineus Rüppell, 1838: 88, Pl. 22, Fig. 5 (Massawa, Eritrea; lectotype, SMF 973).

Apogon igneus Klunzinger, 1870: 710 (Massawa, Eritrea; syntypes ZMB 71; footnote, unavailable name).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 12-14; lateral-line scales 24-25 + 1-3; median predorsal scales 6-7; 1½ scales between lateral line and first dorsal-fin base; total gill-rakers 3-5 + 12-15; developed rakers 2-3 + 8-11 = 10-13; ceratobranchial rakers 8-9 (usually 8). Preopercle ridge smooth; posterior preopercle edge serrate, the angle and ventral part crenulate and membranous. Body depth 2.5-2.8 and head length 2.35-2.7 in SL; snout length 4.25-7.3, eye diameter 2.9-3.3, interorbital width 4.6-5.6, upper-jaw length 1.75-2.1, second dorsal spine 1.6-2.4, all in head length. Anterior nostril closer to upper lip than to posterior nostril; skin flap forming dorsal edge of first supraorbital pore ending laterally with a small notch reaching up to middle of base of anterior nostril tube (Fig. 1B). Caudal-peduncle depth 1.6-2.3 in its length, and peduncle length 3.5-4.4 in SL. Largest specimen, 50 mm, from Oman; smallest mature male and female, 26.3 and 25.1 mm, respectively.

Colour in alcohol: body pale brown to brown, usually with dark-edged scales on predorsal area, between dorsal fins and lateral line, and on upper part of caudal peduncle; in some specimens the dark-edged scales cover most of the body, and together with irregular dusky patches on the middle of scales create a mottled effect; a diffuse dusky stripe along middle of caudal peduncle, usually more distinct posteriorly; the stripe black, very distinct and extending to tip of mid-caudal rays in juveniles (Fig. 4); the stripe becomes diffuse with growth, frequently receding to anterior part of mid-caudal rays in larger fish; usually blackish dots at tips of rays of second dorsal, anal, caudal and, more rarely, pelvic fins; peritoneum with small blackish spots overlaid with scattered larger ones; intestine pale.

Colour in life: transparent reddish pink with dark pigment as described.

DISTRIBUTION: Red Sea, Gulf of Oman and the Persian Gulf.

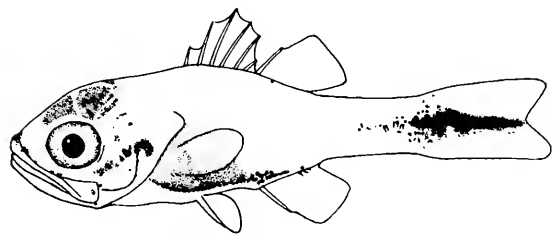

Figure 4. Juvenile *Apogon coccineus*, 10.5 mm, TAU 11330, Dahlak Archipelago, Eritrea, Red Sea.

REMARKS: *Apogon coccineus* is similar to *erythrosoma* and *campbelli*. It differs from the former in having modally more pectoral rays (Table 1), as well as a shorter second dorsal spine and a more slender caudal peduncle (peduncle depth 1.3-1.7 in HL and 2.0-2.9 in peduncle length in *erythrosoma*). *Apogon campbelli* has modally 14 pectoral rays and 7-10 developed gill-rakers (Tables 1-2), its anterior nostril is about midway between upper lip and rear nostril, and the first supraorbital pore skin flap extends laterally beyond the anterior nostril (Fig. 1A).

Table 1. Frequency distribution of pectoral-fin rays in species of the *Apogon coccineus* group in the Red Sea.

	Left pectoral fin					Right pectoral fin				
	11	12	13	14	n	11	12	13	14	n
A. campbelli			3	15	18			2	14	16
A. coccineus		2	86	1	89		1	89		90
A. erythrosoma	1	30	1		32	1	31			32

Table 2. Frequency distribution of gill rakers in species of the *Apogon coccineus* group in the Red Sea.

	Developed rakers on upper limb				Developed rakers on lower limb							
	1	2	3	n	6	7	8	9	10	11	12	n
A. campbelli	18			18	1	6	10	1				18
A. coccineus		56	34	90			8	55	27			90
A. erythrosoma		32	1	33				7	14	10	2	33

Faded specimens of *Apogon semiornatus* may appear like *coccineus*, but *semiornatus* is easily distinguished from this species in having only 8 developed gill-rakers, and $2^1/_2$ scales between the lateral line and first dorsal fin.

Rüppell's type series includes 4 specimens in bad condition; in 3 of these, including the holotype, part of the body is torn off (U. Zajonz and H. Zeztsche, SMF, pers. comm.) No measurements were taken from Klunzinger's specimens of *igneus* in Berlin due to their fragile condition. We identify them as this species for their 13 pectoral-fin rays.

According to the Code of Zoological Nomenclature (1999: Article 11.6), the name *Apogon igneus* is unavailable. This name was first published in the synonymy of *coccineus* (Klunzinger, 1870: 710, footnote). Subsequent authors (Klunzinger, 1884, Dor, 1984) also listed it in synonymy and never treated it as a valid name. Bleeker's collection includes a 75.4-mm specimen (RMNH 13057) labelled *Apogon coccineus* collected by R. Kossmann in the Red Sea. The first author identified this fish as *A. imberbis*, a Mediterranean species that does not occur in the Red Sea; evidently, the locality on the label was incorrect.

Specimens were collected on coral reefs or rocky bottom down to 50 m.

MATERIAL EXAMINED: 106 specimens, 11.3-40.5 mm. Egypt, Gulf of Aqaba, north of Nabek, TAU P.11407, 4: 21.9-36.3 mm; Gulf of Suez, Abu Durba, TAU P.6704, 2: 36.4-38.1 mm; El Tûr, HUJ 11321, 2: 37.6-39.8 mm. Southern end of Sinai Peninsula, Ras Muhammad TAU P.10023, 2: 38.8-40.5 mm. Sudan, Port Sudan, BPBM 19757, 2: 35.0-35.3 mm; Suakin Harbour, BPBM 20377, 33 mm. Eritrea, Dahlak Archipelago, HUJ 11324, 13: 26.6-35.3 mm; HUJ 11939, 13: 25.1-31.9 mm; HUJ 11967, 17(of 52): 11.3-33.7 mm; Massawa, SMF 973 (lectotyoe of *A. coocineus*, in bad condition); SMF 4704-4706 (3 paralectotypes of *A. coccineus*, in bad condition); ZMB 71, 2: 22.2-23.2 mm (syntypes of *A. igneus*, in bad condition); Dahlak Kebir, TAU 11330, 10.5 mm; Museri, TAU P.4443, 27(of 32): 24.9-37.6 mm; TAU P.10024, 5: 29.4-34.4 mm; Jezirat at Ta'ir Islet, BPBM 35696, 2: 18.5-30.0 mm. Persian Gulf, Bahrain, BPBM 21296, 6: 27.8-50 mm. Oman, BPBM 21347, 3: 27.8-37.7 mm.

Apogon cookii

Plate 1D, E

Apogon cookii Macleay, 1881: 344 (Endeavor River and Darnley Id, Queensland; syntypes, AMS I.16307-01).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 14-15 (usually 15); lateral-line scales 24 + 3-4 (usually 28); median predorsal scales 4; total gill-rakers 4-5 + 12-15; developed rakers 2 + 8-11; ceratobranchial rakers 8-9. Preopercle ridge smooth; preopercle edge serrate. Body depth 2.6-3.0 and head length 2.5-2.8 in SL; snout length 4.65-5.5, eye diameter 2.7-3.2, interorbital width 4.8-5.1, and upper-jaw length 2.0-2.3, all in head length; caudal-peduncle depth 1.5-1.8 in its length, and peduncle length 3.6-4.1 in SL. Largest specimen, 82.2 mm; smallest mature male and female, 63.1 and 62.8 mm, respectively.

Colour in alcohol: body pale with 6 dark brown stripes wider than pale interspaces; third stripe (postocular) relatively narrow, fading out below second dorsal fin; first dorsal and pelvic fins dusky to dark brown; second dorsal and anal fins pale to dusky with dark brown basal stripe; caudal fin pale to dusky; caudal spot fairly large and distinct, 2.6-2.9 in caudal-peduncle depth; peritoneum with scattered small dark spots; intestine dark.

Colour in life: interspaces between dark brown stripes bright white on head, changing to pale bluish on body; lowest (6th) stripe reddish, continuing onto anal fin as a basal stripe with pale bluish upper and lower margins; pelvic fins reddish with pale leading edge. Randall (1995) provided a photograph of this species from Oman.

DISTRIBUTION: Red Sea and east coast of Africa to the western Pacific where it ranges from Japan to the Great Barrier Reef and New Caledonia.

REMARKS: The basal dark brown stripe of the second dorsal fin is much wider in adult males than in females and may occupy the entire lower third of this fin.

Apogon cookii is similar to *nigrofasciatus*, which differs in having 15-19 developed rakers (10 on ceratobranchial), usually 14 pectoral-fin rays, and no postocular stripe.

Red Sea examples of these two species have been variously misidentified as *Apogon endekataenia* Bleeker, *A. fasciatus* (White), or *A. novemfasciatus* Cuvier (see Dor 1984), none of which occurs in the Red Sea. *A. fasciatus* has only 3 dark stripes on the body, and is found only in southeastern Australia (Kuiter 1993). Smith (1961) gave arguments for recognising *endekataenia* for western Indian Ocean and Red Sea specimens, but his material consisted of *cookii* and *taeniophorus* (Fraser 1974). The first author examined several of Klunzinger's (1870, 1884) "*A. fasciatus*", all of which are *cookii*. *Apogon* sp. of Khalaf and Disi (1997) is also *cookii*.

A. cookii is an inshore species of protected waters of lagoons and lee reefs; it is often found in tidepools and on shallow seagrass beds.

MATERIAL EXAMINED: 27 specimens, 33.4-82.2 mm. Gulf of Aqaba (Israel, Jordan and Egypt), Eilat, HUJ 12086, 28.9 mm (misidentified by J.L.B. Smith (1961) as *Ostorhynchus endekataenia*); Aqaba, MNHN 77-822, 4: 33.4-61.3 mm; SMF 16155, 2: 47.1-77.5 mm; SMF 16156, 38.7 mm; Nuweiba, BPBM 20834, 75 mm; HUJ 9404, 2: 65.7-66.0 mm; Shurat el Mankata, TAU P.9674, 63.1 mm. Egypt, Gulf of Suez, El Bilayim, HUJ 12077, 4: 42.1-73.4 mm; Ras Garra, TAU P.3391, 3: 62.8-72.4 mm; Hurghada (= Al Ghardaqa), ZSM 22770, 66.8 mm; Al Quseir, SMF 596, 74.4 mm; SMNS 3437, 6: 66.0-82.2 mm (both lots were collected by Klunzinger).

Apogon cyanosoma
Plate 1F

Apogon cyanosoma Bleeker, 1853a: 71 (Solor, Indonesia; holotype, RMNH 5595).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13-15; lateral-line scales 24 + 4; median predorsal scales 4; total gill-rakers 6-7 + 16-18; developed rakers 4-6 + 14-18 = 18-22; ceratobranchial rakers 10-11 (usually 11). Preopercle ridge smooth, the edge serrate. Body depth 2.6-3.0 and head length 2.4-2.7 in SL; snout length 4.6-5.45, eye diameter 2.45-3.1, interorbital width 4.9-5.95, and upper-jaw length 2.0-2.2, all in head length; caudal-peduncle depth 1.7 in its length, and peduncle length 3.8-4.0 in SL. Largest specimen, 55.8 mm; smallest mature male and female, 41.2 and 38.9 mm, respectively.

Colour in alcohol: pale brown, usually with no markings or with 4-5 faint dusky stripes on body; stripes wider than interspaces; snout somewhat darker than rest of head and body; no caudal spot; fins pale, but second dorsal and anal fins sometimes with faint brown basal stripe; peritoneum with scattered small blackish spots; intestine dark brown.

Colour in life: body bluish silver with 6 orange yellow stripes on side of body; another short mid-dorsal stripe from interorbital space to origin of dorsal fin; snout and interorbital space frequently dark; fins with orange hue; pelvic fin with narrow pale leading edge. Randall (1995) photographed this species in Oman.

DISTRIBUTION: Red Sea and east coast of Africa to the western Pacific, where it ranges from southern Japan to the Great Barrier Reef and New Caledonia.

REMARKS: Weber and de Beaufort (1929: 316) found a small difference in the number of lateral-line scales between Bleeker's type of *cyanosoma* and Klunzinger's (1870) description of this species from the Red Sea. They suggested that the Red Sea specimens may not be this species. Klausewitz (1959) used the name *chrysotaenia* (Bleeker, 1851) for specimens he collected in the northern Red Sea; he was followed in the use of this name by Abel (1960) and Magnus (1964, 1967). However, *Apogon chrysotaenia* is a distinctly different East Indian species with 13-15 developed gill-rakers. Furthermore, we can find no difference in the lateral-line scale counts of Red Sea specimens of *cyanosoma* and those from elsewhere in the range of the species.

A. cyanosoma is common in the Red Sea, where it is found in association with rock and coral to at least 30 metres. It is usually seen in small aggregations under ledges or at the entrance to holes and caves. Schools are frequently mixed with *Cheilodipterus novemstriatus*

Table 3. Proportional measurements of the holotype and selected paratypes of *Apogon erythrosoma* expressed as a percentage of the standard length (* = damaged)

	HOLOTYPE	PARATYPES					
	HUJ 18626	HUJ 11202	TAU P.7774	HUJ 11202	TAU P.7774	TAU P.7774	TAU P.7774
Standard length (mm)	29.8	27.4	33.2	35.1	35.2	35.4	35.8
Body depth	36.6	36.1	37.4	34.4	37.6	36.0	36.9
Body width	20.8	21.0	20.75	21.9	20.45	20.3	21.65
Length of head	40.1	40.5	38.35	36.3	37.6	35.45	36.45
Length of snout	8.6	7.7	7.5	6.3	7.1	8.3	7.5
Eye diameter	13.6	14.2	13.5	12.9	13.9	13.4	12.7
Interorbital width	8.05	7.85	7.2	7.7	7.7	7.5	7.4
Length of upper jaw	21.1	22.1	20.15	20.1	20.7	20.8	20.8
Length of lower jaw	23.3	24.3	23.5	23.0	23.6	23.5	22.6
Maxilla width	6.0	5.7	5.3	5.3	6.0	5.5	5.7
Length of first dorsal spine	5.2	5.7	3 8	5.4	5.8	6.1	5.7
Length of second dorsal spine	26.3	27.7	25.0	25.5	25.4	27.0	27.5
Length of spine of second dorsal fin	16.1	15.3	13.7	16.2	15.8	14.8	15.9
Length of longest dorsal ray	27.2	24.6	*	24.0	23.15	*	24.3
Length of second anal spine	13.3	13.9	12.3	*	12.8	13.4	13.1
Length of longest anal ray	23.0	23.7	*	*	22.6	*	21.3
Length of pectoral fin	26.3	27.4	25.9	24.9	24.7	24.6	27.65
Length of pelvic fin	24.7	25.55	23.8	24.3	24.4	24.0	24.6
Length of pelvic spine	17.45	17.7	15.6	18.1	17.9	17.2	17.6
Length of caudal peduncle	28.2	27.55	27.4	30.2	25.85	26.0	27.4
Depth of caudal peduncle	12.75	12.4	11.4	10.5	12.5	10.45	12.15
Distance from anus to anal origin	3.0	3.1	3.6	2.8	2.8	3.0	2.8
Distance between pelvic and anal origins	22.65	23.0	23.3	24.2	23.9	24.4	23.7
Predorsal length	44.6	44.3	44.5	44.4	45.45	45.5	45.7
Preanal length	61.6	59.85	60.15	60.2	58.4	60.2	59.4
Prepelvic length	39.6	38.0	38.2	38.4	37.8	39.0	37.7

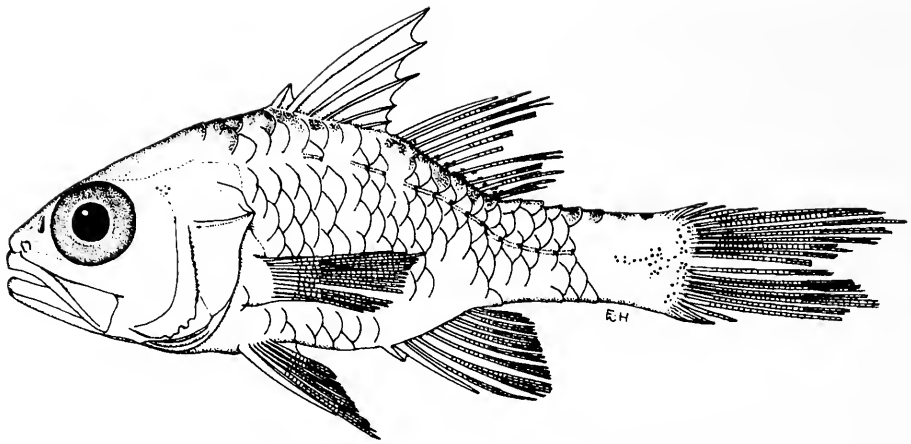

Figure 5. *Apogon erythrosoma* n.sp., 29.8 mm SL, holotype, HUJ 18626, Egypt, Gulf of Aqaba, Marsa Ktana.

and *C. pygmaios*. Smaller individuals sometimes shelter among the spines of sea-urchins of the genus *Diadema*.

MATERIAL EXAMINED: 46 specimens, 29.5-55.8 mm. Red Sea, RUSI 3136, 9: 48.4-53.3 mm. Gulf of Aqaba, Eilat, BPBM 18336, 10: 24-55 mm; TAU P.1930, 5: 29.5-55.8; Marsa Ktana, TAU P.7402, 3: 41.2-43.8 mm; Shurat el Mankata, TAU P.3404, 5: 29.7-45.9 mm. Egypt, Tiran Island, TAU P.8657, 4: 40.4-47.4 mm; TAU P.8658, 2: 38.9-46.0 mm; south end of Sinai Peninsula, Marsa Bareka, TAU P.7765, 3: 38.9-49.5 mm. Sudan, N of Port Sudan, BPBM 19758, 2: 45-49 mm. Saudi Arabia, Yanbu, BPBM 30387, 3: 30-46 mm.

Apogon erythrosoma, n. sp.

Fig. 5, Plate 1G, Table 3

HOLOTYPE: HUJ 18626, 29.8 mm SL, male, Egypt, Gulf of Aqaba, Marsa Ktana, M. Goren and A. Ben-Tuvia, 15 October 1979.

PARATYPES: TAU P. 3395, 28.1 mm, Israel, Eilat, L. Fishelson, 7 Dec. 1969; HUJ 11202, 6: 22.5-37.6 mm and RUSI 63557, 35.2 mm, both collected with holotype. Egypt, along Gulf of Aqaba and southeast coast of the Sinai Peninsula: TAU P.7558, 4: 22.7-32.8 mm, Marsa Ktana, M. Goren, March 1979; TAU P.10025, 32.6 mm, Ras Burqa, 6 Oct. 1968; TAU 11328, 3: 27.8-35.0 mm, Dahab, 11 Oct. 1968; TAU P.8667, 2: 31.8-33.3 mm, north of Nabek, wreck of the *Maria Schroeder*, M. Goren, 3 Nov. 1980; TAU P.11333, 29.3 mm, Nabek, M. Goren, 4 Nov. 1980; TAU P.7774, 15: 22.2-37.5 mm, Sharm al Sheikh, M. Goren, 15 Oct. 1979; USNM 364594, 35.7 mm; RUSI 63555, 35.5 mm (last two lots collected with TAU P.7774); BPBM 18194, 29.3 mm, Sharm el Moya, reef in 22 m, J.E. Randall and A. Levi, 21 Sept. 1974; TAU P.7773, 35.2 mm, Marsa Bareika M. Goren, 16 Aug. 1979.

OTHER MATERIAL: Maldives: BPBM 32930, 2: 29.3-34 mm.

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 11-12 (rarely 13); 1½ scales between lateral line and first dorsal-fin base; total gill-rakers 4-5 + 12-15; developed rakers 2 + 9-12; ceratobranchial rakers 8-9. Preopercle ridge smooth; posterior preopercle edge serrate, the angle and ventral part crenulate and membranous. Second dorsal spine 1.3-1.7 in head length. Anterior nostril closer to upper lip than to posterior nostril; skin flap forming dorsal edge of first supraorbital pore ending laterally with a small notch under or slightly before medial margin of anterior nostril, but not reaching base of nostril's tube (Fig. 1C). Caudal-peduncle depth 2.0-2.9 in its length. Largest specimen, 37.6 mm; the smallest female with mature gonads is 28.1 mm.

Colour in alcohol: body pale; edge of several predorsal scales, and/or scales along dorsal fin bases and/or dorsal surface of caudal peduncle sometimes with variable amount of dark brown pigment; some dark brown to blackish dots usually present on middle of caudal peduncle anterior to caudal-fin base and across base; distal part of second dorsal and anal fins often with fine dark dots; variable amount of dark dots may be present on distal part of caudal-fin rays; dots may extend to base of upper- and lowermost rays; tips of pelvic-fin rays sometimes with scattered dark dots; dark brown dots may be present on cheek, behind maxilla; peritoneum with dense small dark brown to blackish dots of various sizes; intestine pale.

Colour in life: transparent reddish pink with dark pigment as described.

DESCRIPTION: data for paratypes, when different from the holotype, are in parentheses. Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 12 (11-13); lateral-line scales lost (24 + 1-2); median perdorsal scales lost (6-7); scales between lateral line and first dorsal-fin base 1½; total gill-rakers 4 + 13 (4-5 + 12-15 = 16-19); developed rakers 2 + 11 (2 + 9-12); ceratobranchial rakers 8 (8-9).

Body elongate and compressed, its depth 2.7 (2.65-2.9) and head length 2.5 (2.5-2.8) in SL; body width 1.8 (1.6-1.8) in body depth; snout length 4.7 (4.2-5.8), eye diameter 2.95 (2.6-2.9), interorbital width 5.0 (4.7-5.3), all in head length; upper-jaw 1.9 (1.7-1.9) and lower

jaw 1.7 (1.5-1.7) in head length.

Preopercle ridge smooth; posterior preopercle edge serrate, the angle and ventral part crenulate and membranous. Exposed edge of posttemporal ossified and smooth (rarely membranous, with up to 4 small serrae in some paratypes). Posterior nostril small, oval, about 10 times in vertical eye diameter, close in front of orbit, at level of middle of eye; anterior nostril smaller, round, with a short tube, closer to upper lip than to rear nostril and slightly above lateral end of first supraorbital pore. First supraorbital pore about twice as large as rear nostril; skin flap forming its dorsal edge ending laterally with a small notch under or slightly before medial margin of anterior nostril, but not reaching base of nostril's tube (Fig. 1C); second supraorbital pore medial to and smaller than rear nostril; area of third supraorbital pore damaged; first suborbital pore larger than rear nostril, a short distance below it, and slightly slanted backward; second and third pores very small and well apart from each other.

Mouth slightly oblique; maxilla reaching posteriorly to vertical between rear edge of pupil and eye, its depth 3.5 (3.5-3.9) in upper jaw length; both jaws with a polyserial band of villiform teeth tapering posteriorly; vomer and palatines with 2 series of similar teeth.

Dorsal profile of head straight and fairly steep; first dorsal spine short, 5.1 (4.4-6.6) in second spine; second dorsal spine more robust than other spines, 1.5 (1.3-1.7) in head length; spine of second dorsal fin 2.5 (2.2-2.8) and first dorsal ray longest, 1.5 (1.4-1.65) in head length; first anal spine 4.65 (3.9-6.3) in second spine; second anal spine 3.0 (2.4-3.1) and longest anal ray (first) 1.7 in head length; pectoral fin reaching over base of 4th anal-fin ray, 3.8 (3.6-4.1) in SL; pelvic fin reaching base of second anal-fin spine, 4.05 (3.9-4.2) in SL; pelvic spine 2.3 (2.0-2.45) in head length and 1.4 (1.35-1.5) in pelvic fin length; distance from snout to first dorsal fin 2.2 (2.2-2.3), to second dorsal spine 1.7 (1.6-1.7), to pelvic fin origin 2.5 (2.6-2.65) and to anal-fin origin 1.6 (1.7), all in SL; caudal peduncle relatively slender, the depth 2.2 (2.0-2.9) in its length, the length 3.55 (3.3-4.0) in SL; distance from anus to anal-fin origin 7.5 (6.5-8.5) in distance from pelvic insertion to anal-fin origin, and the latter distance 4.4 (4.1-4.35) in SL.

Colour of holotype in alcohol: body pale; faded dark brown pigment on edges of predorsal scales, and on scales along dorsal fin bases and dorsal surface of caudal peduncle; irregular series of faint dark brown dots across caudal-fin base, extending anteriorly a distance of about 3 scales along middle of caudal peduncle; distal part of second dorsal and anal fins with faint dark dots; peritoneum with dense blackish dots of various sizes; intestine pale.

Colour of holotype in life: see Diagnosis.

DISTRIBUTION: Red Sea and the Maldive Islands.

REMARKS: *Apogon erythrosoma* is one of a complex of 3 similar Red Sea species (the other species are *A. campbelli* and *coccineus*) that were previously confused under the name *coccineus*. See Tables 1-2 for meristic differences for these species, and Fig. 1 for differences in the configuration of the anterior nostril and the skin flap of the first supraorbital pore. In addition, *A. erythrosoma* usually has a longer second dorsal spine (spine length 1.6-2.4 in head length in the other two species).

Data on the holotype of *Apogon doryssa* (Jordan & Seale, 1906) from Western Samoa (USNM 51812), provided by David G. Smith, indicate that it is a similar but probably different species. Unfortunately, the second dorsal spine of the holotype of *doryssa* is damaged, but it has only one developed gill-raker on the upper limb of the first gill arch (2 rakers in *erythrosoma*). Some of the *coccineus* reported by Winterbottom et al. (1989: 29, Fig. 158) may be this species, but their range of gill-rakers implies that more than one species may be present in their material.

Our Red Sea material was collected on the outer reef at 5-22 m.

ETYMOLOGY: The name *erythrosoma*, from the Greek *erythros* (red) and *soma* (body), refers to the reddish colour of this species. The name is considered a noun in apposition.

Apogon exostigma
Plate 1H

Amia exostigma Jordan & Starks in Jordan & Seale, 1906: 238, Fig. 31 (Apia, Western Samoa; holotype, USNM 51732).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13; lateral-line scales 24 + 4-6; median predorsal scales 5; scales around caudal peduncle 12; total gill-rakers 4-5 + 13-14; developed rakers 2 + 8-12; ceratobranchial rakers 8-9 (usually 8). Suborbital bones, and preopercle edge and ridge serrate. Body depth 2.95-3.5 and head length 2.4-2.6 in SL; snout length 3.8-4.9, eye diameter 2.9-3.2, interorbital width 6.3-6.7, and upper-jaw length 2.4-2.5, all in head length; caudal-peduncle depth 1.6-2.05 in its length, and peduncle length 3.5-4.0 in SL. Largest specimen, 83.5 mm.

Colour in alcohol: body and head pale brown, with a dark brown mid-lateral stripe from tip of snout to caudal peduncle, usually tapering out about 3 scales before a small caudal spot placed just above tube of lateral line; spot diameter 4.5-8.4 in peduncle depth; leading edge of first dorsal fin blackish; rest of fin, as well as second dorsal, anal and caudal fins dusky; second dorsal and anal fins with faint dark basal stripe; upper and lower edges of caudal fin blackish; leading edge of pelvic fins dusky; peritoneum speckled with small blackish spots; intestine pale.

Colour in life: tan to light grey with iridescence; the mid-lateral black stripe edged in white (silvery where passing through eye); first dorsal fin with dark brown to blackish narrow leading edge; pelvic fin with white leading edge. This species was photographed by

Randall (1995) and Kuiter (1998, fish with caudal spot) in Oman and the Maldive Islands, respectively.

