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Apogon limenus, a new species of cardinalfish (Perciformes: Apogonidae) from New South Wales

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ABSTRACT. *Apogon limenus* is described as a new species from