DISTRIBUTION: Red Sea, Oman, Maldives to Western Samoa.

REMARKS: The colour pattern of *Apogon exostigma* is similar to that of *A. fraenatus* and *A. kallopterus*. All 3 species are members of the subgenus *Pristiapogon*, for which the serrate edges of the preopercle and suborbital bones are diagnostic features (Fraser & Lachner, 1985). The majority of Red Sea specimens of these species that we examined in various collections were identified as *A. fraenatus*. *A. exostigma* was first reported from the Red Sea by Randall (1983). It is distinct from *fraenatus* in usually having 13 instead of 14 pectoral rays, and its dark caudal spot is smaller (4.5-8.4 in peduncle depth) and positioned higher in relation to the lateral line (generally the ventral edge of the dark spot rests on the lateral line, whereas the spot diameter of *fraenatus* is 2.3-3.3 in peduncle depth and the spot is centred on the lateral line at the base of the caudal fin). Small *kallopterus* may also be confused with *exostigma*. The former has a larger caudal spot (3.8-4.0 in peduncle depth), and its dark stripe does not taper as much posteriorly on the body.

MATERIAL EXAMINED: 26 specimens, 26.9-83.5 mm. Gulf of Aqaba, Egypt, El Hamira, BPBM 30906, 2: 47-59 mm; Nuweiba, TAU P.7563, 15: 26.9-83.5 mm; Sharm el Moya, BPBM 18198, 42.5 mm. Sudan, Towartit Reef, BPBM 27428, 2: 38-53 mm; Suakin Harbour, BPBM 19737, 39 mm. Eritrea, Entedebir, HUJ 11911, 5: 46.2-72.1 mm (misidentified by Clark et al. (1968) as *A. fraenatus*).

Apogon fleurieu

Plate 1I, J

Ostorhinchus fleurieu Lacepède, 1801: Pl. 32, Fig. 2; 1802: 23 (Pacific Ocean; described from a drawing).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13-15; lateral-line scales 24 + 4-5; median predorsal scales 5; total gill-rakers 5-7 + 15-17 = 20-23; developed rakers 3-4 + 14-15; ceratobranchial rakers 10-11. Preopercle ridge smooth, the rear edge and most of ventral edge serrate. Body depth 2.5-2.9 and head length 2.4-2.6 in SL; snout length 4.7-5.35, eye diameter 2.6-3.0, interorbital width 4.4-4.85, and upper-jaw length 1.9-2.1, all in head length; caudal-peduncle depth 1.3-1.7 in its length, and peduncle length 4.0-4.7 in SL. Largest specimen, 102 mm; smallest mature male and female, 70.1 and 65.8 mm, respectively.

Colour in alcohol: body pale brown to brown, with a broad dark brown bar on rear of caudal peduncle; bar somewhat diffuse ventrally, its upper and lower edges sometimes slightly rounded, but never expanded sideways; juveniles with large caudal spot, 1.5-1.7 in peduncle depth; dark stripe from tip of snout to opercle, fading out a short distance behind eye; series of dark spots along lateral line, one on underside of each scale, usually decreasing posteriorly in size and intensity; dorsal fins pale to dusky, sometimes with darker leading edge; anal and pelvic fins with dusky leading edge; anal fin with series of dark dashes along base; gill chamber, gill-rakers and arches dark; peritoneum with small blackish spots; intestine dark brown to black.

Colour in life: coppery with iridescence, becoming golden on side of body and postorbital head; edges of blackish stripe on head bright blue; bright blue line on side of maxilla. Randall (1995) provided an underwater photograph of subadult *fleurieu* from Oman.

DISTRIBUTION: Red Sea and east coast of Africa south to Durban, also known from Seychelles, Persian Gulf, India and Sri Lanka, Andaman Sea, Indonesia, Malaysia, Hong Kong and Philippines (Randall et al., 1990b).

REMARKS: The dark spots on the lateral line and along the anal-fin base tend to disappear after a long period in preservative. The large caudal spot of the juvenile is gradually transformed, starting at about 45 mm, into the dark bar of the adult. The upper part of the gill chamber and the bases of the gill-rakers of the upper limb darken at about 35-40 mm. The dark pigment spreads ventrally and along rakers with growth.

Lacepède (1802: 24) based his description of *Ostorhinchus fleurieu* on a drawing by Commerson (published in Lacepède 1801: Pl. 32, Fig. 2). Because no teeth are apparent on the drawing, Lacepède assumed that they were fused to form dental plates like those of scarids, diodontids and tetraodontids. This led Whitley (1959) to regard *fleurieu* as an oplegnathid. Smith (1961: 399), however, decided that the drawing is an apogonid and recognised *fleurieu* as a valid species. Fraser (1972) wrote that the description of *fleurieu* does not agree with that of any apogonid and suggested that it be regarded as an unidentifiable taxon. Gon (1987a) concluded that Lacepède's figure is the apogonid now known as *Apogon fleurieu*, but he placed *A. aureus* (Lacepède) in the synonymy. Randall et al. (1990b) showed that *aureus* is a valid species very similar to *fleurieu*. It differs from *fleurieu* in having 22-27 total gill-rakers, and the dorsal and ventral ends of the dark caudal peduncle bar are wider than the middle, thus giving it the shape of an hourglass.

We do not agree with the suggestion of Eschmeyer et al. (1998) that the neotype designation of *Apogon fleurieu* by Gon (1987a), which was regarded as invalid by Randall et al. (1990b), be accepted. The decision by Randall et al. served to maintain the long-accepted name of *aureus* for that species; and to reverse this decision would only cause nomenclatural instability.

Most Red Sea workers followed Smith (1961) in using *A. fleurieu* for this species (Dor 1984). The name *aureus*, as used by Klunzinger (1884) for *annularis* of Klunzinger (1870), by Borsieri (1904), and by Khalaf and Disi (1997) refers to *fleurieu* (see also Remarks for

annularis above). Although both *aureus* and *fleurieu* occur in the Indo-west Pacific region (the former does not occur in the Red Sea), they overlap along the east coast of Africa, Seychelles, Sri Lanka, Indonesia, Philippines and Hong Kong. They were collected together at one station only in Sri Lanka (Randall et al., 1990b).

MATERIAL EXAMINED: 17 specimens, 33.4-102 mm. Red Sea, RUSI 3170, 9: 33.4-58.6 mm. Gulf of Aqaba, Eilat, BPBM 31874, 102 mm; RUSI 27672, 2: 35.7-43.5 mm; Nuweiba, BPBM 19811, 96 mm; HUJ 9407, 4: 65.8-72 mm.

Apogon fraenatus
Plate 2A

Apogon fraenatus Valenciennes, 1832: 57, Pl. 4, Fig. 4 (New Guinea; lectotype, MNHN 8709).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13-15; lateral-line scales 25 + 3-5; median predorsal scales 4-5 (rarely 4); circumpeduncular scales 12; total gill-rakers 4-5 + 12-14; developed rakers 2 + 8-10; ceratobranchial rakers 8. Edge of suborbitals serrate; preopercle edge and ridge serrate. Body depth 2.85-3.7 and head length 2.4-2.7 in SL; snout length 3.7-4.8, eye diameter 2.8-3.4, interorbital width 5.7-6.4 and upper-jaw length 2.1-2.3, all in head length; caudal-peduncle depth 1.7-2.1 in caudal peduncle length and peduncle length 3.5-4.55 in SL; caudal fin slightly forked. Largest specimen, 88.9 mm; smallest mature male and female, 51.6 and 70 mm, respectively.

Colour in alcohol: Head and body pale with tapering mid-lateral black stripe from front of snout through eye to base of caudal fin where it ends in round dark brown spot varying in diameter from slightly smaller than pupil to about half caudal-peduncle depth (2.3-3.3 in peduncle depth); fins pale, except for blackish leading edge of first dorsal fin, blackish band at base of second dorsal and anal fins, and blackish upper and lower edges of caudal fin; peritoneum with dark spots of various sizes; intestine pale.

Colour in life: tan to light grey, the mid-lateral black stripe edged in white (silvery where passing through eye). Randall (1995) and Kuiter (1998) photographed this species in Oman and the Maldive Islands, respectively.

DISTRIBUTION: Northern Red Sea to Durban and east to central Pacific Line and Society Islands.

REMARKS: See Remarks for *A. exostigma* above for a comparison of *fraenatus* with *exostigma* and *kallopterus*. Klunzinger's (1870, 1884) colour description of *fraenatus* probably applies to more than one species (see Remarks for *kallopterus* below). Moreover, his statement (1884: 22) that these features agree with "most" of his specimens implies that he probably had more than one species identified as *fraenatus*. Ben-Tuvia and Steinitz (1952) were the first to clearly report *fraenatus* from the Red Sea from two specimens (HUJ 5753) collected by Ben-Tuvia in Eilat, 1949. Smith (1961) quoted Klausewitz (1959) who reported a specimen of *fraenatus* from Ghardaqa. However, the fish illustrated by Klausewitz (1959: Fig. 5), with a small caudal spot clearly above the mid-lateral stripe, is *exostigma*. We examined the specimens of *fraenatus* (HUJ 11911) reported by Clark et al. (1968) from Entedebir, Eritrea, and they are also *exostigma*.

Apogon fraenatus is common on shallow coral reefs.

MATERIAL EXAMINED: 14 specimens, 35.0-88.9 mm. Gulf of Aqaba (Israel and Egypt), Eilat, HUJ 5753, 2: 85.2-88.9 mm; Taba, TAU P.9235, 80 mm; Nuweiba, HUJ 9408, 9: 47.8-73.4 mm. Egypt, southern end of Sinai Peninsula, Ras Muhammad, BPBM 18354, 2: 35-37 mm.

Apogon guamensis
Fig. 6, Plate 2B

Apogon guamensis Valenciennes, 1832: 54 (Guam, Mariana Islands; syntypes, MNHN 8767).

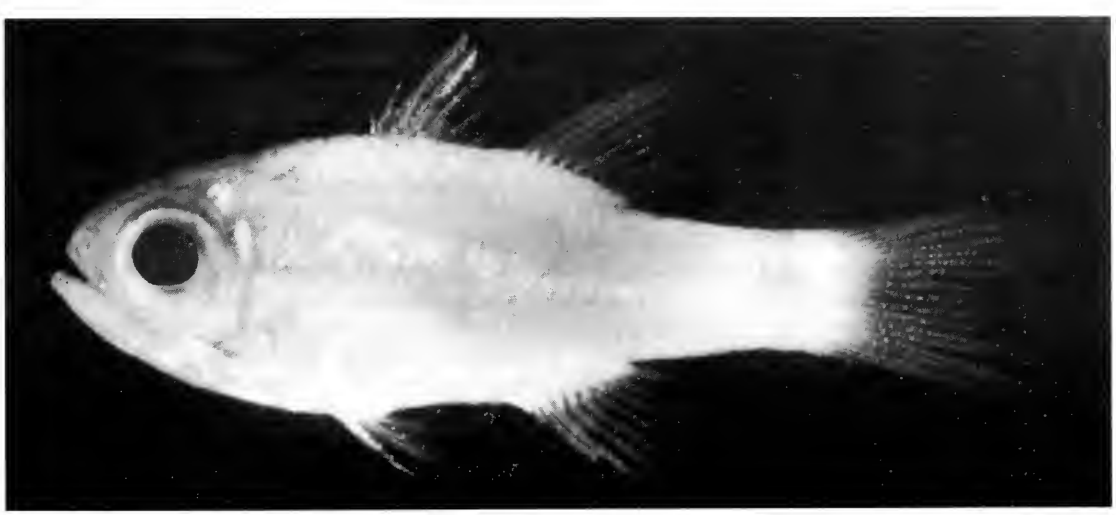

Figure 6. *Apogon guamensis*, 24 mm SL, juvenile, BPBM 30388, Saudi Arabia, Red Sea (JER).

Apogon nubilus Garman, 1903: 229, Pl. 1, Fig. 1 (Suva, Fiji; holotype, MCZ 28315).
Apogon spongicolus Smith, 1965: 529, Fig. 1 (Eritrea; holotype, RUSI 354).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 12-13 (usually 13); lateral-line scales 24 + 3; median predorsal scales 3-4; total gill-rakers 6-9 + 18-20 = 25-28; developed rakers 5-7 + 17-19 = 23-26; ceratobranchial rakers 11-12. Preopercle ridge smooth, the edge serrate. Body depth 2.4-2.5 and head length 2.3-2.5 in SL; snout length 5.6-6.4, eye diameter 2.4-2.6, interorbital width 3.9-4.1, and upper-jaw length 2.0-2.1, all in head length; caudal-peduncle depth 1.2-1.5 in its length, and peduncle length 3.9-4.8 in SL. Largest specimen, 72.1 mm; smallest mature female, 58 mm.

Colour in alcohol: body pale brown with round blackish spot posteriorly on side of caudal peduncle which may extend diffusely to form a bar (but never well-defined black saddle); side of body below dorsal fins often with about 4 pale bars slightly narrower than brown interspaces; an oblique, slightly tapering, dark brown line from ventral edge of orbit to corner of preopercle ridge; upper and lower edges of caudal fin not darker than rest of fin; peritoneum with scattered small blackish spots; intestine dark brown. Juveniles with numerous very small dusky spots with white dot in centre.

Colour in life: purplish to reddish brown dorsally, shading to silvery with iridescence on sides and ventrally; blackish spot on side of caudal peduncle and oblique black line on cheek.

DISTRIBUTION: Red Sea and western Indian Ocean to the central Pacific, Tonga, Samoa, Phoenix and Marshall Islands (Fraser et al., 1999).

REMARKS: In juveniles the caudal spot is more or less midlateral on the caudal peduncle (Fig. 6), migrating dorsally with growth. In preserved material, the oblique cheek mark and caudal spot may be absent or very faint.

Previously known as *Apogon nubilus* Garman (Dor 1984), this species was, for a long time, the only one of the *bandanensis* group known from the Red Sea. Gon (1986a) reported another species, i.e. *savayensis* (= *zebrinus*), most likely confused with *guamensis* or misidentified as *bandanensis* in earlier papers (see Dor 1984; see also Remarks for *zebrinus* below). One of the two specimens of *bandanensis* (MNHN 52-97) reported by Roux-Estève and Fourmanoir (1955) and Roux-Estève (1956) is *guamensis*, and the other is *zebrinus*. Smith (1965) described *spongicolus* from off Eritrea, but his specimens are juvenile *guamensis* (Fraser et al. 1999).

Klunzinger (1884) included his Red Sea *monochrous* (Klunzinger, 1870) in the synonymy of *bandanensis*. The first author identified 5 of Klunzinger's *monochrous* as *guamensis*; however, one specimen (SMF 1076) has no trace of the cheek mark or caudal spot, and it has 26 developed gill-rakers, which is within the range for *zebrinus*.

Southern Red Sea specimens were found in shallow protected waters with scattered, small coral heads and coral rubble. Juveniles occur in sponges (Smith, 1965).

MATERIAL EXAMINED: 15 specimens, 28.5-72.1 mm. Red Sea, SMF 1076, 72.1 mm. Egypt, Sinai Peninsula, Ras Muhammad, BPBM 18346, 33 mm; Al Quseir, SMNS 3528, 3: 69.0-71.6 mm; ZMB 7901, 65.3 mm (all 3 lots collected by Klunzinger). Saudi Arabia, Abu Latt Id., MNHN 1952-97, 58 mm. Eritrea, Dahlak Archipelago, TAU P.10375 5: 43-61 mm. Guam, MNHN 8767, 3: 28.5-55.6 mm (syntypes of *Apogon guamensis*).

Apogon gularis

Apogon gularis Fraser & Lachner, 1984: 632, Fig. 1 (Red Sea, off Yemen; holotype, USNM 225672).
Apogon smithvanizi Allen & Randall, 1994: 24, Fig. 1 (off Bahrain; holotype, WAM P.25988-001).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 14-15 (usually 14); lateral-line scales 24-25; median predorsal scales 5; total gill-rakers 5-7 + 16-19 = 23-26; developed rakers 4-5 + 16-19. Preopercle ridge smooth or weakly crenulate, the edge finely serrate. Anus in unusual forward position, just behind mid-ventral pelvic scales; urogenital papilla 2 scale rows anterior to first anal spine. Body depth 2.9-3.5 and head length 2.35-2.55 in SL; snout length 4.05-4.3, eye diameter 3.0-3.6, interorbital width 4.4-4.9, and upper-jaw length 1.9-2.2, all in head length; caudal-peduncle depth about half peduncle length, and peduncle length 3.6-3.95 in SL; caudal fin slightly forked. Largest specimen, 57.3 mm SL from Andaman Sea.

Colour in alcohol: body pale, with a narrow blackish stripe from front of snout to eye, sometimes continuing across operculum and onto body as a double line; another dusky narrow stripe below first dorsal-fin base sometimes present; fins pale; digestive tract and anus black.

Colour in life: similar to pattern in alcohol; body whitish with silver on ventral part and on side of head.

DISTRIBUTION: Southern Red Sea, Persian Gulf, Gulf of Oman, Andaman Sea, and the Philippines.

REMARKS: The forward position of the anus, just behind the pelvic fin origins, separates this species from all other apogonids. In other characters it fits well in the subgenus *Ostorhinchus* (= *Nectamia* of Fraser and Lachner, 1984).

Specimens have been collected by trawling in the depth range of 30-290 m.

Fraser (1998) concluded that *A. smithvanizi* is a junior synonym of *A. gularis*.

MATERIAL EXAMINED: Andaman Sea, off Burma, 290 m, BPBM 29204 (ex-USNM 225678), 5: 41-51 mm (paratypes of *A. gularis*).

Apogon heptastygma
Plate 2C

Apogon heptastygma Cuvier, 1828: 160 (Red Sea; syntypes, ZMB 65, lost).
Apogon enneastigma Rüppell, 1838: 87, Pl. 22, Fig. 3 (Massawa, Eritrea; lectotype, SMF 1065).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 14; lateral-line scales 24 + 3; median predorsal scales 3; total gill-rakers 3-5 + 12; developed rakers 1 + 7-8; ceratobranchial rakers 7. Preopercle ridge smooth; rear preopercle edge and angle finely serrate, the ventral edge smooth. Body depth 2.5-2.8 and head length 2.2-2.45 in SL; snout length 4.05-5.3, eye diameter 2.6-3.4, interorbital width 4.9-6.2, and upper-jaw length 2.1-2.3, all in head length; caudal-peduncle depth 1.4-1.6 in its length, and peduncle length 3.8-4.6 in SL. Largest specimen, 51.2 mm; smallest mature male and female, 40 and 34 mm, respectively.

Colour in alcohol: uniformly pale brown; small dark brown spot on origin of first dorsal fin and at origin and rear base of second dorsal; larger spot on side of body between lateral line and pectoral-fin base; caudal spot minute, 8.4-10.1 in caudal-peduncle depth; fins usually pale, but anterior part of first dorsal sometimes dusky; second dorsal sometimes with faint basal stripe; peritoneum with minute dark spots; intestine pale.

Juveniles smaller than 21 mm have the body pale, with scattered minute blackish spots, small caudal spot and usually dark spot between lateral line and pectoral-fin base; spots at dorsal-fin bases are diffuse aggregates of several small melanophores; second and third dorsal spines, and fin membrane between these spines and between third and fourth spines black.

Colour in life similar, but body with pinkish hue; leading edge of first dorsal fin dusky to brown, edged in white posteriorly; leading edge of pelvic fin white.

DISTRIBUTION: Endemic to the Red Sea.

REMARKS: Some of the dark spots described above are sometimes missing in preserved material.

There seems to be some confusion with regard to type specimens of *Apogon heptastygma*. Dor (1984: 113) stated "Type: MNHN, apparently lost." Bauchot and Desoutter (1986: 93) listed it as a species that either was not found or was never deposited at MNHN. Eschmeyer et al. (1998: 721) listed 1 syntype (ZMB 65), implying that the specimen is at ZMB. We have established that lot ZMB 65 was apparently lost during the Second World War. The listing in Eschmeyer et al. (1998) is probably based on the original entry for this lot in the ZMB general catalog book (P. Bartsch, ZMB, pers. comm.) Moreover, Cuvier (1828: 160) did not indicate the number of specimens his description was based on. ZMB catalog entries do not state the number of specimens deposited and whether any were donated to MNHN.

Apogon heptastygma is found in shallow, sheltered areas to about 10 m. Rarely seen during the day.

MATERIAL EXAMINED: 27 specimens, 20.3-51.2 mm. Egypt, Tiran Island, TAU P. 8763, 31.2 mm; TAU P. 8764, 3: 20.3-47.9 mm; TAU P. 8765, 5: 28.3-51.1 mm. Sudan, Suakin Harbour, BPBM 17902, 2: 26-32 mm. Eritrea, Sheikh el Abu, HUJ 6237, 39.9 mm; Massawa, SMF 1065, 36.2 mm (lectotype of *enneastigma*); SMF 12130, 2: 32.4-36.1 mm (paralectotypes of *enneastigma*); Sheikh el Abu, BPBM 32719, 12: 23-48 mm.

Apogon isus
Plate 2D

Apogon isus Randall & Böhlke, 1981: 136, Pl. I D (north of Port Sudan, Red Sea; holotype, BPBM 17895).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 12; lateral-line scales 24; median median predorsal scales 4; circumpeduncular scales 16; total gill-rakers 5-6 + 14-16. Preopercle ridge smooth; posterior preopercle edge finely serrate, the ventral margin smooth and membranous. Jaws, vomer and palatines with villiform teeth. Body depth 2.9-3.2 and head length 2.3-2.4 in SL; snout length 3.2-4.1, eye diameter 3.2-3.6, interorbital space slightly concave, 5.8-6.7, and upper-jaw length 1.9-2.05, all in head length; caudal peduncle long and slender, its length 3.7-3.9 in SL, its depth 1.8-2.1 in peduncle length; caudal fin forked with rounded lobes. Largest specimen, 66 mm SL.

Colour in alcohol: dusky dorsally, pale ventrally, with blackish stripe on side of snout and across operculum from behind centre of eye; black spot larger than pupil at rear base of second dorsal fin, with small pale spot immediately behind black spot; peritoneum pale; intestine black.

Colour when fresh: dusky red dorsally, shading to pale red ventrally; blackish stripe on head and black spot at rear base of second dorsal fin, followed by small white spot; fin spines and rays red, the membranes transparent except for broad outer red zone on first dorsal fin.

DISTRIBUTION: Endemic to Red Sea and Gulf of Aden.

REMARKS: This species is similar in colour and morphology to *A. evermanni* Jordan and Snyder, 1904 of the Indo-Pacific region (but not the Red Sea) and western Atlantic, differing principally in having the lateral-line scales equal in size to those of the rest of the body (in *evermanni* the body scales are much smaller than the lateral-line scales).

A. isus is usually found in caves at depths of 9-45 m.

MATERIAL EXAMINED: Holotype and 21 paratypes from Red Sea and Gulf of Aden (Randall & Böhlke, 1981).

Apogon kallopterus
Plate 2E

Apogon kallopterus Bleeker, 1856a: 33 (Sulawesi, Indonesia; holotype, RMNH 5592).
Apogon snyderi Jordan & Evermann, 1903: 180 (Honolulu, Hawaii; holotype, USNM 50640).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 12-13 (usually 13); lateral-line scales 24-25 + 4-5 = 28-29 (usually 29); median predorsal scales 4-5; scales around caudal peduncle 12-14; total gill-rakers 4-5 + 13-14; developed rakers 2-3 + 8-11 = 10-13; ceratobranchial rakers 8. Suborbital bones, and preopercle edge and ridge serrate. Body depth 2.65-2.95 and head length 2.3-2.5 in SL; snout length 3.9-4.3, eye diameter 2.9-3.2, interorbital width 5.1-5.7, and upper-jaw length 2.2-2.5, all in head length; caudal-peduncle depth 1.6-1.65 in its length, and the peduncle length 3.8-4.1 in SL. Largest specimen, 112 mm; smallest mature male and female, 37.2 and 41.3 mm, respectively.

Colour in alcohol: variable; body pale brown to brown with dark brown stripe from tip of snout to caudal peduncle, becoming somewhat obscure in front of caudal spot; stripe width nearly uniform throughout its length; stripe sometimes with 1-2 more intense, widened regions on body and caudal peduncle; dark brown saddle under second dorsal fin and on dorsal part of caudal peduncle sometimes present; caudal spot well defined to diffuse, 3.8-4.0 in caudal-peduncle depth; caudal spot and lateral stripe on dorsal half of caudal peduncle, their ventral margin touching lateral line; area above caudal spot dark brown, sometimes expanding ventrally to encircle caudal-fin base, partially masking caudal spot; leading edge of first dorsal fin dark brown; remainder of fin, as well as second dorsal fin, dusky; anal fin pale to dusky; second dorsal and anal fins with a basal stripe, that of the latter usually more distinct; caudal fin pale to dusky, with darker upper and lower margins; leading edge of pelvic fins dusky to brown; peritoneum with blackish dots; intestine pale.

Colour in life: similar to preserved colour; body pale brown with dark scale edges; intensity of stripe and caudal spot variable; stripe may be edged in white; leading edge of first dorsal fin usually pale yellow, sometimes edged in white posteriorly; leading edge of pelvic fin usually white. Kuiter (1998) photographed this species in the Maldives.

DISTRIBUTION: Northern Red Sea to Algoa Bay, South Africa, and east to the Hawaiian and Pitcairn Islands (Fraser & Lachner, 1985: Fig.5).

REMARKS: This species is frequently confused with *Apogon fraenatus* and *exostigma*. Fraser and Lachner (1985) used the number of scales around the caudal peduncle as a key character to separate *kallopterus* (usually 14) from *fraenatus* and *exostigma* (usually 12). However, most of our *kallopterus* specimens have 12 circumpeduncular scales. See Remarks for *A. exostigma* for comparisons of these three species.

Klunzinger's (1870) colour description of *fraenatus* includes features of *kallopterus*, e.g. a dark ring at caudal-fin base and a large dark spot under the second dorsal fin. Klunzinger (1884) provided another clue, describing the caudal spot as above the lateral line. The first author examined several of Klunzinger's Red Sea specimens (SMNS 1872, 3477), all of which are *kallopterus*.

Apogon kallopterus is a common coral-reef species.

MATERIAL EXAMINED: 24 specimens, 37.2-112.3 mm. Gulf of Aqaba, BPBM 13903, 86 mm; TAU P.11406, 57.8 mm; Eilat, ZSM 23275, 2: 100-100.7 mm. Egypt, south end of Sinai Peninsula, Marsa el At, TAU P.4422, 3(of 4): 61.4-85.0 mm; Marsa Bareka, TAU P.11215, 7(of 15): 37.2-44.6 mm; Tiran Island, TAU P.8682, 4: 52.4-80.5 mm; Al Quseir, SMNS 1872, 2: 96.9-112.3 mm; SMNS 3477, 3: 93.5-105.3 mm (both SMNS lots collected by Klunzinger). Saudi Arabia, Khor Obhur, ANSP 163227, 67.2 mm.

Apogon leptacanthus
Plate 2F

Apogon leptacanthus Bleeker, 1856b: 204 (Ternate, Indonesia; syntype, RMNH 5570).

DIAGNOSIS (measurements, except body width, after Fraser & Lachner, 1985): Dorsal fin VI + I,9; anal fin II,9; pectoral-fin rays 12-13; lateral-line scales 24; median predorsal scales 6; total gill-rakers 6-9 + 21-24; developed rakers 5-7 + 21-24. Preopercle ridge smooth, the edge serrate. Body deep, the depth 1.95-2.85 in SL, and very compressed, the width 2.8-3.0 in depth; head length 2.5-2.8 in SL; snout length 11.1-14.3 in SL; eye large, the diameter 6.65-8.3 in SL; interorbital width 10-11.1 in SL; upper-jaw length 5.55-6.25 in SL; caudal-peduncle length 4.15-5.9 in SL; caudal-peduncle depth 5.9-6.7 in SL; second and third dorsal spines elongate, the second longest, 1.5-4.1 in SL; caudal fin forked, the lobes pointed. Largest specimen, 45 mm SL, from Western Samoa.

Colour in alcohol: body pale with dusky line along base of dorsal fins and mid-dorsally on caudal peduncle; peritoneum with small dark spots; digestive tract black.

Colour in life: translucent grey, silvery over lower head and body, with vertical yellow and blue lines on postorbital head and anterior body, and few scattered small blue spots on body; iridescent pale blue line at base of dorsal fins and dorsally on caudal peduncle. Kuiter (1998) photographed this species in the Maldive Islands.

DISTRIBUTION: Red Sea to Mozambique Island, Seychelles, Maldives, and Chagos to the Marshall and Samoa Islands.

REMARKS: *Apogon leptacanthus* is one of 4 species in

the subgenus *Zoramia* revised by Fraser and Lachner (1985). Randall (1983) was the first to report it from the Red Sea.

This species is generally found in aggregations, at 2-12 m, hiding during the day among branches of coral. At night, when it is actively feeding on zooplankton, it loses the blue and yellow markings.

MATERIAL EXAMINED: 17 specimens, 24-39 mm. Sudan, Port Sudan Harbour, BPBM 20396, 7: 34-36 mm. Saudi Arabia, 85 km north of Jeddah, BPBM 21498, 8: 24-35 mm; Yanbu, BPBM 30571, 2: 38-39 mm.

Apogon multitaeniatus
Plate 2G

Apogon multitaeniatus Cuvier, 1828: 159 (Red Sea; holotype, MNHN, lost).

DIAGNOSIS: Dorsal fin VIII (sometimes last spine not visible externally) + I,9; anal fin II,8; pectoral-fin rays 13-14 (usually 14); lateral-line scales 36-40; median predorsal scales 3-6; total gill-rakers 5-6 + 14-16; developed rakers 2-3 + 10-14; ceratobranchial rakers 9. Preopercle ridge smooth, the edge serrate. Body depth 2.6-2.8, and head length 2.4-2.8 in SL; snout length 4.0-4.6, eye diameter 3.2-3.7, and interorbital width 4.35-5.5, all in head length; caudal-peduncle depth 1.6-1.8 in its length, and peduncle length 3.6-4.3 in SL. Largest specimen, 125 mm; smallest mature male and female, 85 mm.

Colour in alcohol: body generally brown with numerous narrow darker stripes running along scale rows; first dorsal fin dark brown; second dorsal, anal, caudal and pelvic fins pale to dusky, with darker edge; pectoral fin pale, but its base may be dark brown; peritoneum with dark spots of various sizes; intestine dark brown. Juveniles and young adults with a wide dark brown bar around caudal-fin base; dark spot at rear end of second dorsal-fin base extends about 3 scale rows below fin base; dark spot at rear end of anal-fin base extends dorsally about 2.5 scale rows; distinct dark spot around base of anterior 1-3 dorsal-fin spines.

Colour in life: (based on photograph in Randall, 1983: 64) generally red with darker, brownish red narrow stripes; area of body above lateral line and across caudal-fin base blackish; first dorsal fin black; all other fins red; dorsal and anal fins with pale base; pale pink stripe on distal third of pelvic fin.

DISTRIBUTION: Known only from the Red Sea and the Gulf of Aden.

REMARKS: The juvenile's dark spots under and above second dorsal and anal fin base, respectively, may remain in adults as areas slightly darker than the rest of the body.

Unable to find any differences between his Red Sea specimens and the description of *Apogon noordzieki* (Bleeker, 1859), Klunzinger (1884) erroneously included the latter species in the synonymy of *A. multitaeniatus*. He also incorrectly identified Day's (1875: 57, Pl. 16, Fig. 1) *multitaeniatus* (= *kalosoma*) as this species. The type of *multitaeniatus* is apparently lost (Bauchot & Desoutter, 1986). Gon (1995) revised the subgenus *Lepidamia* comprising 4 large Indo-Pacific species. *A. natalensis* and *A. omanensis* differ from *multitaeniatus* in having usually 15-17 pectoral-fin rays, 8-11 developed gill-rakers, and 39-48 lateral-line scales.

Apogon multitaeniatus is a secretive species, living in dark holes and crevices of the coral reef, at 0-4 m, and is rarely seen by divers.

MATERIAL EXAMINED: 16 specimens, 22.5-125 mm. Red Sea, BMNH 1871.7.15.29, 116.5 mm (coll. Klunzinger); NMW; 35009-010, 2: 115.8-121.8 mm (coll. Klunzinger). Egypt, Gulf of Suez, Ras Garra, TAU 9261, 43.5 mm; Tiran Island, TAU 8683, 4: 22.5-47.9 mm; TAU 8692, 71.2 mm; Al Quseir, SMNS 2058, 2: 122.8-125.0 mm (coll. Klunzinger); SMNS 3459, 3: 115.1-124.7 mm (coll. Klunzinger). Eritrea, Museri, TAU 4433, 2: 66.5-70.4 mm.

Apogon nigrofasciatus
Plate 2H, I

Apogon nigrofasciatus Lachner, 1953: 466, Fig. 81 (Bikini, Marshall Ids; holotype, USNM 142230).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13-15; lateral-line scales 24 + 3-4 (usually 28); median predorsal scales 3-4 (usually 4); total gill-rakers 5-7 + 15-18 = 20-24; developed rakers 3-4 + 12-16 = 15-19; ceratobranchial rakers 10. Preopercle ridge smooth, the edge serrate. Body depth 2.7-2.9 and head length 2.5-2.7 in SL; snout length 4.2-5.3, eye diameter 2.6-2.8, interorbital width 5.5-6.1, and upper-jaw length 1.8-2.0, all in head length; caudal-peduncle depth 1.6 in its length, and peduncle length 3.7-4.0 in SL. Largest specimen, 68 mm; smallest mature male and female, 39.5 and 42.8 mm, respectively.

Colour in alcohol: body pale brown, with 5 dark brown stripes, the middle 3 stripes equal to or wider than pale interspaces; caudal spot indistinct (a widening of the mid-lateral stripe at caudal-fin base); ventral stripe continuing onto anal fin as basal stripe; second dorsal fin also with dark brown basal stripe; anterior part of first dorsal fin sometimes dusky; upper limb of gill arches and / or bases of its gill-rakers frequently with dark pigment; peritoneum with scattered small, dark spots; intestine dark brown.

Colour in life: stripes dark brown to black, suffused with red (often lower stripes mainly red), alternating with narrow white or pale yellow stripes; spines and rays of fins pale red.

DISTRIBUTION: Red Sea and east coast of Africa to the islands of Oceania, except not known from the Hawaiian Islands, Pitcairn Group and Easter Island.

REMARKS: In the Red Sea, this common species was confused by early authors with *Apogon cookii* (see Remarks of *cookii* for differences). *A. nigrofasciatus* was reported from the Red Sea by Randall and Lachner (1986), but Goren and Dor (1994) overlooked this record. Smith's (1961) Red Sea specimen of *"Ostorhynchus angustatus"* (HUJ 12091), examined by us, is *A. nigrofasciatus*; consequently, the inclusion of the Red Sea in the range of *A. angustatus* in Randall et al. (1990a) is incorrect. The latter species differs from *nigrofasciatus* in having 11-14 developed gill-rakers of which 2 (rarely 3) are on the upper limb. The *Apogon novemfasciatus* reported by Ben-Tuvia and Steinitz (1952), Roux-Estève and Fourmanoir (1955) and Roux-Estève (1956) are also *nigrofasciatus*. The 3 main body stripes of *Apogon novemfasciatus* extend well onto the caudal fin, with the upper and lower stripes bending toward the middle stripe.

A. nigrofasciatus is a common coral-reef species reported from depths of 1-45 m (but usually below 8 m).

MATERIAL EXAMINED: 41 specimens, 20.5-68.0 mm. Gulf of Aqaba (Jordan, Israel and Egypt), Aqaba, MNHN 1977-815, 62.8 mm; MNHN 1977-816, 52.9 mm; SMF 16165, 3: 42.0-58.6 mm; SMF 16166, 20.5 mm; SMF 16167, 27.2 mm; SMF 16168, 29.7 mm; Eilat, BPBM 18370, 3: 52-68 mm; El Hamira, BPBM 13397, 3: 35-55 mm; HUJ 6230, 3: 39.5-54.0 mm; Dahab, HUJ 5761, 7: 47.2-52.0 mm; TAU P.4503, 8: 42.8-59.4 mm. Egypt, Gulf of Suez, Ras Garra, TAU P.5698, 3: 54.8-55.5 mm; south end of the Sinai Peninsula, Sharm al Sheik, HUJ 12091, 48.6 mm. Saudi Arabia, Abu Latt, MNHN 1952-95, 50.3 mm. Eritrea, Dahlak Archipelago, TAU P.11139, 3: 51.0-56.6 mm; TAU P. 11141, 52.6 mm.

Apogon pharaonis
Fig. 7, Plate 2J

Apogon pharaonis Bellotti, 1874: 264 (Gulf of Suez, Red Sea; holotype, MSNM, lost).
Apogon suezii Sauvage, 1883: 156 (Gulf of Suez, Red Sea; holotype, MNHN A-5137).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 14-15 (usually 15); lateral-line scales 24 + 3; median predorsal scales 2; total gill-rakers 5-6 + 12-15; developed rakers 2-3 + 9-11; ceratobranchial rakers 8-9 (usually 8).

Preopercle ridge smooth, the edge serrate. Body depth 2.2-2.4 and head length 2.1-2.4 in SL; snout length 4.4-4.9, eye diameter 3.0-3.55, interorbital width 3.9-4.6, and upper-jaw length 1.8-2.2, all in head length; caudal-peduncle depth 1.2-1.3 in its length, and peduncle length 4.7-5.3 in SL. Largest specimen, 78 mm; smallest mature female, 33.9 mm.

Colour in alcohol: body pale brown to brown with 3 dark brown bars; first bar from anterior part of first dorsal base, containing large dark brown spot ringed in white above middle of pectoral fin (ocellus sometimes faint or, rarely, absent in adults); second bar between bases of second dorsal and anal fins, and extending basally onto both; third bar at caudal-fin base, masking slightly wider caudal spot; faint bars frequently present between main 3 bars; narrow oblique cheek mark present; leading edge of first dorsal fin dark brown, the remainder dusky; second dorsal and anal fins pale to dusky (except dark brown extension of second bar); caudal fin pale to dusky; pelvic fins brown on proximal part, becoming dark brown distally; peritoneum with dark spots of various sizes; intestine pale.

Colour in life: similar to preserved pattern; generally bronze dorsally to silvery ventrally.

DISTRIBUTION: Red Sea, Persian Gulf and western Indian Ocean.

REMARKS: The body and head of juveniles smaller

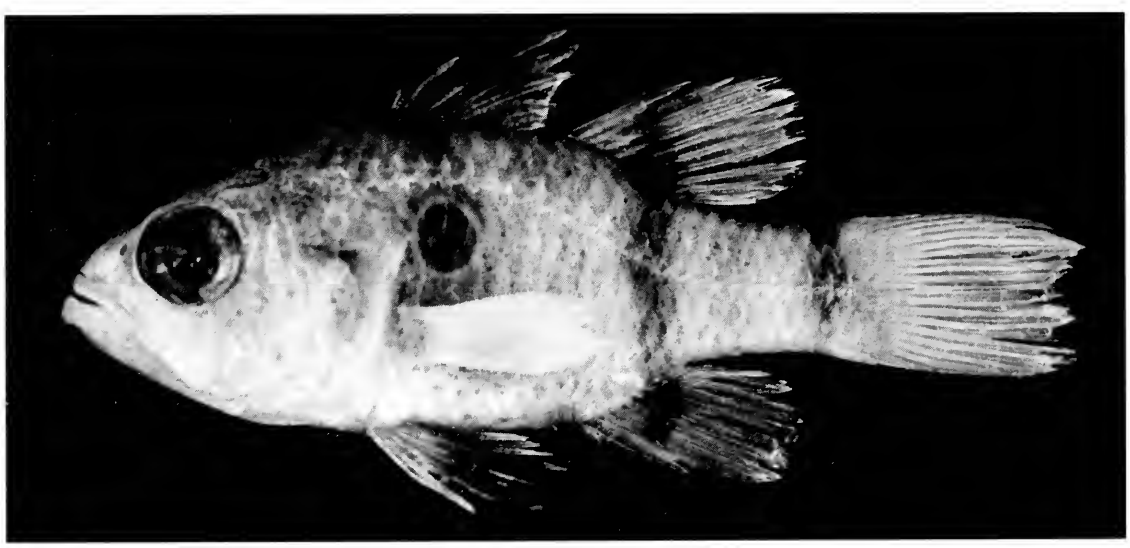

Figure 7. *Apogon pharaonis*, 34.9 mm SL, HUJ 11803, Gulf of Suez.

than 32 mm have large, stellate melanophores; the dorsal and anal fins of these juveniles are dusky to brown, except where the dark brown bars extend onto these fins.

Apogon pharaonis is similar to *pseudotaeniatus*, *taeniatus* and *timorensis*, all occurring in the Red Sea and western Indian Ocean. To our knowledge these four species have not been collected at the same station, but misidentifications may occur, especially with preserved material. *A. pseudotaeniatus* differs in lacking a bar on the caudal peduncle, in having a second body bar that does not extend onto the anal fin, 3 median predorsal scales, 9-11 developed rakers, a dark intestine, and in lacking a dark ocellus above the pectoral fin.

In *A. taeniatus* the second bar originates at the rear part of the second dorsal-fin base, usually fades out on the middle of the body and does not extend onto the second dorsal fin. In addition, *taeniatus* has a caudal spot, but no bar on the caudal-fin base, 5-6 narrow dusky stripes along the body, which are never present in *pharaonis*, and usually 3 median predorsal scales.

The colour pattern of *A. timorensis* is similar to that of *pharaonis*, but *timorensis* never has an ocellus between the lateral line and pectoral fin, and its bars are less distinct. In addition, *timorensis* has 8-9 developed rakers, with only one raker on the upper limb, usually 7 ceratobrancial gill-rakers, and usually 3 median predorsal scales.

Authors of recent papers on Red Sea fishes followed Smith (1961) in using *A. nigripinnis* Cuvier for this species. Smith (1961: 395), however, expressed some reservations, because he could not reconcile its colour pattern with Cuvier's type. He was also not sure about the status of *A. thurstoni* Day, another name used by previous authors for Red Sea specimens of this species (see synonymy of *A. nigripinnis* in Dor 1984). According to Gon (2000), *A. nigripinnis* (*thurstoni* is a synonym) is restricted to the eastern Indian and western Pacific oceans, and *A. pharaonis* occurs in the western Indian Ocean. Both species have the ocellus below the lateral line, but *nigripinnis* has fewer gill-rakers (15-17), longer pelvic fins (2.6-3.4 in SL), pelvic fin/spine ratio 1.7-2.2, and lacks the two wide dark bars below the dorsal fins (it frequently has up to 11 narrow dusky bars on the body). Randall's (1995: 158, Fig. 384) account of *A. nigripinnis* from the Persian Gulf is based on *A. pharaonis*.

Apogon pharaonis occurs on mangroves, seagrass beds and on silty reefs. It is the only Red Sea apogonid known to have migrated to the Mediterranean through the Suez Canal. Bellotti (1874) collected it in Suez, at the southern end of the Canal, five years after it was first opened. It was found 73 years later on the Mediterranean coast of Israel (Haas & Steinitz, 1947, as *A. taeniatus*), and Demetropoulos and Neocleous (1969) reported it (as *A. thurstoni*) from Cyprus. Recently, it was found on the coast of Turkey (Gucu et al. 1994, as *A. nigripinnis*).

MATERIAL EXAMINED: 15 specimens, 21.0-78.1 mm. Red Sea: Egypt, Suez, MNHN A-5137, 50.2 mm (holotype of *Apogon suezii*); Gulf of Suez, Ras Misalla, HUJ 11803, 6: 21.0-34.9 mm; HUJ 11810, 53.6 mm; Ras Sudar, HUJ 5764, 4: 30.5-54.8 mm; east of Deversoir, HUJ 5767. 55.8 mm. Mediterranean: Israel, Acre, HUJ 13584, 2: 75.4-78.1 mm.
Apogon nigripinnis: India, Pondicherry, MNHN 8694, syntype, 62.9 mm.
Apogon thurstoni: India, Madras, BMNH 1889.8.17.2, holotype, 54.2 mm.

Apogon pselion
Plate 3A

Apogon pselion Randall, Fraser & Lachner, 1990: 57, Figs. 8, 9 (El Hamira, Gulf of Aqaba; holotype, BPBM 21515).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13-14; lateral-line scales 24; median predorsal scales 4; total gill-rakers 5-6 + 14-16 (includes 2-3 upper and 0-1 lower-limb rudiments). Preopercle ridge smooth, the edge serrate. Body depth 2.8-3.4 and head length 2.45-2.6 in SL; snout length 3.85-4.3 in head length; eye large, its diameter 2.5-3.0 in head length; interorbital space flat to slightly convex, its width 4.55-5.4 in head length; upper-jaw length 1.9-2.05 in head length; caudal-peduncle depth 1.5-2.1 in peduncle length, and peduncle length 4.1-4.55 in SL; caudal fin forked. Largest specimen, 41.3 mm SL.

Colour in alcohol: body pale with black bar encircling posterior caudal peduncle and extending slightly onto base of caudal fin, the bar widest on mid-side of peduncle (bar width about half orbit diameter); faint dusky mid-lateral stripe on head and body; narrow dusky stripe from front of lower jaw through lower edge of eye to end of opercle; fins pale except for dusky stripe on second dorsal and anal fins near base; peritoneum pale to slightly dusky; digestive tract black.

Colour in life: body pale pinkish grey dorsally, iridescent bluish silver ventrally, with a mid-lateral brassy yellow stripe faintly edged in pale iridescent blue; black bar around posterior caudal peduncle; head with dusky golden yellow stripes separated by blue lines; median fins transparent bluish, their rays edged with pale salmon; second dorsal and anal fins with dusky pale orange band, edged in pale blue, near base.

DISTRIBUTION: Endemic to the Red Sea.

REMARKS: *Apogon pselion* might be confused with *Apogon fleurieu*, which has a similar black bar on the peduncle. However, *fleurieu* is a much larger fish; at a size as small as *pselion* it has a black spot instead of a black bar on the peduncle. Also *fleurieu* is deeper bodied (depth 2.5-2.9, compared to 2.8-3.4 for *pselion*), and it lacks the lateral stripe on the body.
Apogon pselion occurs on coral-reefs in 18-43 m.

MATERIAL EXAMINED: 59 specimens, 20.6-41.3 mm.

Gulf of Aqaba and Gulf of Suez, holotype and 51 paratypes as listed by Randall et al. (1990). Yemen, Zubayr Group, BPBM 35702, 7 (of 9): 26.0-28.4 mm.

Apogon pseudotaeniatus
Plate 3B, C

Apogon pseudotaeniatus Gon, 1986b: 11, Fig. 2 (Eilat, Gulf of Aqaba, Red Sea; holotype, BPBM 27395).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 15; lateral-line scales 24 + 4-5 (usually 28); median predorsal scales 3; total gill-rakers 4-5 + 13-14; developed rakers 2 + 7-9; ceratobranchial rakers 8. Body depth 2.3-2.5 and head length 2.2-2.4 in SL; snout length 4.3-4.6, eye diameter 3.25-3.8, interorbital width 4.8-5.4, upper-jaw length 2.1-2.35, third dorsal-fin spine 2.0-2.45, second anal-fin spine 2.6-2.8, and pelvic-fin spine 2.6-2.8, all in head length; caudal-peduncle depth 1.2-1.65 in its length, and peduncle length 4.3-4.8 in SL. Largest specimen, 87.2 mm.

Colour in alcohol: body pale brown, with dark brown bar originating under anterior part of each dorsal fin; bars usually fade out at level of pectoral fin; caudal spot small, 4.6-5.35 in peduncle depth; all fins, except pectorals, dusky (pelvics darkest); pectoral fins pale; oblique narrow cheek mark sometimes present; peritoneum with scattered minute dark spots; intestine brown.

Colour in life: juveniles semi-transparent and adults grey; in both, the bars extending down almost to ventral margin of body. Randall (1995) photographed this species in Oman.

DISTRIBUTION: Red Sea, Persian Gulf, Gulf of Oman and India.

REMARKS: The similarity of colour pattern to that of *A. taeniatus* and the overlap between the two species in most meristic and morphometric characters account for the frequent misidentifications of *pseudotaeniatus* as either *taeniatus* or its junior synonym *bifasciatus* (Rüppell, 1838). The differences between these two species can be summarised as follows: in *taeniatus* the dark bar under the second dorsal fin is under the posterior part of this fin; frequently it is joined by a short bar originating at the front of the second dorsal-fin base and forming a Y-shaped mark under this fin. In *pseudotaeniatus* the bar is under the anterior part of the dorsal fin and there is no Y-shaped mark. In addition, *pseudotaeniatus* never has a dark ocellus on the shoulder, no narrow dusky stripes on the body, and no additional markings between the second bar and the caudal spot, as described for *taeniatus* (see below). Other differences include: a smaller caudal spot (diameter 4.6-5.35 in peduncle depth in *pseudotaeniatus* vs. 3.4-3.8 in *taeniatus*); the second developed gill-raker on the upper limb is only slightly shorter than the first one in *pseudotaeniatus*, but is no more than half the first raker in *taeniatus*; *pseudotaeniatus* has a dark intestine, but it is pale in *taeniatus*. *Apogon bifasciatus* of Khalaf and Disi (1997) is *A. pseudotaeniatus*.

Preserved specimens of *pseudotaeniatus* may also be confused with *pharaonis*; see Remarks of the latter for the differences between these two species.

According to Gon (2000) previous records of *pseudotaeniatus* from the eastern Indian and western Pacific oceans, north to Japan, are a similar species, *A. sialis* (Jordan & Thompson, 1914).

In the Red Sea, *pseudotaeniatus* is found on outer reefs and isolated coral heads in depths ranging from 5-30 m. In the Gulf of Aqaba, the first author observed and photographed a group of 11 juveniles swimming close to the bottom at 20-25 m (Plate 3C).

MATERIAL EXAMINED: Seven specimens, 60.6-87.2 mm. Gulf of Aqaba (Jordan and Egypt), Aqaba, SMF 15948, 60.6 mm; Taba, BPBM 27395, 85.8 mm (holotype of *pseudotaeniatus*); BPBM 30551, 86.5 mm (paratype of *pseudotaeniatus*); BPBM 31878, 3: 20-46 mm. Egypt, Gulf of Suez, HUJ 9085, 87.2 mm.

Apogon quadrifasciatus
Plate 3D

Apogon quadrifasciatus Cuvier, 1828: 153 (Pondicherry, India; holotype, MNHN 865).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 15-16; lateral-line scales 24 + 4; median predorsal scales 5; total gill-rakers 5-6 + 13-15; developed rakers 3 + 11-13; ceratobranchial rakers 9. In adults, edge of suborbital bones sometimes with small serrae; serrae on ventral part and around angle of preopercle ridge; most fish smaller than 50 mm with 2-3 small serrae at angle of preopercular ridge; preopercle edge always serrate. Body depth 2.6-2.7 and head length 2.45-2.6 in SL; snout length 4.5-5.05, eye diameter 3.0-3.6, interorbital width 4.7-5.4, and upper-jaw length 2.0-2.2, all in head length; caudal-peduncle depth 1.5-1.7 in its length, and peduncle length 3.7-4.2 in SL. Largest specimen, 71.5 mm; smallest mature male and female, 42.5 and 51.3 mm, respectively.

Colour in alcohol: body pale brown with 2 dark brown stripes; first stripe narrow, in straight line from above posttemporal bone, above lateral line, and fading out short distance behind posterior end of second dorsal-fin base; second stripe wider, mid-lateral from tip of snout to end of caudal fin; distal edge of second dorsal, anal and pelvic fins dusky or sparsely spotted; second dorsal and anal fins usually with faint, thin basal stripe; peritoneum with dark brown spots of various sizes; intestine dark brown or with dark spots.

Colour in life: dark stripes have narrow, silvery white margins; usually bluish silver vertical lines and small spots on the lower side.

DISTRIBUTION: Red Sea and east coast of Africa to the western Pacific Ocean.

Plate 1

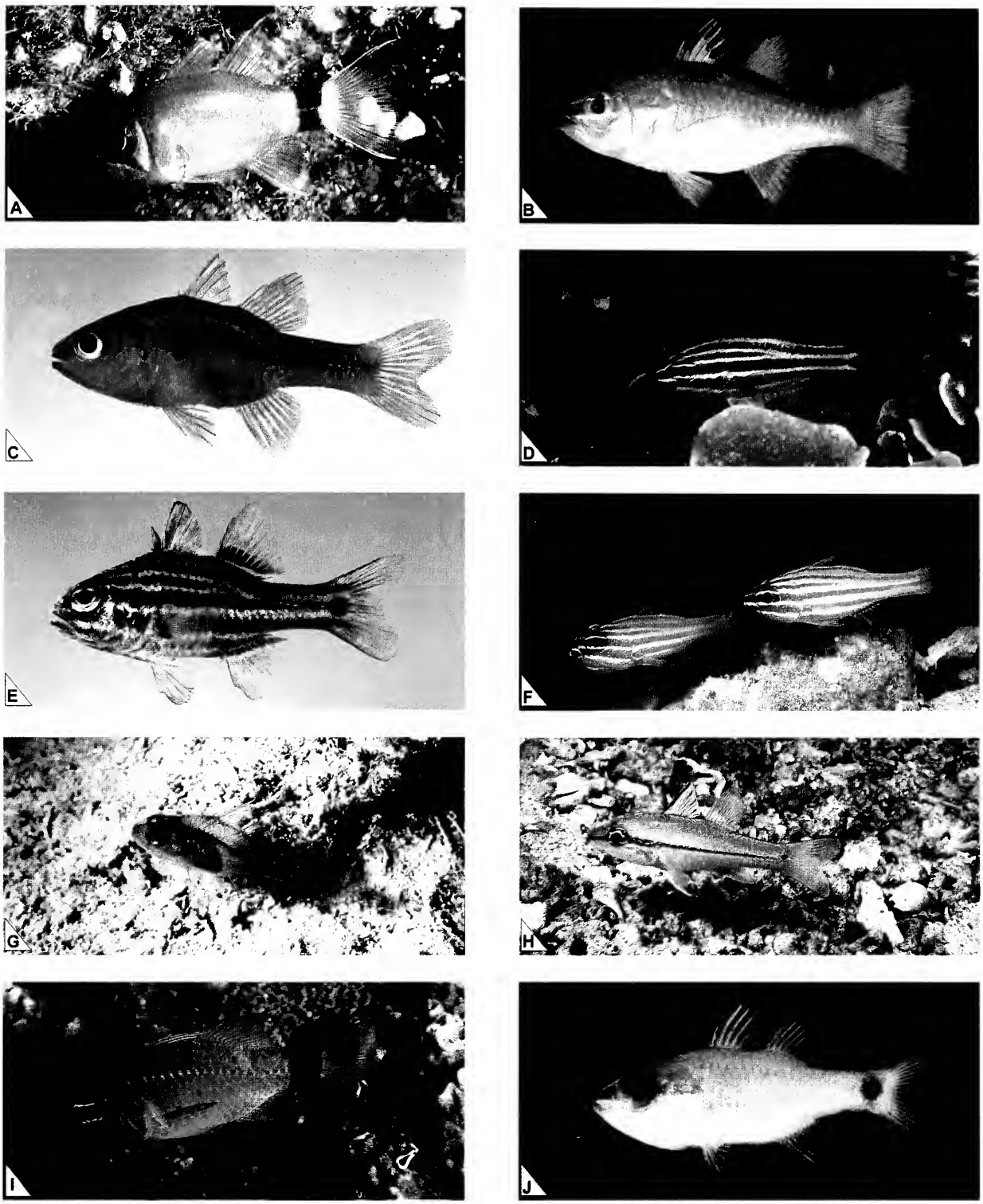

Plate 1
a) *Apogon annularis,* **Sudan, Red Sea (JER) b)** *Apogon apogonides,* **105 mm, Eilat, Gulf of Aqaba, Red Sea (JER) c)** *Apogon coccineus,* **36 mm, Suakin Harbour, Sudan, Red Sea (JER) d)** *Apogon cookii,* **65 mm TL, Masirah Island, Oman (JER) e)** *Apogon cookii,* **75 mm SL, Nuweiba, Gulf of Aqaba, Red Sea (JER) f)** *Apogon cyanosoma,* **57 mm TL, Gulf of Aqaba, Red Sea (JER) g)** *Apogon erythrosoma,* **Sharm al Sheikh, Sinai Peninsula, Red Sea, night (JER) h)** *Apogon exostigma,* **100mm TL, Gulf of Aqaba, Red Sea, night (JER) i)** *Apogon fleurieu,* **100 mm TL, Taba, Gulf of Aqaba, Red Sea (JER) j)** *Apogon fleurieu,* **32 mm TL, Eilat, Gulf of Aqaba, Red Sea**

Plate 2

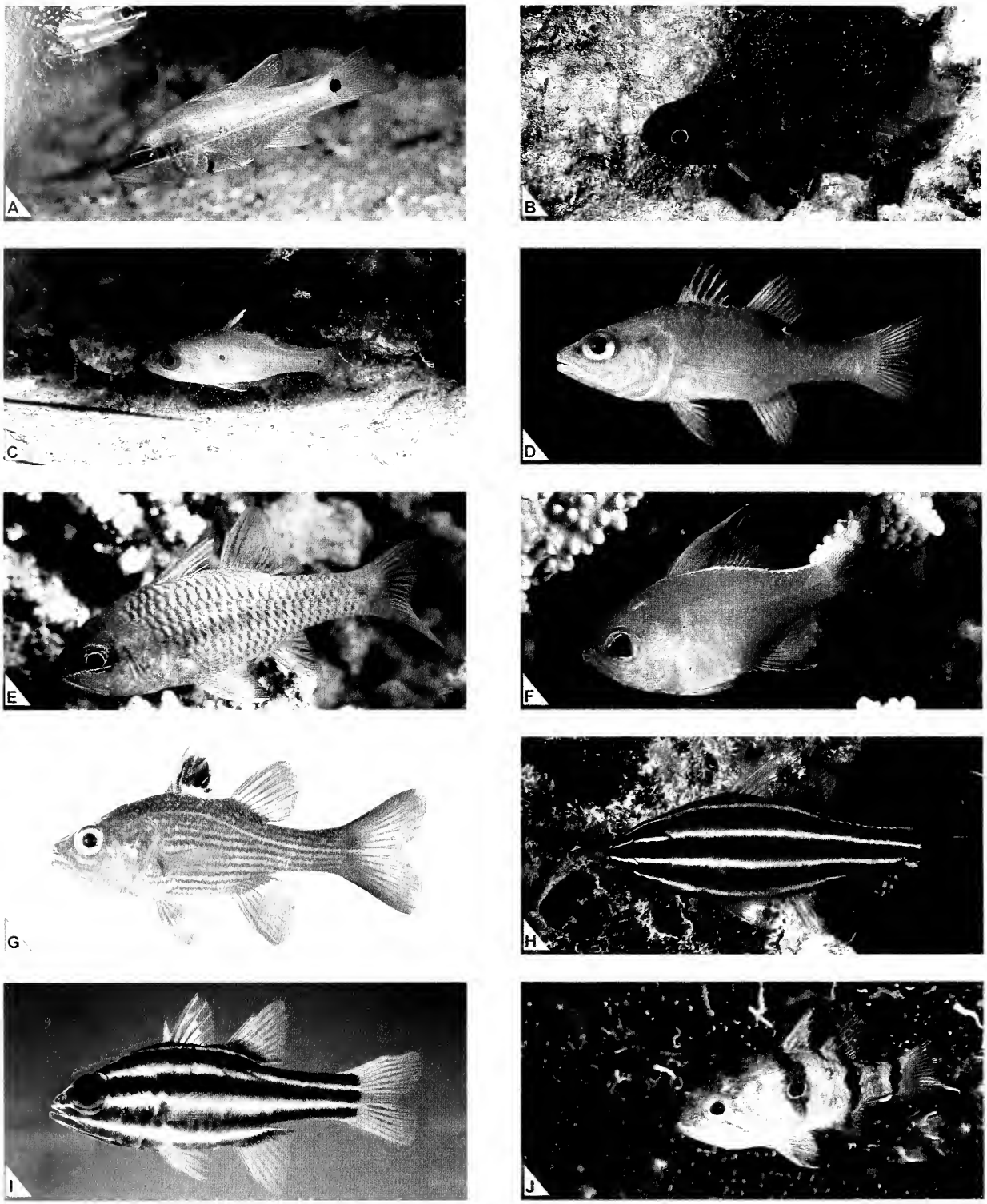

Plate 2

a) *Apogon fraenatus,* 60 mm TL, Taba, Gulf of Aqaba, Red Sea (JER) b) *Apogon guamensis*, Eqypt, Red Sea (RHK)
c) *Apogon heptastygma*, Egypt, Red Sea (RHK) d) *Apogon isus*, 56 mm, Port Sudan, Sudan, Red Sea (JER)
e) *Apogon kallopterus*, Sharm al Sheikh, Sinai Peninsula, Red Sea (JER) f) *Apogon leptacanthus*, Djibouti, Gulf of Aden (JER)
g) *Apogon multitaeniatus*, 89 mm, Maskali Islands, Djibouti, Gulf of Aden (JER) h) *Apogon nigrofasciatus*, 55 mm TL, Jeddah, Saudi Arabia, Red Sea (JER) i) *Apogon nigrofasciatus*, 55 mm SL, Gulf of Aqaba, Red Sea (JER) j) *Apogon pharaonis*, 75 mm TL, Saudi Arabia, Persian Gulf (JER)

Plate 3

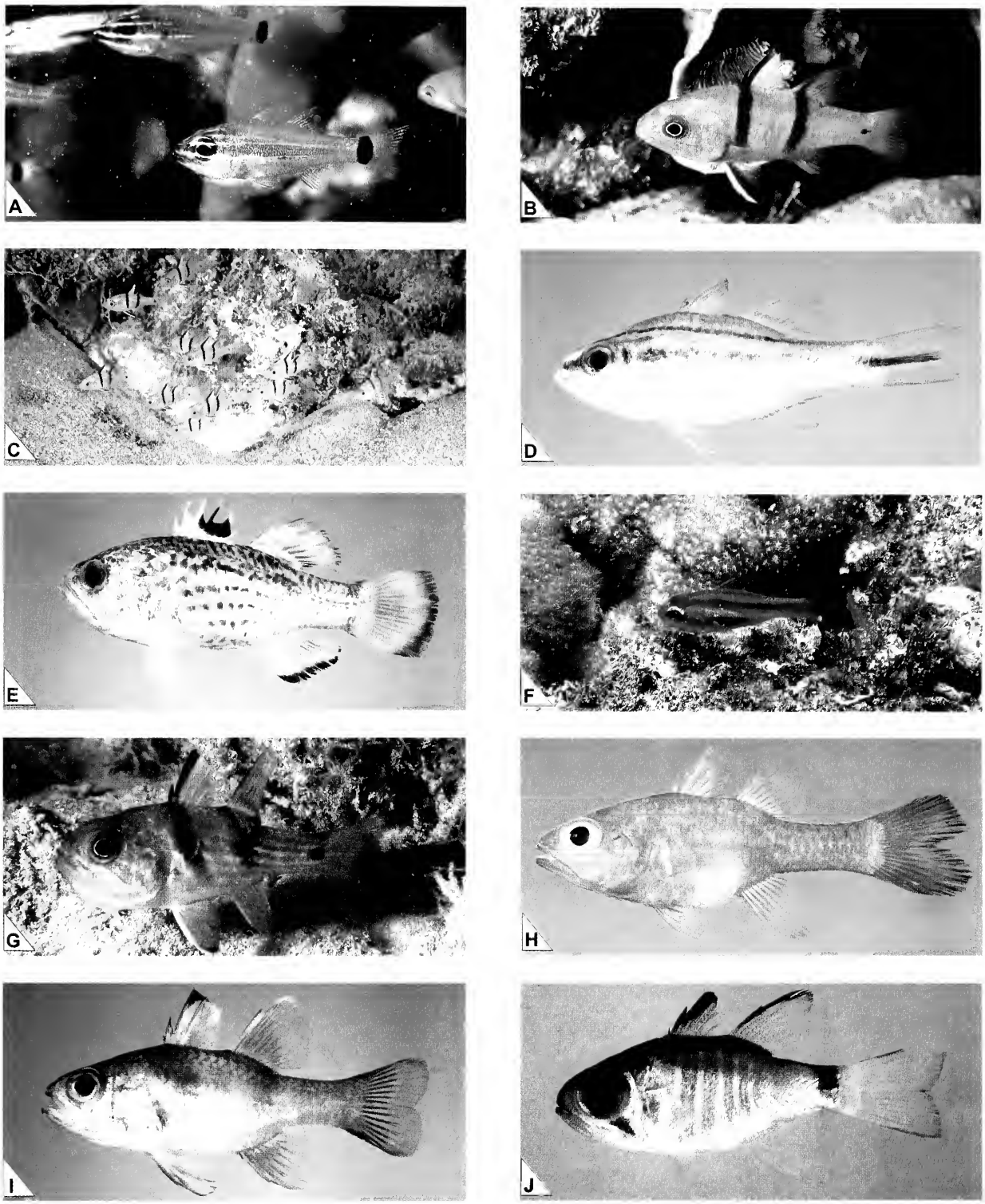

Plate 3

a) *Apogon pselion,* **40 mm TL, Eilat, Gulf of Aqaba, Red Sea (JER) b)** *Apogon pseudotaeniatus*, **adult, 75 mm TL, Taba, Gulf of Aqaba, Red Sea (JER)**

c) *Apogon pseudoteaniatus*, **juveniles, 45 mm TL, Taba, Gulf of Aqaba, Red Sea (OG) d)** *Apogon quadrifasciatus*, **49 mm SL, Oman (JER)**

e) *Apogon queketti*, **68 mm SL, Madras, India (JER) f)** *Apogon seminornatus*, **45 mm TL, Gulf of Aden (JER)**

g) *Apogon taeniatus*, **60 mm TL, Jeddah, Saudi Arabia, Red Sea (JER) h)** *Apogon talboti*, **35 mm SL, Mauritius (JER)**

i) *Apogon timorensis*, **52 mm SL, Nuweiba, Gulf of Aqaba, Red Sea (JER) j)** *Apogon zebrinus*, **41 mm SL, N of Port Sudan, Red Sea (JER)**

Plate 4

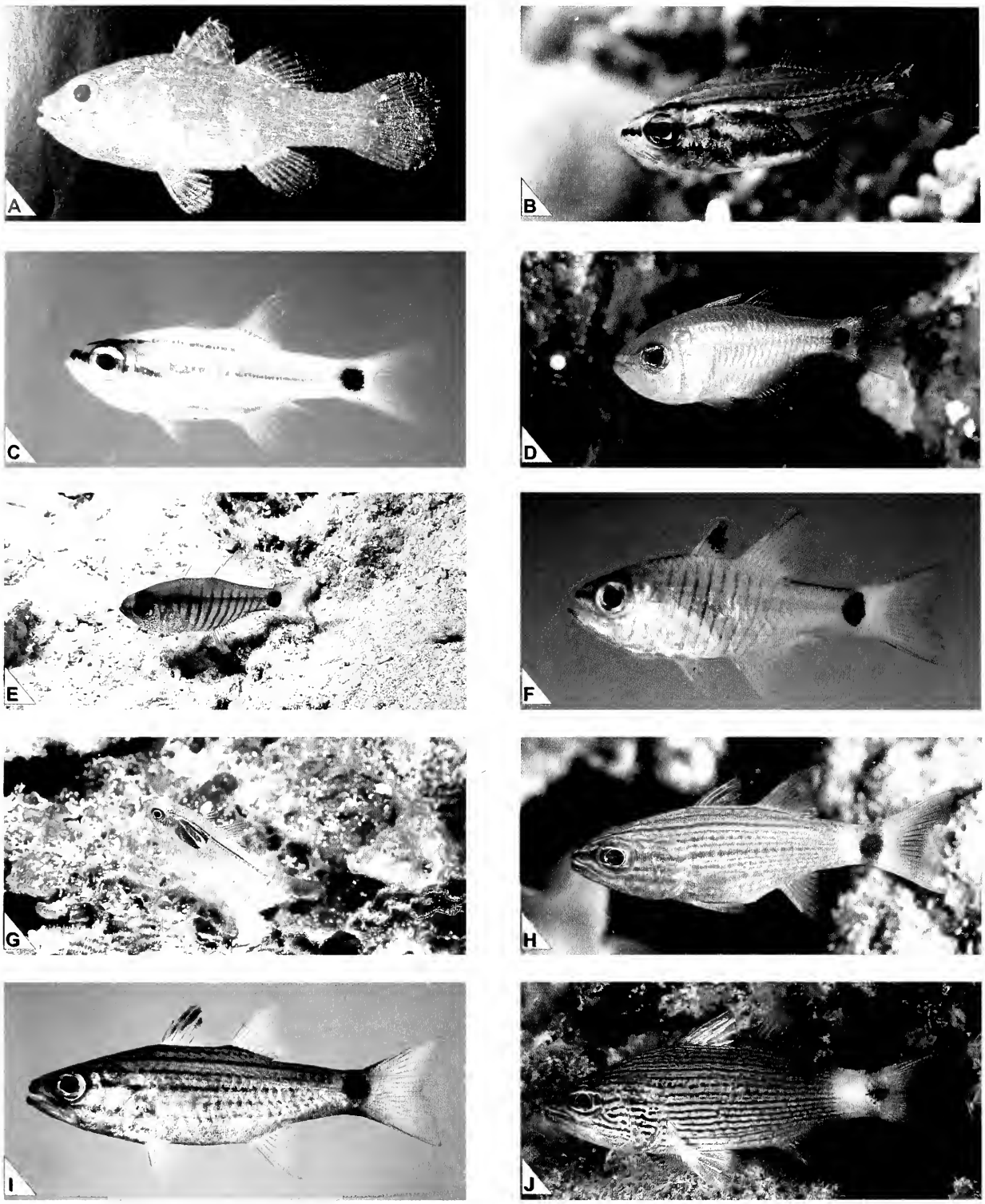

Plate 4

a) *Apogonichthys perdix,* **32 mm SL, Kwajalein Lagoon, Marshall Islands (JER) b)** *Archamia bilineata,* **Hurghada, Egypt, Red Sea (DE) c)** *Archamia bilineata,* **29 mm SL, Towartit Reef, Sudan, Red Sea (JER) d)** *Archamia fucata,* **Gulf of Aqaba, Red Sea (JER) e)** *Archamia lineolata,* **60 mm TL, Gulf of Aqaba, Red Sea (JER) f)** *Archamia lineolata,* **34 mm SL, Sharm al Sheikh, Sinai Peninsula, Red Sea (JER) g)** *Cercamia eremia,* **45 mm SL, Solomon Islands, night (JER) h)** *Cheilodipterus lachneri,* **100 mm TL, N of Jeddah, Saudi Arabia, (JER) i)** *Cheilodipterus lachneri,* **89 mm TL (lost), Gulf of Aqaba, Red Sea (JER) j)** *Cheilodipterus lineatus,* **150 mm TL, Sanganeb Atoll, Sudan, Rea Sea (JER)**

Plate 5

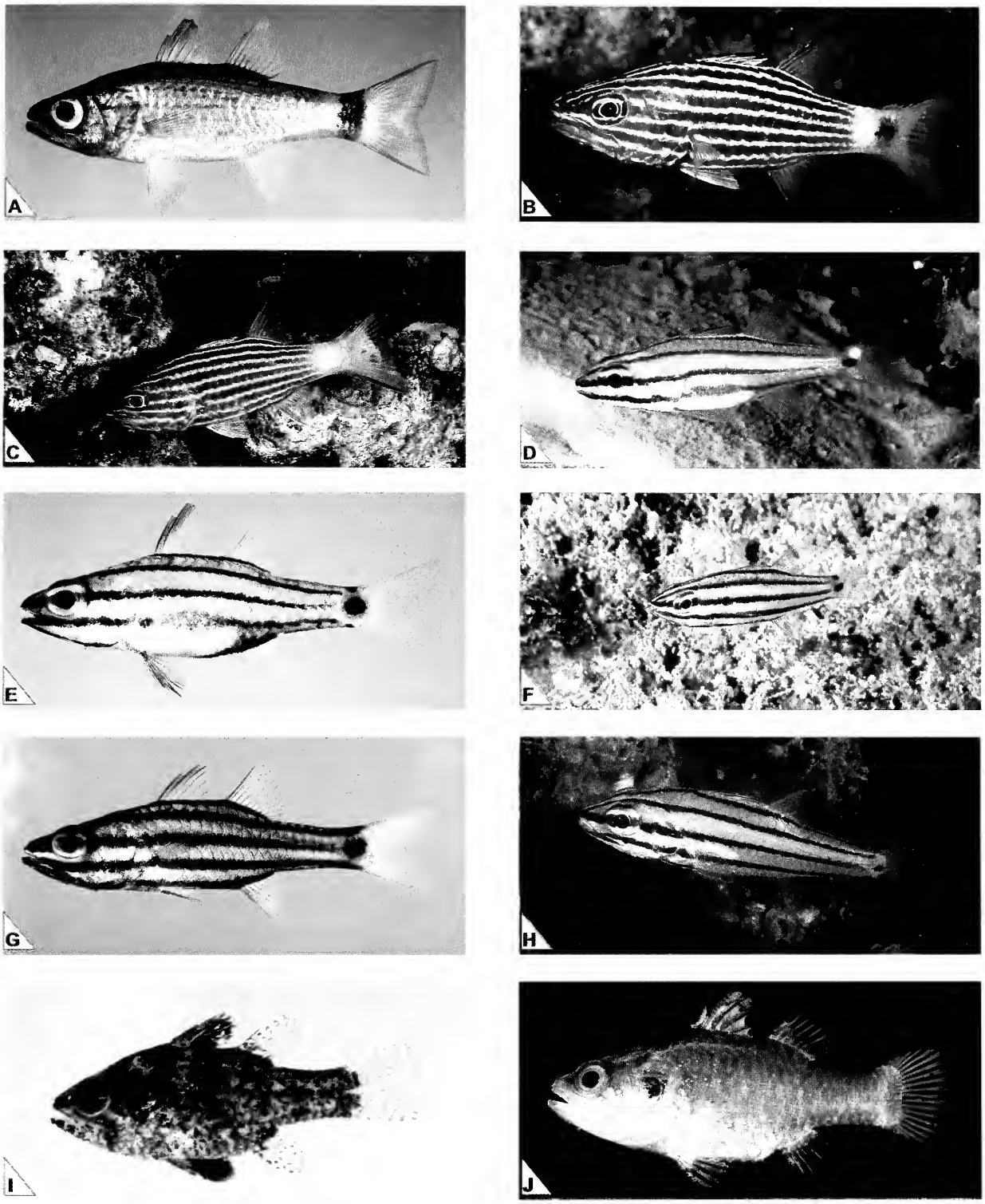

Plate 5

a) *Cheilodipterus lineatus,* **BPBM 20711, 103 mm SL, Port Sudan, Sudan, Rea Sea (JER) b)** *Cheilodipterus macrodon*, **Port Sudan, Rea Sea (JER) c)** *Cheilodipterus macrodon*, **160 mm TL, Taba, Gulf of Aqaba, Rea Sea (OG), note absence of the dark caudal spot. d)** *Cheilodipterus novemstriatus*, **45 mm TL, Sanganeb Atoll, Sudan, Red Sea (JER)**

e) *Cheilodipterus novemstriatus*, **BPBM 30886, 46 mm SL, Gulf of Aqaba, Red Sea (JER) f)** *Cheilodipterus pygmaios*, **45 mm TL, Port Sudan, Red Sea (JER) g)** *Cheilodipterus pygmaios*, **BPBM 27433, paratype, 41 mm SL, Sudan, Rea Sea (JER) h)** *Cheilodipterus quinquelineatus*, **100 mm TL, Port Sudan, Rea Sea (JER)**

i) *Foa fo*, **37 mm SL, Inhaca Island, Mozambique (OG) j)** *Fowleria aurita*, **45 mm SL, Eilat, Gulf of Aqaba, Rea Sea (JER)**

Plate 6

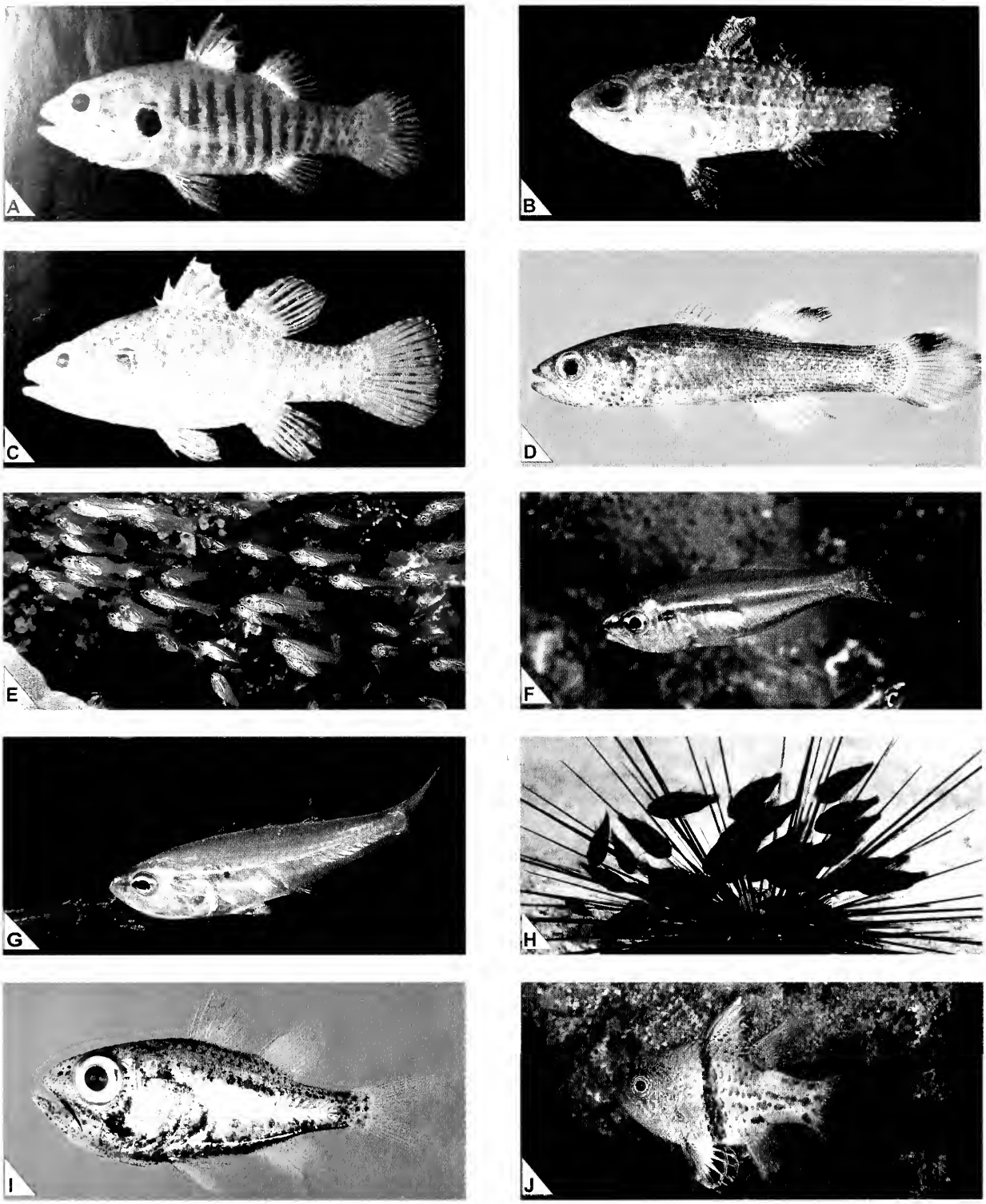

Plate 6

a) *Fowleria marmorata,* **37 mm SL, Florida Islands, Solomon Islands (JER) b)** *Fowleria vaulae,* **35 mm SL, Ari Atoll, Maldive Islands (JER). c)** *Fowleria variegata,* **45 mm SL, Nabq, Egypt, Gulf of Aqaba, Rea Sea (JER) d)** *Pseudamia gelatinosa,* **52 mm SL, Towartit Reef, Sudan, Red Sea (JER)**

e) *Rhabdamia cypselura,* **Gulf of Aden (JER) f)** *Rhabdamia nigrimentum,* **Sudan, Red Sea (JER)**

g) *Rhabdamia spilota,* **El Hamira, Egypt, Gulf of Aqaba, Rea Sea (JER) h)** *Siphamia permutata,* **Red Sea (HF)**

i) *Siphamia permutata,* **27 mm SL, El Hamira, Egypt, Gulf of Aqaba, Rea Sea (JER) j)** *Sphaeramia orbicularis,* **95 mm TL, Palau, Western Pacific Ocean (JER)**

REMARKS: The colour pattern of this species is similar to *A. bryx* from the Red Sea and western Indian Ocean, but the latter has only 6 dorsal spines, 14 pectoral rays and 22-23 developed gill-rakers.

There has been confusion over the use of the name *Apogon fasciatus* (White). Lachner (1953: 439, Pl. 35A) designated a specimen from New South Wales as the neotype of this species. Randall and Hoese (1988) mistakenly regarded *A. fasciatus* as a senior synonym of *A. quadrifasciatus* Cuvier. *A. fasciatus*, however, is restricted to southern Queensland and New South Wales (Kuiter, 1993), and *quadrifasciatus* is a valid species. Live *fasciatus* differ from *quadrifasciatus* in having 3 dark stripes on the body. The additional stripe is a short postocular stripe fading out below second dorsal fin.

A. quadrifasciatus is typically found on silty sand or mud at 20 m or more, generally not far from some benthic invertebrate or debris where it seeks shelter.

MATERIAL EXAMINED: 23 specimens, 30.1-71.5 mm. Red Sea, Egypt, Gulf of Suez, TAU P. 6306, 57 mm; Gulf of Aqaba, north of Gezirat Faraun, HUJ 6196, 5: 58.3-71.4 mm. Eritrea, Massawa, HUJ 11914, 17: 30.1-51.6 mm.

Apogon queketti
Plate 3E

Apogon queketti Gilchrist, 1903: 206, Pl. 14 (KwaZulu-Natal, South Africa; syntypes SAM 11657-8).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13-17 (usually 16); lateral-line scales 24 + 3; median predorsal scales 1-3; total gill-rakers 3-7 + 11-12 = 14-18; developed rakers 2 + 10-11; ceratobranchial rakers 8. Preopercle edge and ridge smooth, the ventral edge crenulate. Body depth 2.6-2.9, and head length 2.2-2.5 in SL; snout length 5.0-7.0, eye diameter 3.3-4.0, and interorbital width 4.1-4.9, all in head length; caudal-peduncle depth 1.3-1.8 in its length, and peduncle length 4.2-5.1 in SL. Largest specimen, 77.6 mm, from KwaZulu-Natal.

Colour in alcohol: top of head and snout sometimes dark brown; body pale brown to brown, usually with series of spots that may form irregular, sinuous lines; scales above lateral line with dark edge; dusky cheek and temporal marks present or absent; large dark brown to black spot on posterior part of first dorsal fin; second dorsal, anal, and caudal fins pale to dusky, with dark distal edge; sometimes second dorsal and anal fins with faint dark stripe, at mid-level and along base, respectively, which gradually darken posteriorly; other fins pale, but brown spots sometimes present along pelvic rays (not on membranes); peritoneum and intestine pale.

Colour in life: pinkish grey dorsally, shading to silvery on sides and ventrum, but otherwise as described above; spot on first dorsal fin and distal edge of anal fin intense black; edge of second dorsal and caudal fins blackish.

Randall (1995: 159, Fig. 388) photographed a 91 mmTL fish from the Persian Gulf.

DISTRIBUTION: Red Sea, Mozambique, South Africa, Persian Gulf and the Arabian Sea off India.

REMARKS: *Apogon queketti* belongs to the *carinatus* species group of the subgenus *Jaydia* (Gon, 1996). The other two species in this group, *carinatus* and *poecilopterus*, do not occur in the Red Sea and the western Indian Ocean. The fish reported by Budker and Fourmanoir (1954) as *poecilopterus* from the Gulf of Suez is probably *queketti*.
This species was collected by trawl in 50-92 m.

MATERIAL EXAMINED: Eight specimens, 36.3-77.6 mm. Egypt, Gulf of Suez, MNHN 1968-154, 72.9 mm. Eritrea, Dahlak Archipelago, HUJ 11770, 36.3 mm. South Africa, KwaZulu-Natal, SAM 11657, 73.9 mm (syntype); SAM 11658, 5: 43.0-77.6 mm (syntypes of *Apogon queketti*).
Apogon poecilopterus: Indonesia, Java, RMNH 214, 79 mm (holotype).

Apogon semiornatus
Plate 3F

Apogon semiornatus Peters, 1876: 436 (Mauritius; holotype, ZMB 9454).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 12; lateral-line scales 25; median predorsal scales 7; scales between lateral line and first dorsal fin 2½; total gill-rakers 3-4 + 12; developed rakers 1 + 7. Preopercle ridge smooth; posterior edge of preopercle usually serrate, the ventral edge membranous and often crenulate. Anterior nostril closer to upper lip than to rear nostril; skin flap covering first supraorbital pore ending laterally with a small notch below anterior nostril (Fig. 1B). Body depth 2.6-2.8 and head length 2.4-2.6 in SL; snout length 3.7-4.4 and eye diameter 2.9-3.0 in head length; caudal-peduncle depth 1.7-1.9 in peduncle length, and peduncle length 3.6-4.0 in SL; caudal fin forked with rounded lobes. Largest specimen 50 mm.

Colour in alcohol: body pale with broad blackish stripe from above gill opening to end of caudal fin, this stripe darkest and broadest on caudal peduncle and caudal fin; broad blackish oblique band from behind eye to base of anal fin; narrow blackish stripe below base of dorsal fins; peritoneum with dark spots; intestine pale.

Colour in life: translucent red with dark stripes as described. Randall (1995) provided an underwater photograph taken in Oman.

DISTRIBUTION: Red Sea and Gulf of Oman, to KwaZulu-Natal, South Africa, Chagos, Mauritius, to the western Pacific where it ranges from southern Japan

to the Great Barrier Reef and New Caledonia.

REMARKS: The broad stripes of this species (sometimes faded in preserved fish) will easily distinguish fresh specimens from the similar looking members of the *coccineus* group. In addition, species of the latter group have only 1½ scales between the lateral line and the first dorsal-fin base. Preserved, faded *semiornatus* can be confused with *coccineus* which has 10-13 developed gill-rakers (2-3 on upper limb), usually 13 pectoral rays, and frequently a faint dark stripe on caudal peduncle.

Randall (1994: 263, Pl. 6, Fig. 6) provided the first record of this cardinalfish for the Red Sea from a specimen collected at the Hanish Islands off Yemen.

Apogon semiornatus is a cryptic shallow-water species. In the Red Sea it is rarely seen except at night or in the dim light of dusk and dawn, and then never far from the shelter of coral reef or rocky bottom.

MATERIAL EXAMINED: Off Yemen, Hanish Islands, BPBM 35713, 35 mm.

Apogon smithi

Jaydia hungi Fourmanoir, 1967: 265 (Gulf of Suez, Red Sea; holotype, MNHN 1965-711; preoccupied).

Jaydia smithi Kotthaus, 1970: 59, Fig. 238 (Somali coast, Gulf of Aden; holotype, ZMH 5033).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 15-17; lateral-line scales 24 + 2-4 (usually 27); median predorsal scales 3-5 (usually 4); total gill-rakers 3-5 + 10-13 = 13-17; developed rakers 1 + 9-11; ceratobranchial rakers 8-9 (usually 8). Preopercle ridge smooth, the edge weakly serrate. Body depth 2.8-3.4, and head length 2.3-2.6 in SL; snout length 5.0-6.95, eye diameter 3.3-4.3, and interorbital width 4.2-5.5, all in head length; caudal-peduncle depth 1.2-1.8 in its length, and peduncle length 4.2-5.1 in SL; intestinal and anal light organs present. Largest specimen, 93.2 mm; smallest mature male and female, about 58 mm.

Colour in alcohol: top of head and snout covered with minute dark spots; body pale brown to brown, with 4-6 dark brown bars; scale pockets above lateral line, and sometimes above anal-fin base, with dark edge; cheek and temporal marks present, but may be faint; narrow dark brown line usually present along edge of preopercle ridge; distal half of first dorsal fin dark brown; second dorsal and caudal fins pale to dusky with darker distal edge, and a dark brown stripe along middle of second dorsal fin; anal and pelvic fins pale to dark brown, the pigment arranged as series of small dark spots, mostly along fin rays; occasionally several dark brown spots, sometimes forming thin stripe, present on proximal third of anal fin; pectoral fin pale, but series of small spots sometimes present along its rays; peritoneum with dark spots of various sizes; intestine variably covered with smaller dark spots, rarely pale. The fresh colour pattern, as shown in photographs (identified as *Apogon ellioti*) in books by Gloerfelt-Tarp & Kailola (1984) and Shen et al. (1993), is similar to the preserved pattern.

DISTRIBUTION: Red Sea and Gulf of Oman to the Philippines and Marshall Islands, and north to Taiwan.

REMARKS: *Apogon smithi* belongs to the *truncatus* group of the subgenus *Jaydia* and closely resembles *hungi* and *truncatus*. It is distinguished from the latter by lacking the dark stripe across the middle of the anal fin and by having minute dark spots on the dorsal surface of the head (dark spots large and well-spaced in *truncatus*). Differences from *hungi* include 10-11 (rarely 12) developed gill-rakers (12-13 in *hungi*), and 8 ceratobranchial rakers (9 in *hungi*). Both *hungi* and *truncatus* occur in the western Indian Ocean, but not in the Red Sea (Gon, 1996).

Fourmanoir (1967) described *Jaydia hungi* from a fish collected in the Gulf of Suez (MNHN 1965-711). Gon (1996) pointed out that this name is a secondary homonym of *Apogon hungi* Fourmanoir and Nhu-Nhung (1965), a species restricted to the southwest Indian Ocean. *Apogon smithi* is caught with trawls in 22-230 m.

Figure 8. Apogon spilurus (75.3 mm SL, from Kotthaus, 1970: fig. 254, holotype of Ostorhynchus micromaculatus).

MATERIAL EXAMINED: 14 specimens, 45.9-93.2 mm. Red Sea, Gulf of Aqaba, Eilat, TAU 5500, 58.1 mm. Gulf of Suez, MNHN 1965-711, male, 93.2 mm, holotype of *Jaydia hungi* Fourmanoir, 1967; El Tûr, HUJ 5680, 45.9 mm. Eritrea, HUJ 11319, 4: 60.6-78.6 mm; HUJ 11936, 63.8 mm; HUJ 11946, 49.9 mm; Massawa, USNM 212826, 4: 70.8-86.1 mm. Yemen, NMW 34884, 57.3 mm. *Apogon truncatus*: Indonesia, Jakarta, RMNH 5582, 53.5 mm (holotype).
Apogon hungi: NW Madagascar, USNM 340009, 76 mm (neotype designated by Gon, 1996).

Apogon spilurus
Fig. 8

Apogon spilurus Regan, 1905: 321, Pl. 3, Fig. 5 (Karachi, Pakistan; syntypes, BMNH 1904.5.25.113-117).
Ostorhynchus micromaculatus Kotthaus, 1970: 70, Fig. 254 (southern Red Sea; holotype, ZMH 5050).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 14; lateral-line scales 24-25 + 3-4 = 28; median predorsal scales 5; total gill-rakers 5-6 + 15; developed rakers 3-4 + 12-13 = 16-17. Preopercle edge serrate, ridge smooth. Body depth 2.5-2.6, and head length 2.2-2.5 in SL; snout length 4.5-5.2, eye diameter 3.0-3.4, and interorbital width 4.5-5.0, all in head length; caudal-peduncle depth 1.3-1.5 in its length, and peduncle length 4.2-4.7 in SL. Largest specimen, 73.5 mm.

Colour in alcohol: body pale brown; edge of scale pockets above lateral line dark; oblique dark line from tip of snout through upper margin of eye; narrow blackish stripe from front of lower lip to lower margin of eye; oblique dark streak on posterior (exposed) part of maxilla, continuing onto cheek; dark brown spot, as large as or smaller than pupil dorso-posteriorly on caudal peduncle, just touching spot of other side; first dorsal fin dusky, with tips of membranes of third and fourth spines dark brown; other fins pale, except for faint dark stripe along anal-fin base; upper part of gill arches, including bases of gill-rakers, dusky to dark; peritoneum with dense dark spots; intestine with dark spots, denser near anus.

Colour in life unknown.

DISTRIBUTION: Southern Red Sea, Somalia and Pakistan.

REMARKS: In one syntype (47.4 mm) of *A. spilurus*, the two stripes on the snout are joined into a single wide stripe from the snout to the ridge of the preopercle.

Kotthaus (1970), Dor (1984) and Goren and Dor (1994) overlooked Regan's (1905) description of *Apogon spilurus*. We are not aware of any report of this species in the period between Regan's (1905) original description and Kotthaus' (1970) paper. Kotthaus (1970) associated and compared his *micromaculatus* with *savayensis* of the *Apogon bandanensis* group, but it is a member of the *fleurieu* species group.

Apogon spilurus is known from trawls in 37-65 m.

MATERIAL EXAMINED: 19 specimens, 42.0-73.5 mm. Off Eritrea, ZMH 5050, 75.3 mm (holotype of *micromaculatus*). Off Yemen, USNM, 212302, 42 mm. Somalia, BPBM 32715, 12: 62-77 mm; ZMH 5052, 4: 62.25-71.0 mm (paratypes of *micromaculatus*). Pakistan, Karachi, BMNH 1904.5.25.113, 47.4 mm (syntype of *spilurus*).

Apogon taeniatus
Plate 3G

Apogon taeniatus Cuvier, 1828: 159 (Eritrea; syntypes, MNHN 8693, ZMB 54).
Apogon bifasciatus Rüppell, 1838: 86, Pl. 22, Fig. 2 (Jeddah, Saudi Arabia; syntypes, SMF 2186, 4622-3).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13-15; lateral-line scales 24 + 3-4 (usually 27); median predorsal scales 2-4; total gill-rakers 4-5 + 13-15; developed rakers 1-2 + 8-11; ceratobranchial rakers 8-9 (usually 8). Preopercle ridge smooth, the edge serrate on posterior part and angle, and weakly serrate to smooth on ventral part (serrate in small juveniles). Body depth 2.2-2.6 and head length 2.1-2.6 in SL; snout length 4.8-6.3, eye diameter 2.6-2.7, interorbital width 4.2-4.6, and upper-jaw length 1.9-2.3, all in head length; caudal-peduncle depth 1.2-1.8 in its length, and peduncle length 4.0-4.8 in SL. Largest specimen, 71 mm.

Colour in alcohol: body brown with 2 dark brown bars; one from front of first dorsal-fin base, fading out at level of pectoral fin; the second dark bar from rear end of second dorsal-fin base, fading out on middle of body; small caudal spot, 3.4-3.8 in caudal-peduncle depth; additional dark brown markings sometimes present between 2 main bars, and between second bar and caudal spot; body usually with 6-8 faint dusky stripes of which upper 2-3 follow lateral line contour; usually dark brown saddle under or in front of spine of second dorsal fin; this saddle may join the rear bar to form diffuse dusky Y mark under second dorsal fin; often white-edged dark brown spot contained within lower part of anterior dark bar; narrow cheek mark present; leading edge of first dorsal dusky to dark brown; second dorsal frequently with dusky to brown basal stripe; pelvic fins dark brown with pale leading edge; upper and lower margin of caudal fin dusky to brown; peritoneum with scattered minute dark spots; intestine pale.

Colour in life: similar to preserved pattern; body olive grey, shading to pale silvery grey ventrally; bars and caudal spot black, stripes dusky; leading edge of first dorsal fin black and continuous with anterior bar on body; pelvic fins dusky, with white leading edge and blackish tips. Randall (1995) photographed this species in Oman.

DISTRIBUTION: Red Sea and Gulf of Oman, south to Mozambique and Madagascar.

REMARKS: The second developed gill-raker of the upper limb is never more than half the height of the first raker. Gon (1986b) overlooked the minute dark spots on the peritoneum of this species.

A. taeniatus is easily confused with *pseudotaeniatus*, which has a similar colour pattern. See Remarks for the latter for the differences between the two species. Gon (1986b) reviewed the taxonomic history of both species. Preserved, faded specimens of *taeniatus* may also be confused with *pharaonis* and *timorensis*; see Remarks for these two species for differences from *taeniatus*.

Apogon taeniatus is found in seagrass beds or areas with heavy algal growth (Randall, 1995).

MATERIAL EXAMINED: 47 specimens, 20-71 mm. Red Sea, MNHN 8768, 3: 58.1-62.9 mm; RMNH 62, 66.8 mm; SMNS 896, 2: 55.3-58.1 mm. Egypt, Gulf of Aqaba, Nabek, BPBM 18180, 2: 58-71 mm. Saudi Arabia, Jeddah, RMNH 12973, 8: 48.0-67.4 mm; SMF 2186, 67.8 mm (syntype of *A. bifasciatus*); SMF 4622, 68.2 mm (syntype of *A. bifasciatus*); SMF 4623, 62.5 mm (syntype of *A. bifasciatus*); Abu Latt Island, MNHN 5296, 55.7 mm. Sudan, Port Sudan, BPBM 20407, 3: 20-46 mm; Mersa Towartit, BPBM 20700, 5: 46-56 mm. Eritrea, Massawa, HUJ 11317, 6: 34.4-69.8 mm; HUJ 11318, 9: 23.0-59.4 mm; MNHN 8693, 2: 54.0-56.7 mm (syntypes of *A. taeniatus*); ZMB 54, 2: 46.2-47.8 mm (syntypes of *A. taeniatus*).

Apogon talboti
Plate 3H

Apogon talboti Smith, 1961: 387, Pl. 47, Fig. A (Zanzibar; holotype, RUSI 353).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 13; lateral-line scales 24 + 2-6; median predorsal scales 6 or 7; total gill-rakers 5 + 15-16; developed rakers 3-4 + 13-15; ceratobranchial rakers 9-10. Preopercle ridge smooth, the edge with fairly large serrae on vertical part, but crenulate and poorly ossified on ventral part. Body depth 2.8-3.05 and head length 2.6-2.7 in SL; snout length 4.3-5.2, eye diameter 2.4-3.2, interorbital width 4.5-5.3, upper-jaw length 1.8-2.0, and second dorsal spine 1.7-2.3, all in head length; caudal-peduncle depth 1.8-2.1 in its length, and peduncle length 3.7-4.1 in SL. Largest specimen, 81 mm.

Colour in alcohol of holotype: head and body brown, darker on head and above lateral line; edge of scales, mostly below lateral line and on caudal peduncle, dark brown; tip of jaws dark brown; fins pale, with faded dark spots distally on first dorsal fin; tips of rays of anal, caudal and pelvic fins dusky to dark; caudal-fin base dark brown. Red Sea juveniles pale brown with no evident pattern, or with some dark-edged scales on predorsal area; fins similar to adult, except one of two specimens lacking dark spots on tips of pelvic-fin rays; peritoneum with dark spots of various sizes; intestine pale.

Colour in life: entirely opaque red, as opposed to the transparent red of the small *coccineus*-like species.

DISTRIBUTION: Red Sea, Zanzibar and the Great Barrier Reef (Randall et al., 1990a).

REMARKS: *Apogon talboti*, previously unknown in the Red Sea, is similar to species of the *coccineus* group, which have fewer developed gill-rakers (the combined range of developed rakers for the three species is 1-3 + 6-12), and attain a much smaller maximum size.

This species inhabits the dark recesses of shallow tropical coral and rocky reefs.

MATERIAL EXAMINED: Three specimens, 25.0-81.1 mm. Egypt, south end of Sinai Peninsula, Marsa Bareka, TAU 7781, 27.5 mm. Sudan, Suakin harbour, BPBM 35790, 25 mm. Zanzibar, RUSI 353, 81.1 mm (holotype of *Apogon talboti*).

Apogon timorensis
Plate 3I

Apogon timorensis Bleeker, 1854a: 207 (Timor; holotype, RMNH 5583).

Apogonichthyoides fraxineus Smith, 1961: 396, Pl. 48 D (Pinda, Mozambique; holotype RUSI 356).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 14-15 (usually 15); lateral-line scales 24 + 2-3 (usually 27); median predorsal scales 2-3 (usually 3); total gill-rakers 3-4 + 11-14 = 15-17; developed rakers 1 + 7-8; ceratobranchial rakers 7-8 (usually 7). Preopercle ridge smooth, the edge serrate. Body depth 2.5-2.8 and head length 2.5-2.7 in SL; snout length 4.8-5.5, eye diameter 2.7-2.9, interorbital width 4.3-5.2, and upper-jaw length 1.95-2.1, all in head length; caudal-peduncle depth 1.5-1.8 in its length, and peduncle length 3.9-4.4 in SL. Largest specimen, 63.7 mm; smallest mature male and female, 41.7 and 47.0 mm, respectively.

Colour in alcohol: body pale to medium brown, usually with 2-3 faint dark brown bars, one under each dorsal fin and one at caudal-fin base; additional 1-2 bars sometimes present under second dorsal fin and on caudal peduncle; no caudal spot; narrow oblique cheek mark usually present; leading edge of first dorsal fin dusky to dark brown; second dorsal and anal fins usually with a faint basal stripe; pelvics dusky to dark brown, sometimes with distal part of fins darker; peritoneum and intestine pale ventrally, but with small dark spots on lateral and dorsal parts.

Live fish observed at night in the Gulf of Aqaba had black dorsal, anal and pelvic fins and intensely dark bars. Randall (1995) photographed a 72 mm TL specimen in Oman and gives the maximum size as 9 cm TL.

DISTRIBUTION: Red Sea and east coast of Africa to western Pacific (north to Taiwan and south to

Australia).

REMARKS: The colour pattern of *Apogon timorensis* is similar to that of *A. pharaonis*; see Remarks of the latter for a comparison of these two species. Another species with similar colour, as well as overlapping gill-rakers and median predorsal-scale counts, is *A. taeniatus*. However, *timorensis* has no caudal spot and no faint dusky stripes on the body, two typical features of *taeniatus*, and usually has 15 pectoral rays (14 in *taeniatus*).

Smith (1961) incorrectly placed Klunzinger's (1870) *A. monochrous* in the synonymy of his *A. fraxineus*. He evidently did not see any of Klunzinger's specimens (they are *A. guamensis*) which have many more gill-rakers than *timorensis* and only 13 pectoral rays.

The specimens observed in the Gulf of Aqaba were on an exposed gravel bottom, at 0.5-3 m, about 20-30 m from a seagrass area with scattered small coral heads.

MATERIAL EXAMINED: 36 specimens, 22.0-63.7 mm. Gulf of Aqaba (Israel and Egypt), Eilat, BPBM 21510, 63 mm; north of El Hamira, TAU P.8678, 2: 25-28 mm; Nuweiba, BPBM 19830, 10: 33-52 mm; Wasset, TAU P.9690, 2: 41.75-49.2 mm; TAU P.9691, 3: 45-47 mm; Dahab, TAU P.9692, 32 mm; Gulf of Suez, ZMH 6545, 63.7 mm; Abu Zneima, TAU P.4432, 7: 29-57 mm; TAU P.9688, 2: 55.3-60.6 mm; south end of the Sinai Peninsula, Marsa el At, TAU P.9689, 39 mm. Saudi Arabia, Yanbu, BPBM 30390, 6: 22-35 mm. Mozambique, Pinda, RUSI 356, 56.4 mm (holotype of *Apogonichthyoides fraxineus*).

Apogon zebrinus
Plate 3J

Apogon zebrinus Fraser, Randall & Lachner, 1999: 2, figs. 1-2 (north of Ras Burqa, Gulf of Aqaba, Red Sea; holotype, USNM 213422).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13; lateral-line scales 24 + 4; median predorsal scales 3; total gill-rakers 6-8 + 19-21; developed rakers 4-7 + 19-20; ceratobranchial rakers 12-13. Preopercle ridge smooth, the edge serrate. Body depth 2.2 and head length 2.3 in SL; snout length 4.5, eye diameter 2.6, interorbital width 3.6, and upper-jaw length 2.0, all in head length; caudal-peduncle depth 1.1 in its length, and peduncle length 4.8 in SL. Largest specimen, 74 mm.

Colour in alcohol: pale brown, shading to silvery on lower part of body; 7-9 dark bars on side of body from pectoral-fin base to anterior part of caudal peduncle, the last bar wavy; oblique cheek mark triangular, its wide end at postero-ventral edge of eye; dark brown saddle on upper part of caudal-fin base, becoming paler below lateral line and fading out before ventral edge of caudal peduncle (juveniles with complete circumpeduncular dark band); leading edge of first dorsal fin dark brown; upper and lower margin of caudal fin dusky; peritoneum and intestine with small dark spots.

Colour in life: body brownish grey dorsally, shading to bluish grey on sides and silvery white ventrally; 7-9 dark grey bars on side of body, 2-3 times broader than pale interspaces; broad, saddle-like black bar posteriorly on caudal peduncle, usually extending below lateral line; wedge-shaped black mark from eye to corner of preopercle ridge; first dorsal fin with black leading edge; upper and lower edges of caudal fin blackish.

DISTRIBUTION: Red Sea and Gulf of Aden.

REMARKS: *Apogon zebrinus* is a member of the *Apogon bandanensis* species group and is most closely related to *A. savayensis* Günther, 1871. Previous authors confused *A. zebrinus* with *A. bandanensis* (Bleeker) and *A. savayensis*; however, these two species do not occur in the Red Sea (Fraser et al., 1999). The first author examined the 2 fish identified as "*A. bandanensis*" (MNHN B3015) by Roux-Estève and Fourmanoir (1955) and Roux-Estève (1956). One was *zebrinus*, and the other was *guamensis*.

Apogon zebrinus occurs on inshore coral and rocky reefs to depths of 15 m.

MATERIAL EXAMINED: 23 specimens, 21.7-74 mm. Gulf of Aqaba (Israel, Jordan and Egypt), Eilat, HUJ 5231, 2: 51.1-63.8 mm; Aqaba, SMF 16164, 2: 65.0-67.3 mm; Ras Burqa, USNM 213422, 59.6 mm, holotype of *Apogon zebrinus*; Paratypes of *A. zebrinus*: Nuweiba, HUJ 7670, 43.6 mm; Wasset, TAU P.9672, 66.9 mm; south end of Sinai Peninsula, Ras Muhammad, BPBM 31807, 4: 51-71 mm; HUJ 6245, 63 mm. Sudan, Port Sudan, BPBM 27417, 41 mm; Suakin, BPBM 19741, 2: 38-44 mm; SMF 8352, 21.7 mm.. Yanbu, BPBM 30388, 4: 58-74 mm. Red Sea, SMF 19742, 3: 29.4-36.2 mm.

Apogonichthys perdix
Plate 4A

Apogonichthys perdix Bleeker, 1854b: 321 (Flores, Indonesia; holotype, RMNH 5616).

Apogon infuscus Fourmanoir in Roux-EstPve & Fourmanoir, 1955: 197 (Abu Latt Island, Red Sea; holotype, MNHN 1952-298).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 14-15 (usually 14); lateral-line scales 24 + 0-1; median predorsal scales 4-5 (usually 4); total gill-rakers 2-3 + 10-12 = 12-14; developed rakers 0-1 + 6; ceratobranchial rakers 6-7 (usually 6). Preopercle edge and ridge smooth, the edge poorly ossified; palatine teeth absent; reduced supramaxilla present. Body depth 2.6-2.95 and head length 2.1-2.4 in SL; snout length 4.3-5.8, eye diameter 3.2-3.7, interorbital width 8.3-10.6, and upper-jaw length 2.0-2.2, all in head length; caudal-peduncle depth 1.2-1.3 in its length, and peduncle length 4.7-5.2 in SL. Caudal fin rounded. Largest specimen, 39.3 mm; smallest mature male and female, 26.5 and 27.7 mm, respectively.

Colour in alcohol: variable; body and head brown to dark brown, often mottled; one specimen with 3 wide bands on head, one on snout, another across interorbital space, and the third on nape; first dorsal, caudal, and pelvic fins dusky to dark; anterior part of first dorsal fin sometimes paler than rest of fin; second dorsal and anal fins pale to dusky; pectoral fins pale, with faint to distinct dark bar near base, sometimes followed by several fainter, irregular bars distally; peritoneum and intestine pale.

Colour in life: depending on substrate; body, head and fins in various shades of red and brown mottled with white.

DISTRIBUTION: Red Sea to KwaZulu-Natal, South Africa and the central Pacific from Hawaii to Rapa; in the western Pacific it ranges from Japan to New Caledonia.

REMARKS: In most specimens the last tubed lateral-line scale was normal and followed by an elongate tubeless scale. In one fish, the elongated scale had an incomplete tube, and another had a simple tube without dorsal and/or ventral pores. A 26.4-mm male had a ball of eggs in its mouth.

We agree with Dor (1984), and Bauchot and Desoutter (1986) in regarding *Apogon infuscus* Fourmanoir, 1955 as a junior synonym of *Apogonichthys perdix*.

This species is usually found in shallow sheltered water, in coral rubble, seagrass and algal beds (Randall 1998); but it was also reported from 65 m (Myers, 1989).

MATERIAL EXAMINED: 10 specimens, 22.6-39.3 mm. Egypt, Gulf of Aqaba, Dahab, HUJ 11971, 26.4 mm; Tiran Island, TAU P.8776, 4: 30.2-34.3 mm; southern tip of Sinai Peninsula, Ras Muhammad, TAU P.10019, 2: 31.3-39.3 mm; TAU P.10069, 3: 22.6-31.7 mm.

Archamia bilineata
Plate 4B, C

Archamia bilineata Gon & Randall, 1995: 546, Fig. 3 (El Hamira, Egypt, Gulf of Aqaba; holotype, BPBM 21514).

DIAGNOSIS: Dorsal fin VI + I,9, anal fin II,12-14(one of 10 with 14); pectoral-fin rays 13-14 (usually 13); total gill-rakers 5-6 + 15-17 = 21-23; developed rakers 3-4 + 15-17; ceratobranchial rakers 10-11 (one of 10 with 10). Preopercle ridge smooth, the edge serrate on ventral part and around angle, its vertical part smooth. Body depth 3.1-3.3 in SL, and body width 2.0-2.2 in body depth; eye diameter 2.8-3.1, and interorbital width 4.5-4.8 in head length; length of first dorsal spine 1.45 in length of second spine; caudal-peduncle length 4.3-4.8 in SL. Largest specimen, 37.4 mm.

Colour in alcohol: body pale brown with 2 dark brown stripes; first from top of snout, above eye and lateral line, and ending under second dorsal-fin base; second stripe from tip of snout, through eye and along middle of body, ending near dark caudal spot; thin dark line on each side of ventral surface of caudal peduncle, from caudal-fin base to rear end of anal-fin base, continuing as somewhat wider dusky subcutaneous band along anal-fin base; caudal spot black, its diameter 1.6-2.0 in peduncle depth; line of melanophores from occiput to first dorsal-fin origin; fins pale; peritoneum with dark spots of various sizes; intestine with smaller and more numerous dark spots.

Colour when fresh: body translucent white, but silvery on abdomen and lower part of head; dark stripe from top of snout, above eye and lateral line, to below second dorsal-fin base; midlateral dark stripe from tip of snout, through eye and opercle, tapering out before dark caudal spot; dark line on underside of caudal peduncle and along anal-fin base as in preserved specimens; caudal spot black, sometimes surrounded by yellow.

DISTRIBUTION: Endemic to the Red Sea.

REMARKS: In a 29 mm specimen, the mid-lateral stripe ends above middle of pectoral fin. The upper stripe consists of individual melanophores in a line starting above eye and ending under first dorsal fin.

The underwater photograph in Plate 4B is provisionally identified as this species noting the differences from the fresh type (Plate 4C). The colour of preserved *Ar. bilineata* resembles that of *Ar. pallida* Gon and Randall, (1995) known from Oman. The latter species differs from *bilineata* in having more pectoral rays (14-15 versus usually 13 in *bilineata*) and a smaller caudal spot (spot diameter 3.5-4.35 versus 1.6-2.0 in peduncle depth). In addition, the posterior edge of the maxilla is straight in *bilineata*, but indented in *pallida*.

Apogon bilineata was collected by us on a coral knoll at 12 m.

MATERIAL EXAMINED: 11 specimens, 23.5-37.4 mm. Egypt, Gulf of Aqaba, El Hamira, BPBM 21514, 31 mm, holotype. Paratypes: (also from El Hamira): BPBM 36452, 2: 28.9-37.4 mm; HUJ 17822, 30.4 mm; RUSI 46950, 31.8 mm; USNM 331828, 29.6 mm. Non-types from El Hamira: MNHN 1977-826, 3: 29.7-30.6 mm. Sudan, BMNH 1960.3.15.284-285, 2: 23.5-24.4 mm.

Archamia fucata
Plate 4D

Apogon fucatus Cantor, 1849: 986 (Sea of Pinang, Malaysia; holotype, BMNH 1860.3.19.353).
Archamia irida Gon & Randall, 1995: 543, Fig. 2 (El Tûr, Gulf of Suez, Red Sea; holotype, BPBM 18184).

DIAGNOSIS: Dorsal fin VI + I,9, anal fin II,15-17; pectoral-fin rays 13-14 (usually 14); lateral-line scales 25 + 4; median predorsal scales 6-7 (usually 6); total gill-rakers 5-7 + 15-17; developed rakers 3-4 + 15-17; ceratobranchial rakers 10-11 (usually 11). Preopercle

ridge smooth except for a flat, blunt triangular spine at its angle; ventral edge and angle of preopercle serrate, the rear edge smooth or with several minute serrae on lower half. Body depth 2.3-2.4 in SL, and body width 2.35-2.5 in body depth; head length 2.5-2.7 in SL; snout length 4.4-5.0, eye diameter 2.7-3.1, interorbital width 3.9-4.3, and upper-jaw length 2.0-2.1, all in head length; length of first dorsal spine 2.1-3.0 in length of second spine; caudal-peduncle depth 1.0-1.2 in its length, and peduncle length 5.3-6.1 in SL. Largest specimen, 69.4 mm.

Colour in alcohol: body pale brown to brown with 21-23 narrow, dusky bars; cheek and top of head usually with dark brown spots, those on cheek larger; short, dark brown stripe from tip of jaws to antero-ventral edge of eye; another, less distinct stripe from tip of snout to antero-dorsal edge of eye; area between stripes usually pale; tip of first dorsal fin dusky; otherwise fins pale; caudal spot large, diameter 1.4-1.75 in peduncle depth; proximal part of gill-rakers of at least upper limb blackish; peritoneum with dark spots of various sizes; intestine dark brown.

Colour in life: similar to colour in alcohol, the narrow bars on body orange; lower part of head with variable amount of yellow, sometimes extending posteriorly to breast; stripes on snout iridescent blue, continuing above and below pupil to rear edge of eye; part of snout between blue stripes yellow to pale brown; second dorsal and anal fins usually with faint orange basal stripe. Randall (1995) provided a photograph of this species from Oman.

DISTRIBUTION: Red Sea to Inhaca Island, Mozambique and east to Samoa; in the western Pacific, from the Ryukyu Islands to New Caledonia.

REMARKS: This relatively common species was first reported from the Red Sea by Smith (1961). The combination of 15-17 anal-fin rays, large caudal spot, and 21-23 narrow dusky bars separates it from all other Red Sea species of *Archamia*. Gon & Randall (1995) described *A. irida* from 7 small, sexually immature specimens collected at El Tûr in the Gulf of Suez. They gave the translucent, unmarked body, the small dark caudal spot and a relatively short 1st dorsal spine as a diagnostic character combination and related *irida* to *Archamia bleekeri* (= *Archamia goni* Chen & Shao, 1993). A recent examination of the colour slide of the freshly collected holotype of *irida* under a microscope revealed traces of many narrow curved orange lines on the body. These lines, the length of the 1st dorsal fin (2.05-2.2 in 2nd spine) and the number of anal-fin rays (15-17) compel us to re-identify the specimens of *irida* as juveniles of *fucata*.

Archamia fucata is found in aggregations or as single individuals near coral or rocky reefs from the shallows to depths of at least 15 m.

MATERIAL EXAMINED: 42 specimens, 26.4-69.4 mm. Egypt, Gulf of Aqaba, Nuweiba, TAU P.8690, 2: 30.1-31.0 mm; Dahab, TAU P.3403, 54.5 mm; Shurat el Mankata, TAU P.4424, 14: 26.4-69.4 mm; south end of the Sinai Peninsula, Ras Muhammad, BPBM 18169, 57 mm; USNM 276650, 20 (of 34): 46.5-66.0 mm. Sudan, Sanganeb Atoll, BPBM 20344, 58 mm; Towartit Reef, BPBM 27429, 3: 56-58 mm.

Archamia lineolata
Plate 4E, F

Apogon lineolatus Cuvier, 1828: 160 (Red Sea; syntypes ZMB 66).

DIAGNOSIS: Dorsal fin VI + I,9, anal fin II,12-14; pectoral-fin rays 13-15; lateral-line scales 25 + 3-4 (usually 28); median predorsal scales 5-7; total gill-rakers 6-7 + 15-17; developed rakers 3-4 + 15-17; ceratobranchial rakers 10-11 (usually 11). Preopercle ridge smooth except for a flat, blunt triangular spine at its angle; preopercle edge serrate. Body depth 2.4-2.5 in SL, and body width 2.3-2.4 in body depth; head length 2.4-2.6 in SL; snout length 4.3-5.2, eye diameter 2.7-2.8, interorbital width 3.9-4.2, and upper-jaw length 1.85-2.15, all in head length; length of first dorsal spine 1.9-2.45 in length of second spine; caudal-peduncle depth 1.25-1.45 in its length, and peduncle length 5.0-5.4 in SL. Largest specimen, 53.3 mm; smallest mature female, 46.4 mm.

Colour of adults in alcohol: body pale brown to brown with 10-13 narrow, dark brown bars; cheek and top of head usually with dark brown spots, those on cheek larger; short dark brown stripe from tip of snout to anterior edge of eye; tip of jaws dark brown; anterior three spines (at least) of first dorsal fin with dark spots, tip of fin may be darker; spine and first ray of second dorsal fin sometimes dusky; otherwise fins pale; caudal spot large, 1.4-1.7 in caudal-peduncle depth; peritoneum and intestine with small dark brown spots.

Colour in life: body translucent with dusky orange bars and caudal spot as described; bars sometimes reddish; dark stripe edged in iridescent blue from tip of snout and jaws to eye; blue lines continue above and below pupil to posterior edge of eye; leading edge of dorsal fins dusky to brown.

DISTRIBUTION: Endemic to the Red Sea.

REMARKS: We found 12 (of 20 specimens) with 1-4 small teeth along the middle of the tongue. The number of dark vertical bars on the body increases with growth. A 24.2 mm fish has 6 bars, and specimens 28.3 and 32.3 mm have 7 and 9 bars, respectively. The bars seem to develop from the front of the body posteriorly.

Archamia lineolata superficially resembles *fucata*, but the latter has more anal-fin rays (15-17), and 21-23 narrower and fainter bars.

Although both Lachner (1951) and Smith (1961) recognised *Archamia lineolata*, they erred in placing *Ar. macroptera* (Cuvier), a western Pacific species, in its synonymy. *Ar. macroptera* has the same number of anal

soft rays as *lineolata*, but it has numerous narrow orange bars like *fucata*. The three specimens of *Archamia lineolata* from Durban reported by Gon (1986a) are a new species described by Gon & Randall (in press).

The specimens from Tiran Island were collected in 1 m depth. Inhabits dark caves and crevices of the coral reef; usually seen at night alone or in small groups.

MATERIAL EXAMINED: 35 specimens, 23.5-53.3 mm. Egypt, Gulf of Aqaba, north of Shurat el Mankata, TAU P.8685, 9: 31.5-36.0 mm; south end of Sinai Peninsula, BPBM 18203, 2: 23.5-24.0 mm; BPBM 18197, 34 mm; Tiran Island, RUSI 59392, 5: 46.5-52.5 mm; Sanafir Island, HUJ 11323, 46.4 mm; El Ghardaqa, USNM 166969, 15: 24.2-47.6 mm. Sudan, Towartit Reef, BPBM 27430, 2: 50.0-53.3 mm.

Archamia macroptera: Indonesia, Java, MNHN 8752, 64.3 mm (syntype).

Cercamia eremia
Plate 4G

Rhabdamia eremia Allen, 1987: 4, Fig. 2 (South Murion Id, Western Australia; holotype, WAM P25815-020).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,12; pectoral-fin rays 10; lateral-line scales 23; scales weakly ctenoid; median predorsal scales 5-6; gill-rakers 1 + 11 or 12. Preopercle ridge with small broad-based spine at angle; angle of preopercle edge with 2-4 (usually 2) short spines; posttemporal with small spine. No canines; no palatine teeth. Body elongate, the depth 3.95-5.0 in SL, and compressed, its width about half its depth; head length 2.45-2.8 in SL; snout 3.5-3.9 and eye diameter 3.6-4.7 in head length; interorbital space flat, 4.9-6.4 in head length; upper-jaw length 1.9-2.2 in head length; caudal-peduncle long, its length 3.05-3.6 in SL; caudal-peduncle depth 2.6-3.1 in peduncle length; caudal fin forked. Largest specimen, 52 mm SL, from Japan.

Colour in alcohol: body pale yellowish with scattered melanophores on head; peritoneum dusky.

Colour in life: translucent pinkish grey with numerous well spaced red dots on head and body; few melanophores on postorbital head and over brain; eyes iridescent blue dorsally; caudal vertebrae visible, outlined in red; body cavity mainly blackish.

DISTRIBUTION: Red Sea, eastern Indian Ocean (Christmas Island), Australia and Japan.

REMARKS: Allen (1987) described *eremia* in the genus *Rhabdamia* from material from Western Australia, Great Barrier Reef, Christmas Island (Indian Ocean), and the Red Sea (WAM P25793-003, 6: 25-31 mm, from near Jeddah, Saudi Arabia). Randall and Smith (1988) reclassified *eremia* in their new genus *Cercamia*. Hayashi (1991) redescribed the species and studied the osteology, based on specimens from Japan.

Allen named this species from the Greek *eremos*, meaning solitary, in reference to its occurring as solitary individuals rather than in aggregations, which are typical of species of the genus *Rhabdamia*. It occurs on shallow coral reefs, usually in the vicinity of caves, and has been observed alive only at night.

MATERIAL EXAMINED: Egypt, Gulf of Aqaba, 1 km north of Gezirat Faraun, BPBM 18219. 2: 29-30 mm.

Cheilodipterus lachneri
Plate 4H, I

Cheilodipterus lachneri Klausewitz, 1959: 260, Fig. 11 (Ghardaqa, Egypt; holotype, SMF 4616).

DIAGNOSIS: Dorsal fin VI+I,9; anal fin II,8; pectoral-fin rays 13-14 (usually 14); lateral-line scales 24-25 + 3 - 4 (usually 28); developed gill-rakers 2-3 + 9-11; ceratobranchial rakers 8-9 (usually 8). Preopercle ridge smooth, the edge with minute serrae. Body depth 3.1-3.9 and head length 2.3-2.8 in SL; snout length 3.9-4.7, eye diameter 3.1-3.6, interorbital space 4.3-5.8 and upper-jaw length 1.9-2.2, all in head length; large canine teeth in both jaws; 1-2 large canines on each side of lower jaw symphysis; first dorsal-spine length 1.4-1.8 in second dorsal spine; caudal-peduncle depth 1.6-2.5 in its length, peduncle length 3.8-4.7 in SL. Largest specimen, 121 cm.

Colour in alcohol: body pale brown to brown, with 9-13 dark brown stripes (in fishes larger than 8 cm SL); stripes subequal to or narrower than interspaces, may vary in intensity, and not reaching caudal-fin base; juveniles with pupil-size or larger dark caudal spot; spot diameter 1.3-2.8 in peduncle depth; in subadult and adult fish, the caudal-fin base may become progressively darker above and below caudal spot, sometimes forming a dark bar that completely obscures the caudal spot; there is usually a pale area between caudal spot, or bar, and posterior ends of body stripes; first dorsal fin dusky with dark tip; second dorsal, anal, and caudal fins pale to dusky; pectoral and pelvic fins pale, but pelvic spine usually with some dark pigment; second dorsal fin sometimes with faint basal stripe; peritoneum silvery with scattered dark spots of various sizes; intestine pale.

Colour in life: body brownish grey with 9-13 dark brown stripes of alternating width and intensity; juveniles with dark brown spot on middle of caudal peduncle larger than pupil size and encircled with yellow; in large fish the dark caudal spot may expand to form a bar around peduncle; distinct snow white area between caudal spot (or bar) and posterior ends of body stripes; distal part of first dorsal fin blackish; upper- and lowermost caudal rays dusky, but not as dark as body stripes; other fins pale with reddish hue; snout with yellow tinge (yellow pigment may be absent in large adults).

DISTRIBUTION: Endemic to the Red Sea.

REMARKS: The number of developed gill-rakers decreases and the number of body stripes increases with growth (Gon 1993: tables 9, 10, respectively).

Cheilodipterus lachneri is very similar to *C. lineatus*. The only non-overlapping character is the size of the caudal spot (Gon 1993), which is larger in *lachneri* (1.3-2.8 in peduncle depth, versus 3.4-4.6 in *lineatus*). Unfortunately, in both species the dark caudal spot may be hidden by the dark bar on the caudal-fin base, though more often in *lineatus*. In addition, *lachneri* has fewer dark body stripes than *lineatus*, but similar-size fish must be compared (Gon 1993: tables 10, 12).

The similarity between *lachneri* and *lineatus* led to misidentifications, resulting in an incorrect geographical range for *lachneri*. Within the Red Sea, *lachneri* is apparently rare south of the Gulf of Aqaba. This species is found on outer coral and rocky reefs in caves, holes or under ledges to depths of at least 15 m.

MATERIAL EXAMINED: 68 specimens, 36.6-120.7 mm SL. Red Sea, RUSI 19454, 84.5 mm. Gulf of Aqaba (Israel, Jordan and Egypt), Eilat, HUJ 5232, 120.7 mm; HUJ 5252, 67 mm; HUJ 5398, 51 mm; HUJ 5748, 3: 39.7-60.1 mm; HUJ 10435, 87.1 mm; HUJ 11522, 5: 70.2-89.6 mm; HUJ 11528, 13: 65.6-120.6 mm; Aqaba, SMF 16177, 36.6 mm; Faraun Island, HUJ 11526, 7: 86.0-103.5 mm; El Hamira, HUJ 11523, 107.2 mm; HUJ 11527, 50.2 mm; Marsa Ktana, TAU 7503, 2: 99.1-113.8 mm; TAU 7767, 55 mm; Marsa Abu-Samra, HUJ 6242, 2: 82.9-103.8 mm; Ras Burqa, TAU 4423, 5: 50.8-59.8 mm; Nuweiba, BPBM 13904, 111 mm; BPBM 20826, 2: 107.3-114.3 mm; HUJ 10999, 7: 65.6-114.8 mm; Nabek, TAU 7765, 105.5 mm; TAU 8638, 115 mm. Egypt, south end of Sinai Peninsula, Sharm al Sheikh, HUJ 11524, 63.5 mm; RUSI 19453, 60 mm; Ras Muhammad, HUJ 6246, 92 mm; Tiran Island, TAU 8635, 2: 87.9-95.7 mm; Ghardaqa, SMF 4616, 102.5 mm, holotype of *Cheilodipterus lachneri*. Sudan, BPBM 20711, 3: 86.9-105.4 mm; BPBM 34627, 51.3 mm.

Cheilodipterus lineatus

Plate 4J, Plate 5A

Perca lineata Forsskål, 1775: 42 (Jeddah, Saudi Arabia; holotype, ZMUC, lost; preoccupied by *Perca lineata* Linnaeus, 1758 [= *Plectorhinchus lineatus*]).

Perca arabica Gmelin, 1788: 1312 (replacement name for *Perca lineatus* Forsskål).

Cheilodipterus caninus Smith, 1949b: 205, Pl. 22, Fig. 472 (Inhaca Id, Mozambique; holotype, RUSI 352).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 13-14 (usually 14); lateral-line scales 24-25 + 3-4 = 28; developed rakers 2 + 8-11; ceratobranchial rakers 7-8 (usually 8). Preopercle ridge smooth, the edge with small to minute serrate, but its uppermost third sometimes smooth. Body depth 2.8-3.7 and head length 2.3-2.8 in SL; snout length 3.5-4.8, eye diameter 2.8-3.8, interorbital space 4.5-6.0, upper-jaw length 1.8-2.0, all in head length; large canine teeth in both jaws; 1-2 large canines on each side of lower jaw symphysis; first dorsal-spine length 1.5-2.4 in second dorsal spine; caudal-peduncle depth 1.3-1.8 in its length, peduncle length 3.8-5.0 in SL. Largest specimen, 18 cm.

Colour in alcohol: body pale brown to brown, with 13-16 dark brown stripes (in fishes larger than 65 mm SL); stripes subequal to or narrower than interspaces and not reaching caudal-fin base; juveniles with pupil-size or smaller dark caudal spot, its diameter 3.4-4.6 in peduncle depth; caudal-fin base usually progressively darker in larger fish, and in fish over 10 cm the caudal peduncle may be completely encircled by dark bar; intermediate conditions of incomplete bars and different pigment intensity exist; depending on bar condition, caudal spot may be distinct to indiscernible; there is usually a pale area between dark bar and posterior ends of body stripes; all fins dusky, but first dorsal fin may be darker, with black membrane between its anterior spines; sometimes faint basal dark stripe along second dorsal fin; peritoneum silvery with scattered small dark spots; intestine pale.

Colour in life: pale brown with 13-16 dark brown stripes. In large fish, dorsal stripes may be irregular; small dark spot encircled by yellow area on caudal peduncle; spot sometimes expanded to form dark brown bar around caudal peduncle; distinct snow white bar between dark caudal spot (or bar) and posterior ends of body stripes; first dorsal fin dusky to dark brown; other fins pale (in young) to dusky (in adults), but never as dark as first dorsal fin; snout somewhat darker than body. Randall (1995) photographed this species in Oman.

DISTRIBUTION: Red Sea, east coast of Africa south to Inhaca Island, Mozambique, also Oman, Pakistan and Seychelles.

REMARKS: The number of developed gill-rakers decreases, and the number of body stripes increases with growth (Gon 1993: tables 11, 12). Small juveniles (HUJ 11980, 25-31 mm) collected in the southern Red Sea have a colour pattern similar to that of *C. novemstriatus*, i.e. 4 stripes, a small dark mid-caudal spot and a smaller, faint dark spot on the dorsal surface of the caudal-fin base.

The first valid species of *Cheilodipterus* was described by Forsskål (1775) from the Red Sea. Probably unaware of Linnaeus' (1758) name, he unfortunately called it *Perca lineata*. Evidently recognizing the homonymy of these names, Gmelin (1788, p. 1319) kept *P. lineata* Linnaeus (1758), and renamed Forsskål's *lineata* as *P. arabica* (p. 1312). Fricke (1999) concurred with Gmelin's view even though it has since been proved that Linnaeus' fish is not an apogonid (Smith 1961) but the haemulid species *Plectorhinchus lineatus* (Fernholm & Wheeler 1983). However, replacing *lineatus* Forsskål with *arabicus* Gmelin would undermine nomenclatural stability. We follow Gon (1993) and Article 23.9.5 of the International Code of Zoological Nomenclature (1999) in maintaining usage of *Cheilodipterus lineatus* (Forsskål).

In the Red Sea, the northernmost record of *arabicus* is Tiran Island; it is not yet known from the Gulf of Aqaba (Gon 1993). It is found on shallow coral and rocky reefs down to at least 10 m.

MATERIAL EXAMINED: 69 specimens 25.0-110.1 mm SL. Red Sea, MNHN 9140, 85 mm (collected by Rüppell); MNHN 9141, 101 mm (collected by Ehrenberg); SMF 4713, 80.4 mm (collected by Rüppell, paratype of *Cheilodipterus lachneri*; ZMB 81, 90.3 mm (collected by Ehrenberg); ZMB 82, 98.4 mm (collected by Ehrenberg). Egypt, Tiran Island, TAU 10334, 85.4 mm; TAU 8637, 100.1 mm. Sudan, Towartit Reef, BPBM 27432, 69.5 mm; Port Sudan, BPBM 20711, 2: 89-103 mm; Suakin Harbour, BPBM 17916, 61 mm. Eritrea, HUJ 11536, 12: 55.8-110.1 mm; Dahlak Archipelago, HUJ 11980, 15: 25-31 mm; TAU 4543, 66.5 mm; Museri, TAU 4418, 11: 58.5-98.5 mm; TAU 4448, 6: 63.0-92.2 mm; TAU 4449, 13: 46.8-105.5 mm; TAU 4450, 88.1 mm. Mozambique, Inhaca Island, RUSI 352, 110 mm (holotype of *Cheilodipterus caninus* Smith).

Cheilodipterus macrodon
Plate 5B, C

Cheilodipterus lineatus (non Forsskål) Lacepède, 1801: 539, Pl. 34, Fig. 1 (Indian Ocean; unavailable name; secondary homonym of C. lineata [Forsskål]).

Centropomus macrodon Lacepède, 1802: 252 (Mauritius; holotype, MNHN 9143).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 12-14 (usually 13); lateral-line scales 24-25 + 3-5 = 27-29 (usually 28); developed gill-rakers 1-2 + 6-9; ceratobranchial rakers 6-7 (usually 7). Preopercle ridge smooth, the edge serrate, serrae becoming relatively smaller with increasing fish length; this edge may become nearly smooth in very large individuals; serrae sometimes scarce or absent on ventral edge of preopercle. Body depth 3.1-3.8 and head length 2.4-2.7 in SL; snout length 3.7-4.8, eye diameter 3.0-3.5, interorbital space 5.8-6.7 and upper-jaw length 1.9-2.0, all in head length; large canine teeth in both jaws; 1-2 large canines on each side of lower jaw symphysis; first dorsal-spine length 1.5-1.7 in second dorsal spine; caudal-peduncle depth 1.4-2.3 in its length, peduncle length 4.0-4.6 in SL. Largest specimen, 20 cm, from Oman.

Colour in alcohol: body brown with 7-10 dark brown stripes (in fish larger than 8 cm SL), usually wider than interspaces; snout somewhat darker than body; large dark caudal spot in young, covering most of caudal peduncle and gradually expanding into a bar in larger fish; bar may fade, leaving caudal peduncle pale in very large specimens (larger than 15 cm SL); first dorsal fin dark brown, frequently with black tip; spine and anterior 1-2 rays of second dorsal and anal fins dark brown, the posterior rays pale to dusky; pelvic fins dusky to dark brown; upper- and lowermost caudal rays dusky to dark brown; peritoneum silvery with scattered dark spots of various sizes; intestine pale.

Colour in life: body pale brown with 7-10 dark brown stripes broader than pale interspaces; either large, dark brown spot or dark brown bar around caudal peduncle; distinct white area separating dark caudal spot (or bar) from posterior ends of body stripes; dark caudal bar in large adults may be faded, and white area sometimes mottled with brown spots; first dorsal fin dusky to dark brown with blackish distal section; pelvic fins, and upper- and lowermost caudal rays, as dark as body stripes; pelvic fins frequently with darker tips and white anterior edge; rays of other fins reddish brown to brown, but membranes transparent with reddish hue; snout, eye, interorbital space, and occiput of juveniles and young adults usually with yellow tinge. Randall (1995) and Kuiter (1998) photographed this species in Oman and the Maldive Islands, respectively.

DISTRIBUTION: tropical Indo-Pacific region, but not at the Hawaiian Islands.

REMARKS: The number of developed gill-rakers in *Cheilodipterus macrodon* decreases with growth (Gon 1993: table 13). This is the largest species in the genus, attaining 20 cm SL (Gon 1993).

There are three large species of *Cheilodipterus* in the Red Sea, i.e. *lineatus* (Forsskål), *lachneri* Klausewitz, and *macrodon* Lacepède. Smith (1961), and Fricke (1999) placed *macrodon* in the synonymy of *lineatus* Lacepède, but Gon (1993) showed that the latter is unavailable (see also Remarks for *lineatus* above). Dor (1984) listed both *macrodon* and *lineatus* of Lacepède as valid species, thus creating the incorrect impression that there are four large species in the Red Sea.

C. macrodon is common on outer reef slopes in 4-30 m depth, sheltering in caves and under ledges.

MATERIAL EXAMINED: 12 specimens, 30.0-164.1 mm SL. Gulf of Aqaba (Jordan and Egypt), Aqaba, SMF 16178, 2: 44.85-56.8 mm; Marsa el Muqebila, BPBM 20850, 164.1 mm; BPBM 31967, 30 mm; Nuweiba, HUJ 11000, 118.5 mm; Ras Abu Galum, HUJ 5787, 71.1 mm. Egypt, south end of Sinai Peninsula, Sharm al Sheikh, HUJ 14601, 66.4 mm. Sudan, Port Sudan, BPBM 20732, 5: 74.3-148.4 mm.

Cheilodipterus novemstriatus
Plate 5D, E

Apogon novemstriatus Rüppell, 1838: 85, Pl. 22, Fig. 1 (Red Sea; holotype, SMF, lost).

Paramia bipunctata Lachner, 1951: 604, Pl. 18, Fig. D (Tarut Bay, Ras Tannurah, Saudi Arabia, Persian Gulf; holotype, USNM 147944).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 11-13; lateral-line scales 24 + 3; developed gill-rakers 2-3 + 9-12; ceratobranchial rakers 8-9. Preopercle ridge smooth, the edge serrate on vertical part and around angle, but smooth on ventral part. Body depth

3.2-3.7 and head length 2.3-2.8 in SL; snout length 4.0-5.0, eye diameter 2.8-3.4, interorbital space 6.2-7.05 and upper-jaw length 2.0-2.3, all in head length; small canine teeth in both jaws; no canines at lower jaw symphysis; first dorsal-spine length 1.3-1.7 in second dorsal spine; caudal-peduncle depth 1.9-2.5 in its length, peduncle length 3.8-4.7 in SL. Largest specimen, 65 mm.

Colour in alcohol: body pale brown, with 4 dark brown stripes; short, arched stripe from pelvic-fin base to area in front of pectoral-fin base; mid-ventral stripe from under angle of preopercle to anus, where it splits into 2 stripes reuniting again behind anal-fin base and continuing as one stripe on ventral surface of caudal peduncle, sometimes ending in an indistinct spot; dark stripe from tip of lower jaw to rear edge of opercle on each side of ventral surface of head; dark brown to black caudal spot, its diameter 2.1-2.8 in peduncle depth; distinct dark spot on dorsal surface of caudal peduncle; front of first dorsal fin dark; other fins pale or slightly dark-pigmented, except for pelvic fins which are as dark as first dorsal fin; peritoneum silvery with scattered dark spots on ventral and dorsal parts, but not on sides; intestine pale.

Colour in life: body silvery grey with 4 black stripes; 5th stripe passing along anal-fin base, continuing to pelvic-fin base, at which point it curves upward to end in front of pectoral-fin base (the part of this stripe anterior to anal-fin base is often indistinct); black caudal spot oval, encircled by yellow area; distinct black spot on dorsal surface of caudal peduncle; area between yellow pigment and this spot appears as distinct white mark; fins pale, except dusky leading edge of first dorsal and pelvic fins. Randall (1995) photographed this species in Oman.

DISTRIBUTION: Red Sea to Persian Gulf (Randall, 1995).

REMARKS: The number of developed gill-rakers in *C. novemstriatus* decreases during growth (Gon 1993: table 14). The decrease is less than in other species and involves at most the partial resorption of 1-2 gill-rakers.

Gon (1993: 35) recovered *C. novemstriatus* from the synonymy of *C. quinquelineatus*. His listing of this species in the synonymy of *quinquelineatus* (Gon 1993: 49) is a *lapsus calami*. *C. novemstriatus*, *C. quinquelineatus*, and *C. pygmaios* are frequently confused due to the similarity in colour pattern. *C. novemstriatus* is distinct in having the lowermost stripe on the body curving upward from the pelvic-fin base to the area in front of the pectoral-fin base (see also Remarks for *pygmaios* and *quinquelineatus*).

This species is commonly found in shallow protected water (1-10 m) in front of holes and under ledges of coral or rocky reefs; it is frequently seen sheltering among the spines of sea-urchins of the genus *Diadema* in groups of up to about 30 individuals, depending on the size of the sea-urchin and the length of the fishes.

MATERIAL EXAMINED: 41 specimens, 30.6-65.0 mm SL. Gulf of Aqaba (Israel and Egypt), Eilat, BPBM 18369, 41 mm; Fjord, HUJ 13635, 40.1 mm; Nuweiba, BPBM 30886, 4: 42.8-46.2 mm; HUJ 9402, 7: 47.0-58.5 mm. Egypt, Tiran Island, TAU 8630, 2: 41.9-44.7 mm; Sanafir Island, HUJ 11532, 42 mm; Gulf of Suez, El Tûr, HUJ 5766, 5: 38.1-65.0 mm; HUJ 11533, 49 mm. Sudan, Port Sudan, BPBM 19712, 32.8 mm. Saudi Arabia, BPBM 33502, 43.4 mm. Ethiopia, HUJ 6218, 3: 30.6-45.5 mm; HUJ 13636, 14: 30.6-40.1 mm.

Cheilodipterus pygmaios

Plate 5F, G

Cheilodipterus pygmaios Gon, 1993: 45, Fig. 17, Pl. III B (Towartit Reef, Sudan; holotype, RUSI 29409).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 10-11 (usually 11); lateral-line scales 24+ 3; developed gill-rakers 2-3 + 9-12 = 12-15; ceratobranchial rakers 8-10. Preopercle ridge smooth; preopercle edge with a few minute serrae at angle and on middle of vertical part. Body depth 3.6-4.0 and head length 2.3-2.7 in SL; snout length 4.0-4.6, eye diameter 2.9-3.6, interorbital space 6.5-7.5 and upper-jaw length 1.9-2.1, all in head length; small canine teeth in both jaws, none at lower jaw symphysis; first dorsal-spine length 1.3-1.5 in second dorsal spine; caudal-peduncle depth 1.95-2.6 in its length, peduncle length 3.9-4.3 in SL. Largest specimen, 50 mm; smallest mature female is about 30 mm.

Colour in alcohol: body brown with 5 dark brown stripes usually narrower than interspaces; mid-ventral dark stripe from isthmus to anus; dark caudal spot fairly large and surrounded by pale ring, its diameter 1.6-2.5 in peduncle depth; small dark spot on ventral and dorsal surfaces of caudal-fin base (ventral dark spot may be less distinct); first dorsal fin pale or anterior two spines and their membrane dusky; other fins pale, but pelvic fins may be lightly dark-spotted; upper and lower caudal-fin rays dark-spotted at their bases; peritoneum with few scattered dark spots ventrally; intestine pale.

Colour in life: body pale brownish grey with 5 dark brown to black stripes narrower than interspaces; black caudal spot about pupil size or slightly larger; small black spot on dorsal surface and another, less distinct, on ventral surface of caudal peduncle; caudal spot encircled by yellow except for small white area on postero-dorsal section of caudal peduncle; snout darker than body; anterior two dorsal spines and tip of third spine dark with dusky membrane; posterior spines of first dorsal fin dusky with transparent membrane; spines of second dorsal and anal fins, and leading edge of pelvic fins dusky to dark, but not as dark as dorsal fin spines; fins otherwise pale.

DISTRIBUTION: Red Sea endemic.

REMARKS: The number of developed gill-rakers in

pygmaios decreases during growth (Gon, 1993: table 21).

Cheilodipterus pygmaios combines features of the colour patterns of two very similar species. The arrangement of the body stripes is the same as *quinquelineatus*, whereas the dark spot on the dorsal surface of the caudal peduncle is similar to *novemstriatus*. The combined characters distinguish it from the latter two species. In addition, *pygmaios* has fewer pectoral rays, 10-11 versus 11-13 in the other two species (Gon, 1993).

Cheilodipterus pygmaios is common on coral reefs, down to at least 30 m, and is frequently seen in front of dark holes and under ledges together with *novemstriatus* and/or *quinquelineatus*. It also seeks shelter among the spines of *Diadema* sea-urchins.

MATERIAL EXAMINED: 43 specimens 21.3-50.0 mm SL. Egypt, Gulf of Aqaba, Fjord, HUJ 11529, 5: 35.9-47.2 mm; HUJ 13576, 2: 31.5-32.4 mm; El Hamira, BPBM 30358, 42.8 mm; HUJ 5768, 4: 30.5-44.4 mm; HUJ 6236, 2: 40.6-43.3 mm; HUJ 11530, 49.6 mm; Ras Burqa, USNM 276589, 50 mm; USNM 276590, 2: 40.3-46.9 mm; north of Nuweiba, BPBM 30893, 3: 36.8-38.9 mm; El Hibek, HUJ 14603, 3: 42.5-45.7 mm. Sudan, Towartit Reef, RUSI 29409, 43 mm (holotype); BPBM 27433, 8: 21.3-41.1 mm. Saudi Arabia, north of Jeddah, ANSP 163230, 4: 30.7-39.7 mm. Eritrea, Melita Bay, USNM 276591, 6: 30.6-34.1 mm.

Cheilodipterus quinquelineatus
Plate 5H

Cheilodipterus quinquelineatus Cuvier, 1828: 167 (Bora Bora, Society Ids; holotype, MNHN 9147).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 12-13; lateral-line scales 24 + 2-4; developed gill-rakers 1-2 + 7-12; ceratobranchial rakers 7-9. Preopercle ridge smooth, the edge serrate. Body depth 3.1-3.5 and head length 2.3-2.7 in SL; snout length 3.7-4.5, eye diameter 2.7-3.4, interorbital space 6.1-6.9 and upper-jaw length 1.9-2.3, all in head length; small canine teeth in both jaws, none at lower jaw symphysis; first dorsal-spine length 1.5-2.0 in second dorsal spine; caudal-peduncle depth 1.7-2.0 in its length, peduncle length 4.1-4.5 in SL. Largest specimen, 76.2 mm.

Colour in alcohol: body yellow to brown with 5 narrow dark brown stripes; dark caudal spot small, 3.9-5.0 in peduncle depth, and usually surrounded by a distinctly paler area; mid-ventral stripe from isthmus to anal-fin origin; anterior 3 dorsal-fin spines and their membrane dark; spine and first ray of second dorsal fin dusky; upper- and lowermost caudal-fin rays dusky to dark; other fins usually pale, but sometimes dusky; peritoneum with unevenly distributed dark spots of various sizes; side of body cavity usually pale; intestine pale.

Colour in life: body silvery grey to greyish brown with 5 black stripes; ventral stripe sometimes less distinct than upper 4 stripes; small black caudal spot encircled by yellow which may extend to dorsal surface of caudal peduncle; membrane between first two dorsal spines and distal part of membrane between second and third spines blackish; upper- and lowermost caudal rays dusky; other fins transparent. Randall (1995) provided an underwater photograph of this species from Oman.

DISTRIBUTION: tropical Indo-Pacific region, except the Persian Gulf and Hawaiian Islands.

REMARKS: The number of developed gill-rakers in *C. quinquelineatus* decreases during growth (Gon, 1993).

In its colour pattern, this species is similar to *Cheilodipterus novemstriatus* and *C. pygmaios*, but these two species always have a distinct dark spot on the dorsal surface of the caudal-fin base and sometimes on the ventral surface as well. In addition, *pygmaios* has fewer pectoral rays (10-11) and relatively broader body stripes. Gon (1993) noted that Red Sea *quinquelineatus* have 1-2 fewer developed gill-rakers and appear to attain a smaller maximum size than the western Indian Ocean population.

This species is common on protected rocky and coral reefs to 40 m. It occurs solitarily or in aggregations, taking shelter in branched coral, under ledges, among the spines of *Diadema setosum*, and in dark crevices.

MATERIAL EXAMINED: 61 specimens 16.9-76.2 mm SL. Egypt, Gulf of Aqaba, Fjord, HUJ 11531, 2: 70.5-71.3 mm; Marsa Ktana, TAU 7405, 36.5 mm; Tiran Island, TAU 8629, 5: 49.1-76.2 mm. Sudan, Port Sudan, BPBM 20726, 70 mm. Saudi Arabia, BPBM 30383, 60.2 mm; BPBM 30391, 16.9 mm. Eritrea, Dahlak Archipelago, HUJ 11534, 24: 40.3-75.5 mm; HUJ 11535, 26: 39.8-73.1 mm.

Foa fo
Plate 5I

Foa fo Jordan & Seale, 1905: 779, Fig. 5 (Cavite and Negros islands, Philippines; type specimens unknown).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 12; lateral-line incomplete, tubed scales 9-10 (usually 9); median predorsal scales 3; total gill-rakers 2-4 + 9-11 = 12-14; developed rakers 1 + 6-7; ceratobranchial rakers 6-7. Preopercle ridge and edge smooth, its ventral part poorly ossified and crenulate; supramaxilla present; palatines with teeth. Body depth 2.3-2.4 and head length 2.25-2.6 in SL; snout length 3.6-5.0, eye diameter 3.0-4.0, interorbital width 4.6-6.2, and upper-jaw length 1.8-1.9, all in head length; caudal-peduncle depth 1.3-1.6 in its length, and peduncle length 4.3-4.85 in SL. Caudal fin rounded. Largest specimen, 37.8 mm; smallest mature female and male, 25 and 25.8 mm, respectively; the male has a ball of eggs in the mouth.

Colour in alcohol: body brown, mottled with dark

brown spots of various sizes; some spots usually form 4-5 narrow bars (sometimes only part of bar is distinct), 1-2 under first dorsal fin, one under middle of second dorsal fin, one at about middle of caudal peduncle, and one at caudal-fin base; several specimens with faint, indistinct stripes radiating from eye; anterior nostril darker than area of snout around it; first dorsal and pelvic fins dark brown; second dorsal and anal fins dusky, or with scattered small dark spots; peritoneum and intestine pale.

Colour in life: unknown in the Red Sea. Specimens collected on seagrass bed at Inhaca Island, Mozambique have the body pale brown, mottled with brown and dark brown; 4 indistinct bars on body; dark brown stripe from tip of snout to eye; 2-3 indistinct stripes radiating from rear margin of eye; first dorsal and pelvic fins dark brown with pale, mottled leading edge; second dorsal, anal and caudal fins pale with several lines of spots across fin.

DISTRIBUTION: Red Sea, Mozambique, Philippines and Samoa.

REMARKS: Of the 7 nominal species referrable to the genus *Foa*, the descriptions of *Foa fo* and *Foa madagascariensis* Petit (1931), are closest to our Red Sea specimens of *Foa*. Smith (1961) doubted the validity of *Foa madagascariensis* because of inconsistencies in Petit's description, and the two syntypes are apparently lost (Bauchot & Desoutter 1986).

There is some confusion in the literature regarding the original description of *Foa fo*. The illustration of this species in the original description (Jordan & Seale, 1905: Fig. 5) is that of *Foa brachygramma*, from Hawaii, taken from Jordan and Evermann (1905: Fig. 82). The 2 type specimens were collected at Cavite and Negros Island, Philippines. A year later, Jordan and Seale (1906) described the species again as new and illustrated a specimen from Apia Samoa as the "type" (USNM 51735); they also mention the 2 specimens from the Philippines. The Samoan specimen is not part of the type series, and therefore cannot be considered as the holotype. Smith (1961), and Gon (1986a), used *Foa brachygramma* for western Indian Ocean *Foa*, but our Red Sea fish, as well as fresh *Foa* from Inhaca Island, Mozambique agree better with the illustration and colour description of *Foa fo* of Jordan and Seale (1906). In view of these problems, we provisionally identify our Red Sea material as *Foa fo*. T.H. Fraser and G.R. Allen, currently revising the genus *Foa*, are investigating specimens (CAS 109672) collected by Dr G.A. Lung in Cavite, Philippines, the type locality of *Foa fo*. These specimens may include one or both of the syntypes of this species (T.H. Fraser pers. comm.)

This genus was not previously reported from the Red Sea. It is rather rare in collections, and we found it either misidentified as *Apogonichthys perdix* or among unidentified apogonid material. *A. perdix* differs from *Foa fo* in having 14 pectoral rays, 4 median predorsal scales, a complete lateral line, and no palatine teeth. Both species may be found in seagrass beds, as well as in other protected habitats.

MATERIAL EXAMINED: 14 specimens, 18.4-37.8 mm. Israel, Gulf of Aqaba, Eilat, HUJ 11776, 5: 18.4-30.7 mm; TAU P.3398, 25.8 mm; TAU P.3399, 35.8 mm; TAU P.4544, 25 mm; TAU P.10039, 25.5 mm; TAU P.10085, 31 mm; TAU P.10086, 26.2 mm; TAU P.10087, 28 mm; TAU P.10094, 36.8 mm; TAU P.10100, 37.8 mm.

Fowleria aurita
Plate 5J

Apogon auritus Valenciennes in Cuvier & Valenciennes, 1831: 443 (Mauritius; holotype, MNHN 8760).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13; lateral-line scales 23 (the 23rd overlapping caudal-fin base), the first 9-10 with tubes; median predorsal scales 4-5 (usually 4); gill-rakers 2-3 + 10-13; developed rakers 1 + 5-6. Preopercle ridge and posterior edge smooth, the ventral edge membranous and crenulate. Body depth 2.6-2.95 and head length 2.35-2.5 in SL; snout length 4.0-4.45, eye diameter 2.7-4.4, interorbital width 4.9-7.6, and upper-jaw length 1.8-2.0, all in head length; villiform teeth in bands on jaws and vomer, but no teeth on palatines; caudal-peduncle depth 1.2-1.35 in peduncle length, and peduncle length 2.2-2.45 in SL; caudal fin rounded. Largest specimen examined, 64.5 mm SL, from the Gulf of Aden.

Colour in alcohol: body yellowish brown, a little darker dorsally; ocellated black spot on opercle nearly as large as eye; no markings in fins; peritoneum and intestine pale.

Colour in life: orangish to reddish brown or dark brown, the black spot on opercle rimmed with yellow (and sometimes an outer dark edge dorsally and posteriorly); fin rays reddish brown to brown, the membranes pale.

DISTRIBUTION: Red Sea and Oman south to Mozambique and east to the western Pacific where it ranges from Japan south to the Great Barrier Reef.

REMARKS: See Remarks for *Fowleria marmorata* and *variegata* for comparisons with *Fowleria aurita*.

Valenciennes (1831) described the holotype of *Apogon auritus* as having a black spot surrounded by silver on the opercle and the body brown without bands or spots; this is diagnostic for the species as described above.

The specimens from Eritrea (HUJ 6219 and TAU 4417) identified as *Fowleria isostigma* (Jordan and Seale) by Goren and Karplus (1980) are *F. aurita*.

Fowleria aurita is often found in seagrass beds or algal flats, but may also occur on reefs (usually well protected). Very cryptic and rarely seen, even at night.

MATERIAL EXAMINED: 10 specimens, 21.0-64.5 mm. Gulf of Aqaba (Israel and Egypt), Eilat, BPBM 19877, 2:

24-34.5 mm; north of Fjord, BPBM 18269, 2: 21-27 mm. Eritrea, Massawa, HUJ 6219, 25 mm; Museri, TAU 4417, 4: 34.5-50.0 mm. Gulf of Aden, Gulf of Tadjoura, Maskali Island, BPBM 21538, 64.5 mm.

Fowleria marmorata
Plate 6A

Apogonichthys marmoratus Alleyne & Macleay, 1877: 268, Pl. 5, Fig. 2 (Cape Grenville, Queensland; lectotype, AMS I.16311).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 14-15 (usually 15); lateral-line scales 23 (the 23rd overlapping caudal-fin base), first 7-10 with tubes; median predorsal scales 6; gill-rakers 2-3 + 10-14; developed rakers 1 + 5-6. Preopercle ridge and posterior edge smooth, the ventral edge membranous and crenulate. Body depth 2.7-3.1 and head length 2.35-2.5 in SL; snout length 4.4-5.0, eye diameter 3.3-3.5, interorbital width 7.5-9.5, and upper-jaw length 2.0-2.2, all in head length; villiform teeth in bands on jaws and vomer, but no teeth on palatines; caudal-peduncle depth 1.3-1.5 in peduncle length, and peduncle length 1.8-2.05 in SL; caudal fin rounded. Largest specimen examined, 44 mm SL, from the Chesterfield Islands, Coral Sea.

Colour in alcohol: body buff to light brown, with 10 to 12 brown bars on middle of body; small dark spots within dark bars on body; an ocellated, dark brown to black spot on opercle, with narrow brown rim (usually incomplete) around the pale edge; dark brown line from below eye to corner of preopercle; fins pale; peritoneum pale, except band of dark spots of various sizes along dorsal part of body cavity; intestine pale.

Colour in life: usually reddish brown, the fins red; otherwise, as described above.

DISTRIBUTION: Red Sea to Mozambique (Smith, 1961: 382, in part, Fig. 4, misidentified as *aurita*) east to the Line Islands, Marquesas Islands, and Society Islands.

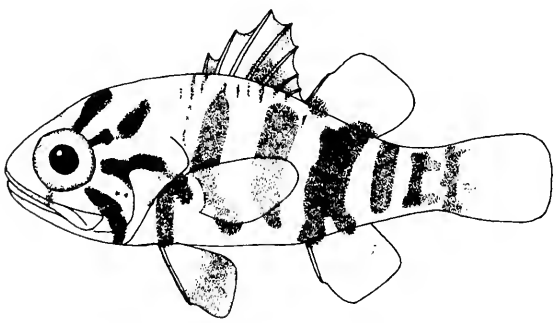

Figure 9. *Fowleria vaiulae*, 12.2 mm, juvenile, TAU 11408, Dahlak Archipelago, Eritrea.

REMARKS: Jordan and Seale (1906) recognized *Apogonichthys marmoratus* as valid, but Weber and de Beaufort (1929) and Fowler and Bean (1930) regarded it as a synonym of *Apogon auritus* (= *Fowleria aurita*). It is readily distinguished from *aurita* by the distinct dark bars on the body, in contrast to the nearly uniform colour of *aurita*. It is more easily confused with *variegata*, which often has irregular dark body bars (although indistinct due to the profusion of small dark spots). *Fowleria aurita* and *variegata* differ from *marmorata* by having modally 13 pectoral rays (modally 15 in *marmorata*), and 4 median predorsal scales (6 in *marmorata*).

We have collected no *Fowleria marmorata* in the Red Sea, but Daniel Golani kindly sent a specimen (HUJ 18345) from El Tûr, Gulf of Suez, and Menachem Goren sent 8 specimens (TAU 7376, identified as *aurita* by Goren and Karplus, 1980) from Ras Muhammad.

Unlike the other *Fowleria* species, *F. marmorata* is found in clear water on exposed, well-developed coral reefs to 37 m. It also occurs in shallow tidepools.

MATERIAL EXAMINED: Nine specimens, 22.5-41.0 mm. Egypt, Gulf of Suez, El Tûr, HUJ 18345, 39.5 mm; south end of Sinai Peninsula, Ras Muhammad, TAU P.7376, 8: 22.5-41 mm.

Fowleria vaiulae
Fig. 9, Plate 6B

Foa vaiulae Jordan & Seale, 1906: 249, Fig. 43 (Apia, Western Samoa; holotype, USNM 51734).
Fowleria abocellata Goren & Karplus, 1980: 232, Fig. 1, Pl. 1 (Eilat, Gulf of Aqaba; holotype, TAU 7377).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 13-14; lateral-line scales 22-23, first 9-11 with tubes; median predorsal scales 4; total gill-rakers 3 + 12-13; developed rakers 1 + 5. Preopercle ridge and edge smooth. Body depth 2.5-2.9 and head length 2.35-2.6 in SL; snout length 4.0-4.65, eye diameter 2.7-3.0, interorbital width 6.4-7.2, and upper-jaw length 1.9-1.95, all in head length; villiform teeth in bands on jaws, vomer, but none on palatines; caudal-peduncle depth 1.3-1.55 in peduncle length, and peduncle length 4.0-4.35 in SL; caudal fin rounded. Largest specimen examined, 39.5 mm, from the Marshall Islands.

Colour in alcohol: body pale, mottled with brown, usually with 5-8 dark bars, and dark bands radiating from posterior half of eye; no ocellated dark spot on opercle; all these characters are very distinct in juveniles (Fig. 9); peritoneum and intestine pale.

Colour in life: body mottled reddish brown, usually with 5-8 dark bars, broader than pale interspaces (or there may be rows of whitish spots between bars); indistinct dark and light bands radiating from rear half of eye; fins dark- and light-spotted. Randall (1995) illustrated a fresh specimen (as *F. abocellata*) from Oman.

DISTRIBUTION: Red Sea and Persian Gulf to the Marshall Islands and French Polynesia; in the western Pacific from southern Japan to the Great Barrier Reef.

REMARKS: Allen (1997) placed *Fowleria abocellata* Goren and Karplus in the synonymy of *Foa vaiulae*, but *vaiulae* belongs in the genus *Fowleria*, because it has no palatine teeth. It is the only Red Sea species of *Fowleria* without the distinctive dark ocellus on the opercle. Note: *Fowleria flammea* Allen, from Papua New Guinea, is solid red without an ocellus. Kuiter (1998: 87, as *abocellata*) placed this species in the genus *Foa*, but gave no explanation for his decision beyond a general statement on similarity.

Fowleria vaiulae occurs in a variety of habitats, from isolated coral reefs to seagrass beds and algal flats; it has been collected in the depth range of 5-52 m.

MATERIAL EXAMINED: Gulf of Aqaba, Egypt, HUJ 12027, 24.7 mm; El Hibek, HUJ 6099, 34.7 mm.

Fowleria variegata
Plate 6C

Apogon variegatus Valenciennes, 1832: 55 (Mauritius; syntypes lost).

Apogon punctulatus Rüppell, 1838: 88, Pl. 22, Fig. 4 (Massawa, Eritrea; holotype, SMF 1261).

Apogonichthys polystigma Bleeker, 1854c: 484 (Seram or Sumatra; lectotype, RMNH 5611).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,8; pectoral-fin rays 12-14; lateral-line scales 23 (23rd overlapping caudal-fin base), first 10-13 with tubes; median predorsal scales 4; total gill-rakers 3-4 + 11-13; developed rakers 1 + 5-6. Preopercle ridge smooth, its rear edge smooth, and lower edge membranous and crenulate. Body depth 2.5-2.95 and head length 2.3-2.4 in SL; snout length 4.2-4.5, eye diameter 3.1-3.8, interorbital width 5.8-7.05, and upper-jaw length 1.9-2.0, all in head length; villiform teeth in bands in jaws and on vomer, none on palatines; caudal-peduncle depth 1.15-1.45 in peduncle length, and peduncle length 4.2-4.7 in SL; caudal fin rounded. Largest specimen, 72 mm SL, from Mactan Island, Cebu, Philippines.

Colour in alcohol: body pale yellowish with small brown blotches overlaid with dark brown dots; blotches and dots sometimes aligned vertically to form about 12 irregular bars; ocellated black spot on opercle and 4 irregular brown bands radiating from rear half of eye; lowermost band ending on cheek behind maxilla; median and pelvic fins with numerous small dark brown spots; peritoneum pale, except for small dark spots dorsally; intestine pale.

Colour in life: similar to preserved pattern; the small dark spots varying from dark brown to black; black spot on opercle narrowly edged with pale yellow or white, and dorsal and posterior outer margin of spot narrowly black; rays of median fins sometimes yellow. Randall (1995), Randall and Anderson (1993) and Kuiter (1998) photographed this species in Oman and the Maldive Islands, respectively.

DISTRIBUTION: Red Sea, Oman, Persian Gulf, Kenya, Maldives and east to the Samoa Islands; in the western Pacific from Ryukyu Islands to New South Wales.

REMARKS: The illustration and description of *Apogon punctulatus* by Rüppell (1838) leave little doubt that it is a junior synonym of *Fowleria variegata*; Rüppell himself listed *A. variegatus* with a question mark in his synonymy of the species. Nevertheless, two of the type specimens of *A. punctulatus* were borrowed from the Senckenberg Museum. These specimens (SMF 4685 and SMF 4686), labelled syntypes, have lost nearly all their colour markings but are otherwise referable to *F. variegata*.

Fowleria polystigma (Bleeker) also appears to be a junior synonym of *variegata*. Bleeker (1854c) described *polystigma* from 2 specimens, 27 & 78 mm total length; only the larger fish, RMNH 5611, 61.5 mm SL, was found (the other 15 specimens in this lot are not types) and it is here designated as the lectotype of this species. Unfortunately, it is not possible to determine whether it came from Sumatra or Seram. It has 14 pectoral rays and seems to have 4 median predorsal scales; the gill-rakers are 3 + 11 or 12 (1 + 5 developed).

Günther (1859) erred in placing *A. punctulatus* Rüppell in the synonymy of *Apogonichthys auritus* (now *Fowleria aurita*); he was followed by some other authors (e.g. Smith 1961; Dor 1984). Allen in Paxton et al. (1989), Allen in Randall et al. (1990a) and Allen (1997) treated *Fowleria punctulata* as a senior synonym of *isostigma* (Jordan and Seale); however, the latter is a valid species that appears to be confined to the Pacific (Bishop Museum has specimens from French Polynesia to Indonesia). It is distinct from *variegata* in having 14-15 (usually 15) pectoral rays, 6 median predorsal scales, and the dark spots on the body are more distinct and arranged in longitudinal rows, one per scale.

The specimen (HUJ 6228) from the Gulf of Aqaba identified as *marmorata* by Goren and Karplus (1980) is *variegata*.

Fowleria variegata is generally found in protected waters on algal flats, seagrass beds, mangrove areas, or silty reefs in depths of 0.3 to at least 27 m.

MATERIAL EXAMINED: 15 specimens, 13.6-45.0 mm. Gulf of Aqaba (Israel and Egypt), Eilat, BPBM 13367, 2: 31-35 mm; HUJ 18409, 2: 13.6-18.7 mm; El Hamira, BPBM 13393, 2: 38.0-40.5 mm; Marsa el Muqebila, HUJ 6228, 42.7 mm. Sudan, Port Sudan Harbour, BPBM 20406, 2: 22.5-45.0 mm; Suakin Harbour, BPBM 19738, 2: 38-42 mm. Eritrea, Massawa, SMF 1261, 36 mm (holotype of *Apogon punctulatus*); SMF 4685, 33 mm and SMF 4686, 29.5 mm (paratypes of *A. punctulatus*). Indonesia, RMNH 5611, 61.5 mm (lectotype of *Apogonichthys polystigma*)

Neamia octospina

Apogon sphenurus Klunzinger, 1884: 20 (Massawa, Eritrea; holotype, ZMB 74) (suppressed name).

Neamia octospina Smith & Radcliffe in Radcliffe, 1912: 441, Pl. 36, Fig. 2 (Palawan, Philippines; holotype, USNM 70251).

DIAGNOSIS: Dorsal fin VIII + I,9; anal fin II,8; pectoral-fin rays 18-19; lateral-line scales 24 + 1; median predorsal scales 4-5 (usually 5); total gill-rakers 2-3 + 11-13; developed rakers 1 + 6-8; ceratobranchial rakers 7-8 (usually 7). Preopercle ridge and rear edge smooth, ventral part of edge poorly ossified and crenulate. Body depth and head length 2.3-2.5, pectoral length 3.0-3.2 and pelvic length 3.5-3.8, all in SL; eye diameter 3.9-4.3, interorbital width 6.4-7.3, and upper jaw 1.9-2.0, all in head length; caudal-peduncle depth 1.25-1.3 in its length and peduncle length 4.8-5.0 in SL; caudal fin rounded. Largest specimen, 37 mm; smallest mature female 30.7 mm SL.

Colour in alcohol: body uniform pale; some speciemens with 1-3 dusky stripes radiating from edge of eye; peritoneum and intestine pale.

Colour in life: pinkish, the stripes radiating from eye reddish brown.

DISTRIBUTION: Red Sea and the east coast of Africa, east to the western Pacific, north to the Ryukyu Islands and south to Australia.

REMARKS: Gon (1987b) showed that Klunzinger's *Apogon sphenurus* was an overlooked senior synonym of *A. octospina*. Following an application to conserve the well known *Neamia octospina* (Gon 1987c), the Commission on Zoological Nomenclature (Opinion 1564, 1989) suppressed the name *Apogon sphenurus* and placed it on the Official Index of Rejected and Invalid Names in Zoology.

Neamia octospina is a secretive species usually found among soft coral to depths of at least 10 m, and is rarely seen by divers.

MATERIAL EXAMINED: Nine specimens, 17.3-37.0 mm. Gulf of Aqaba (Israel and Egypt), Eilat, TAU P.7548, 17.3 mm; Dahab, TAU P. 4549, 37 mm. Egypt, Sanafir Island, HUJ 11780, 34.1 mm; south end of Sinai Peninsula, Ras Muhammad, HUJ 5887, 33.6 mm. Eritrea, HUJ 6217, 29.4 mm; HUJ 11938, 2: 30.7-36.2 mm; ZMB 74, 26.6 mm (holotype of *Apogon sphenurus*). Philippines, Palawan, USNM 70251, 27.6 mm (holotype of *Neamia octospina*).

Pseudamia gelatinosa
Plate 6D

Pseudamia polystigma (non Bleeker): Smith, 1954: 778, Pl. D, E (Kenya to Mozambique).

Pseudamia gelatinosa Smith, 1955: 690, Pl. 18, Fig. A (Aldabra, Seychelles; holotype, RUSI 346).

DIAGNOSIS: Dorsal fin VI + I,8; anal fin II,8; pectoral-fin rays 15-17; scales cycloid, thin, and deciduous; 2 inconspicuous lateral lines; longitudinal scale series 39-43; large scales on opercle; rest of head naked, with horizontal and vertical rows of sensory pores; gill-rakers 3-4 + 11-14; developed rakers 1 + 7 (rarely 8). Body elongate, the depth 4.05-4.7 in SL; interorbital space convex; band of villiform teeth in jaws, with 1-2 slender canines anteriorly on each side (longer in upper jaw), and small slender canines on side of lower jaw; anterior nostril with darkly pigmented membranous flap on hind edge that reaches half or more of distance to rear nostril; first dorsal fin about three-fourths height of second dorsal fin; caudal fin rhomboid, its length 2.7-3.3 in SL. Largest specimen examined, USNM 262473, 79 mm SL, from Fiji.

Colour in alcohol: body pale brown with series of very small brown spots forming longitudinal lines (about every second or third spot two or more times longer than other spots); dark brown spot about as large as eye sometimes present at upper base of caudal fin; head with numerous brown spots of various sizes; first dorsal fin slightly dusky; remaining fins pale; peritoneum dusky with numerous black dots; intestine pale.

Colour in life: body translucent, sides and ventral part of head and body with pale golden to silvery iridescent sheen; the larger brown spots on head and body contain a golden yellow dot.

DISTRIBUTION: Red Sea and east coast of Africa to French Polynesia; in the western Pacific from the Ryukyu Islands to Sydney, Australia. However, it is unknown from the Persian Gulf, India, Malaysia, Lord Howe Island, Hawaiian Islands, Marquesas Islands, Pitcairn Group, and Easter Island (Randall et al. 1985).

REMARKS: *Pseudamia gelatinosa* has been collected from 0.5 to 40 m, generally on coral reefs in protected areas such as lagoons, bays, or harbours. The species is very cryptic, never seen by day and rarely at night.

MATERIAL EXAMINED: See Randall et al. (1985). Red Sea material includes BPBM 17899, 5: 24.7-36.8 mm SL and BPBM 27434, 50.4 mm SL from Sudan.

Rhabdamia cypselura
Plate 6E

Rhabdamia cypselurus Weber, 1909: 167 (Kawa, West Seram, Indonesia; syntypes, RMNH 10027, ZMA 112.206); Weber, 1913: 242, Fig. 60.

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,9; pectoral-fin rays 14-16; lateral-line scales 25 (scales deciduous); median predorsal scales 4; total gill-rakers 4-5 + 12-14 = 17-18; developed rakers 1-2 + 10-12; ceratobranchial rakers 9. Preopercle ridge smooth, the edge membranous. Body depth 3.6-4.3 and head length 2.4-2.8 in SL; snout length 3.8-4.8, eye diameter 2.9-3.6, interorbital width 6.0-6.95, and upper-jaw length 1.95-2.3, all in head length; teeth on side of lower jaw, and sometimes teeth of inner row near jaw symphysis

enlarged; palatine teeth in one row or absent; caudal-peduncle depth 1.9-2.55 in its length, and peduncle length 4.0-4.9 in SL. Caudal fin deeply forked with pointed lobes. Bioluminescent system present. Largest specimen, 38.4 mm; smallest mature female, 29.2 mm.

Colour in alcohol: body pale brown with no pattern; tip of jaws and snout with dark brown spots; usually 1-3 large stellate melanophores between eye and tip of snout; several melanophores on cheek and opercle at level of lower third of eye; narrow dusky to brown stripe on each lobe of caudal fin; peritoneum mostly with dense dark spots, but pale beyond level of anus; intestine with minute dark spots, but pale between second bend and anus.

Colour in life: transparent pale peach, silvery over abdomen, thorax and lower head; narrow black stripe extending posteriorly from eye; snout yellow with black spot on side; chin yellowish; median fins light red-orange, each caudal lobe with blackish longitudinal band.

DISTRIBUTION: Red Sea and east coast of Africa to the Marshall Islands, Ryukyu Islands and south to Australia.

REMARKS: Randall (1994: 264, Pl. 7, Fig. 7) reported the first record of this species from the Red Sea from specimens collected off Sudan and Saudi Arabia. He also reported mouth brooding males.

The bioluminescent system of *Rhabdamia cypselura* is made of two modified pyloric caeca, each connected to a lens-like body through which light is emitted. The lens is almost completely encircled by black tissue and is situated ventrolaterally on the rear edge of the gill cavity and covered by the operculum (Haneda et al., 1969).

This species is usually found schooling in caves and under ledges, often together with other species of *Rhabdamia* and the pempherid genus *Parapriacanthus*.

MATERIAL EXAMINED: 15 specimens, 21.0-38.4 mm. Saudi Arabia, Yanbu, BPBM 30372, 3: 33-34 mm. Sudan, Suakin Archipelago, Saunder's Reef, BPBM 35694, 2: 21-22 mm. Eritrea, HUJ 6226, 10: 27.4-38.4 mm.

Rhabdamia nigrimentum
Plate 6F

Bentuviaichthys nigrimentum Smith, 1961: 412, Pl. 50 E (Eritrea; holotype, RUSI 359).

DIAGNOSIS: Dorsal fin VII + I,10-12; anal fin II,10-11; pectoral-fin rays 16-17; lateral-line scales 25; median predorsal scales at least 2 (some scales missing on all specimens); scales on body weakly ctenoid and deciduous; total gill-rakers 5-6 + 16-17; developed gill-rakers 4 + 15-17; ceratobranchial rakers 11. Preopercle edge and ridge smooth, the edge thin and flexible. Body depth 3.3-3.6 and head length 2.4-2.7 in SL; snout 3.7-4.3, eye diameter 3.1-3.6, interorbital width 4.6-5.4, and upper-jaw length 2.1-2.25, all in head length; both jaws with a pair of inward-projecting small canines near symphysis; posterior part of lower jaw with slender conical teeth; palatines with one row of teeth; caudal-peduncle depth 1.65-1.9 in its length, and the peduncle length 4.3-4.6 in SL. Caudal fin forked, with pointed lobes. Largest specimen, 55.5 mm.

Colour in alcohol: body pale; tip of lower jaw dark brown to black, the pigment spreading a short distance on ventral surface of jaw; dusky stripe from tip of upper jaw through eye, across preopercle and fading out on opercle; two dusky lines on interorbital space, merging as one band mid-dorsally on snout; distal half to two-thirds of first dorsal fin blackish; indistinct dark basal stripe on anal fin; peritoneum with dark brown spots of various sizes; intestine with smaller dark spots near anus. The holotype is unusual in having small dark brown spots all over its body and unpaired fins (see Smith, 1961: Pl. 50, E).

Colour in life: translucent grey, iridescent blue over abdomen except upper part black (internal coloration); dark markings described above more evident.

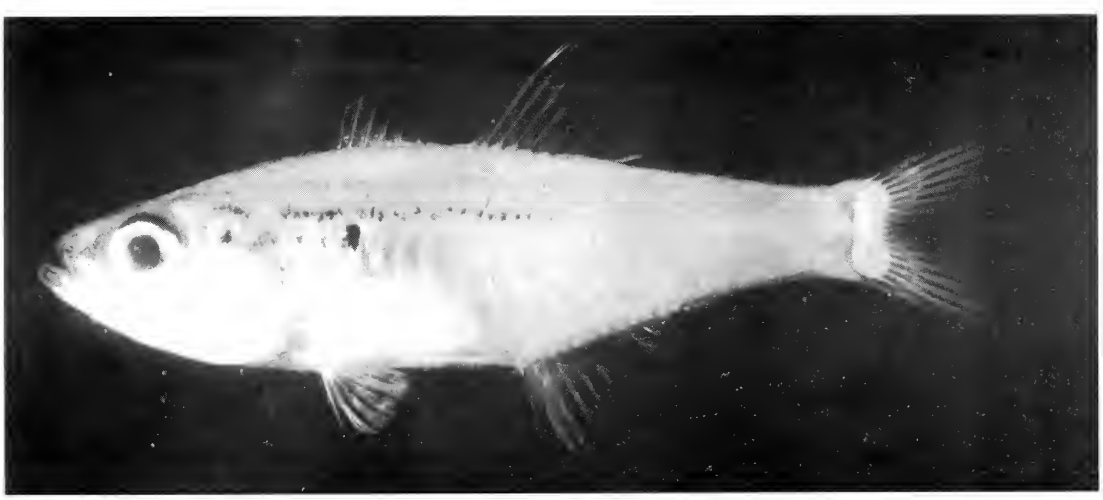

Figure 10. *Rhabdamia spilota*, BPBM 21516, 52.2 mm SL, El Hamira, Gulf of Aqaba, Red Sea (JER).

DISTRIBUTION: Red Sea endemic.

REMARKS: This species is easily distinguished from *R. cypselura* and *spilota*, which have only 6 spines in the first dorsal fin. In addition, the total number of gill-rakers of *cypselura* falls between the values of *nigrimentum* and *spilota* (17-18 and 30-33, respectively).

Smith (1961) created a new genus, *Bentuviaichthys*, for *nigrimentum*, citing as generic characters the 7 first dorsal-fin spines, ctenoid scales on body, and no palatine teeth (however, palatine teeth are present). Moreover, he used similar body shape, scales and dentition to relate *Bentuviaichthys* to the genus *Synagrops*, now classified in the family Acropomatidae. Based on osteological characters, Fraser (1972) recognized *Bentuviaichthys* as a subgenus of *Rhabdamia* in the Subfamily Apogoninae.

Kotthaus (1970) reported *R. nigrimentum* from 70-75 metres in the Zubayr Islands, southern Red Sea. Randall (1994) observed it schooling in caves and under ledges with *R. cypselura* and *Parapriacanthus guentheri* at a depth of 12-14 m. Our specimens were collected on coral reefs in 6-12 m, those from 6 m were aggregating with *Archamia fucata* in a cave.

MATERIAL EXAMINED: Nine specimens, 41.1-55.5 mm. Sudan, Towartit Reef, BPBM 27389, 4: 45.5-55.5 mm. Saudi Arabia, Yanbu, BPBM 30373, 3: 48.5-55.5 mm. Eritrea, HUJ 6238, 41.1 mm; RUSI 359, 51.8 mm (holotype of *Bentuviaichthys nigrimentum*); counts for four additional specimens were taken from Kotthaus (1970).

Rhabdamia spilota
Fig. 10, Plate 6G

Rhabdamia spilota Allen & Kuiter, 1994: 21, Fig. 2 (Bali, Indonesia; holotype, NCIP 6121).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,11-12; pectoral-fin rays 12-13 (usually 13); lateral-line scales 25 + 1-2 (usually 27); median predorsal scales 5-6; total gill-rakers 8-9 + 22-24; developed rakers 7-8 + 21-24; ceratobranchial rakers 13-15. Preopercle edge smooth or with 1-3 minute serrae at angle, the ridge smooth. Body depth 3.4-4.1 and head length 2.6-3.0 in SL; snout length 4.2-4.5, eye diameter 3.1-3.7, interorbital width 4.8-5.3, and upper-jaw length 2.6-2.85, all in head length; no enlarged teeth in jaws; palatine toothless or with minute teeth anteriorly; caudal-peduncle depth 1.5-2.1 in its length, and peduncle length 4.1-4.8 in SL. Caudal fin forked with pointed lobes. Largest specimen, 52.2 mm.

Colour in alcohol: body pale brown; tip of jaws and anterior part of chin with small dark brown spots; faint brown spot, or short stripe, on side of snout; faint dark stripe from tip of snout to above middle of eye; faint narrow stripe from upper part of opercle, under lateral line, to below posterior end of first dorsal-fin base; mid-lateral series of dark spots from behind eye, ending above anterior part of pectoral fin, largest and most conspicuous spot above pectoral fin; some scattered minute dark spots on cheek and nape, spreading posteriorly along upper part of body to upper caudal peduncle; cluster of dark brown spots inside mouth, on each side of upper jaw; tips of caudal rays dusky; fins otherwise pale; peritoneum with small black spots extending posteriorly to vertical at anus; intestine with dense small black spots.

Colour in life: translucent grey with some pink iridescence; scattering of small dark brown spots on mid-side above base of pectoral fin, one conspicuously the largest, about one-third pupil diameter; iridescent light blue line passing through these dark spots, ending in a series of light blue dots on lower side of caudal peduncle; irregular iridescent blue horizontal line on operculum; front of snout yellow; an indistinct narrow brown stripe from front of snout through eye; faint irregular brown arc from front of snout over eye to rear part of opercle; median fins transparent with salmon pink rays.

DISTRIBUTION: Red Sea and Indonesia.

REMARKS: The colour description in alcohol is based on specimens larger than 48 mm. Some of these colour features may not be present in smaller specimens. Specimens less than 40 mm have no pigmentation other than faint spots on the tip of the jaws.

Rhabdamia spilota is similar to *R. gracilis* but has more gill-rakers and median predorsal scales (26-27 and 4, respectively, in *gracilis*). In addition, *gracilis* has no markings on the body except dusky jaw tips and a subdermal dark spot in front of lower caudal-fin base. *R. gracilis* has not been reported from the Red Sea. *R. cypselura* differs from *spilota* in having 9 anal rays, 17-18 gill-rakers, usually 15 pectoral rays and dark stripes on the caudal-fin lobes. A higher number of pectoral rays and gill-rakers also separate *spilota* from *Cercamia eremia*, the counts of which are 10 and 12-13, respectively.

In the Red Sea, *R. spilota* has been found on isolated coral heads and on the reef slope, at 12-15 m.

MATERIAL EXAMINED: 17 specimens, 24.8-52.2 mm. Gulf of Aqaba (Israel and Egypt), Eilat, TAU P.10095, 48.2 mm; ZSM 24064, 48 mm; Taba, TAU P.5509, 9: 24.8-36.4 mm; El Hamira, BPBM 21516, 6: 49.6-52.2 mm.

Siphamia permutata
Plate 6H, I

Beanea trivittata Steindachner, 1902: 337 (El Tûr, Gulf of Suez, Red Sea; holotype lost; name suppressed).
Siphamia permutata Klausewitz, 1966: 217, Fig. 1 (Ghardaqa, Egypt; holotype, SMF 8265).

DIAGNOSIS: Dorsal fin VII + I,9; anal fin II,7-8 (rarely 7); pectoral-fin rays 14-15 (usually 15); lateral-line scales

23; median predorsal scales 5 or 6 (count of scale pockets); total gill-rakers 3-4 + 8-9; developed rakers 1 + 8-9; ceratobranchial rakers 7-8. Preopercle ridge smooth, the edge serrate. Body depth 2.55-2.8 and head length 2.0-2.4 in SL; snout length 4.0-4.85, eye diameter 2.7-3.2, interorbital width 3.95-4.6, and upper-jaw length 1.8-1.9, all in head length; caudal-peduncle depth 1.6-1.9 in its length, and peduncle length 4.8-5.85 in SL. Caudal fin moderately forked, with pointed lobes. Bacterial bioluminescent system associated with gut. Largest specimen, 37.5 mm; the smallest sexually mature male and female measure 21.5 and 22.1 mm, respectively.

Colour in alcohol: variable, with or without 3 dark brown stripes, depending on state of expansion of numerous melanophores on body; striated silvery stripe from isthmus almost to caudal-fin base, and striated silvery area extending from ventral end of pectoral-fin base to ventral base of tongue; scattered blackish spots on upper limb of first gill arch; peritoneum and intestine with dark spots of various sizes.

Colour in life: body usually dark brown; fins pale to dusky.

DISTRIBUTION: Apparently endemic to the Red Sea.

REMARKS: The count of lateral-line scales is based on a single specimen; all the others lost their scales. The count of lower-limb gill-rakers includes only developed rakers. In some specimens, mostly males, the genital papilla is very large, 0.5-1.0 in length of first anal spine.

This species is very similar to several other species of *Siphamia* with dark stripes including *S. versicolor* (Smith and Radcliffe, 1911), *S. ovalis* (Lachner, 1953), and *S. mossambica* (Smith, 1955). Of these, *mossambica* and *versicolor* were described or reported from the western Indian Ocean (Smith 1955, 1961; Randall 1995, respectively). The validity of the small differences between these two species and *S. permutata* listed by Klausewitz (1966) needs to be re-evaluated.

Randall et al. (1986) showed that Steindachner's (1902) species *Beanea trivittata* is an apogonid and not a holocentrid. No type specimens are extant. The most likely Red Sea apogonid species to fit Steindachner's (1902) description is *S. permutata*. Responding to the application made by Randall et al. (1986), the International Commission on Zoological Nomenclature (Opinion 1481, 1988) suppressed the name *Beanea trivittata*.

S. permutata is usually seen in small groups taking shelter among the long spines of sea urchins of the genus *Diadema*; it occurs to depths of at least 15 m.

MATERIAL EXAMINED: 41 specimens, 15.0-37.5 mm. Gulf of Aqaba (Israel and Egypt), Eilat, ZSM 24104, 5: 15.0-19.6 mm; El Hamirah, BPBM 37819, 27 mm. Egypt, Sanafir Island, HUJ 11752, 26(of 33): 22.5-37.5 mm; south end of the Sinai Peninsula, Ras Muhammad, HUJ 11073, 9: 18.8-26.9 mm.

Siphamia mossambica: Mozambique, RUSI 345, 21.5 mm (holotype).

Sphaeramia orbicularis
Plate 6J

Apogon orbicularis Cuvier, 1828: 155 (Java; holotype, RMNH 49).

DIAGNOSIS: Dorsal fin VI + I,9; anal fin II,8; pectoral-fin rays 11-12 (usually 12); lateral-line scales 24 + 2-3 (usually 27); median predorsal scales 6-7 (usually 7); total gill-rakers 5-6 + 18-21 = 24-27; developed rakers 3-5 + 18-20 = 22-25; ceratobranchial rakers 13. Preopercle ridge smooth, the edge serrate. Body depth 1.9-2.0 and head length 2.5-2.6 in SL; snout length 4.1-5.1, eye diameter 2.3-2.6, interorbital width 3.3-3.6, and upper-jaw length 2.2-2.3, all in head length; caudal-peduncle depth 1.0-1.2 in its length, and peduncle length 4.4-5.3 in SL. Caudal fin forked, with rounded lobes; procurrent caudal rays spinous. Largest specimen, 59 mm; smallest mature female, 33.7 mm.

Colour in alcohol: brown with dark brown bar from under second dorsal spine to ventral edge of body and continuing onto distal part of pelvic fin; head and body in front of bar with few small dark brown spots, becoming fewer and fainter ventrally; a series of larger dark spots below dorsal profile of body from behind the dark bar to upper end of caudal peduncle; small caudal spot just in front of end of hypural plate, preceded by a series of 4 short, dark brown dashes or oblong spots along mid-lateral line of peduncle; dark spot above and below anteriormost of these dashes; dark spot usually present slightly below and above rear end of second dorsal- and anal-fin bases, respectively; 4 small, dark brown spots across caudal-fin base; dorsal anal and pelvic fins with dark brown leading edge; middle part of pelvic fins pale to dusky; first dorsal fin with dusky membrane overlain with darker spots similar in size to those on head; second dorsal, anal and caudal fins dusky; peritoneum with small dark spots; intestine with few scattered dark lines or reticulum.

Colour in life: from underwater photographs taken by the second author in Palau and Papua New Guinea; body grey, shading to pinkish grey on head and abdomen, with dark bar and spots as described above; median fins grey, the leading edge of the dorsal fins dusky; small red spots on membranes of first dorsal fin between 3rd and 6th spines; pelvic fins pale yellow except for broad submarginal black band on membranes.

DISTRIBUTION: Red Sea and east coast of Africa to Western Pacific, north to the Ryukyu Islands and south to New Caledonia.

REMARKS: Previously unknown from the Red Sea, this distinct species is probably limited to the southern part of the Red Sea. We have not observed it in the

Red Sea, but in the western Pacific it is known to occur in shallow inshore water. Allen (1975) studied the ecology of this species in Palau and observed groups of up to 30 individuals at the mouth of caves and holes, around mangrove trees, and under piers.

MATERIAL EXAMINED: Eritrea, HUJ 11769, 17: 15-59 mm.

CONCLUDING REMARKS

Nomina dubia

Apogon cupreus Cuvier, 1828: 158 (Red Sea; holotype, lost).
Apogon latus Cuvier, 1828: 159 (Red Sea; holotype, lost).

Bauchot and Desoutter (1986: 92-93) reported that the types of *Apogon cupreus* and *A. latus* were either lost or not deposited at the Musèum National d'Histoire Naturelle, Paris. Cuvier (1828) described six apogonid species collected by Ehrenberg in the Red Sea. He stated that *A. cupreus* was the largest of these, but provided the size only for *A. lineolatus*. The descriptions of *A. cupreus* and *A. latus* are very short and provide no diagnostic characters. Each description corresponds with more than one known Red Sea species. Fowler and Bean (1930: 59) put *A. cupreus* in the synonymy of *A. fuscus* (Quoy and Gaimard, 1825), itself an unidentifiable species, but gave no explanation or evidence in support of their decision.

Doubtful Records

Apogon hyalosoma Bleeker, 1853b: This species was reported from the Red Sea only once, by Fowler and Steinitz (1956). We could not find their fish in the collection of the Hebrew University, Jerusalem.

Smith (1961) examined a 50-mm apogonid from the Mediterranean coast of Israel sent to him by A. Ben-Tuvia who suspected it may be this species. Smith ruled out this possibility, citing differences in colour and number of gill-rakers from the true *hyalosoma*; he also suggested that the 23-mm long specimen from Eilat reported by Fowler and Steinitz (1956) may be the same species as Ben-Tuvia's fish. However, Smith's description of the colour indicates it was *A. imberbis*, a common Mediterranean species that does not occur in the Red Sea.

Apogon taeniophorus Regan, 1908: Randall and Lachner (1986) listed the Red Sea in their BPBM material for this species. Unfortunately, they did not provide catalogue numbers for this material, and we could not find any Red Sea specimens of *taeniophorus* in the BPBM collection. Therefore, the listing of this species from the Red Sea is probably an error.

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STYLE OF THE HOUSE

Hyphens: Certain substantive compounds are hyphenated: gill-raker, soft-ray, type-species, type-locality, type-series, type-specimen. Other words often used together are not hyphenated unless they are used in adjectival expressions before a noun: anal fin / anal-fin rays; lateral line / lateral-line scales; gill arch / gill-arch filaments, etc.

Word usage: Although the following word pairs are often used interchangeably, we believe that consistent use of the first word as a noun and the second as an adjective will improve the precision of our writing: mucus / mucous; maxilla / maxillary; opercle / opercular, operculum / opercular. The operculum (= gill cover) comprises (usually) four separate bones: opercle, subopercle, preopercle and interopercle. The words preoperculum, suboperculum and interoperculum are unnecessary substitutes and not to be used for preopercle, subopercle and interopercle. The plural of operculum is opercula.

Decimal comma versus decimal point: Contrary to most journals published in South Africa and some European countries, we will not use a comma in place of a decimal point. Most computers do not read a comma as a decimal point. In addition, it is common in ichthyological papers to give sequences of measurements that include decimal numbers, with each measurement separated by a comma. If the comma is used to separate items in a series, as well as being used to indicate a decimal number, it will cause considerable confusion.

Fin formulae: Fin formulae will be designated as follows: D XII,10-12 indicates on continuous fin with 12 spines and 10-12 soft (segmented) rays; DX/I,10-12 indicates a fin divided to the base in front of the last spine; and D X+I,12 indicates two separate dorsal fins, the first with 10 spines and the second with 1 spine and 12 soft rays. If it is necessary to differentiate branched and unbranched soft-rays, lower-case Roman numerals will be used for unbranched rays and Arabic numerals for branched rays, e.g. D iii,S. Principal caudal-fin rays are defined as those that touch the hypural bones. The number of principal caudal rays is usually the number of branched rays plus two. If the principal caudal rays are in two separate groups, the number of rays in the dorsal group is given first: thus, "principal caudal rays 8+7" means that there are 15 principal caudal rays, with 8 rays in the dorsal group and 7 in the ventral group.

Abbreviations: Abbreviations normally end with a full stop: et al., e.g., etc., n.b., (note: these commonly used abbreviations of Latin words are not italicized). Dr (Doctor) and Mr (Mister) and compass directions (north, west, northwest, etc.) are abbreviated using capital letters without full stops: N, W, NW. We recommend the following abbreviations for ichthyological terms: SL - standard length, TL - total length, FL - fork length, GR - gill-rakers, LL - lateral line.

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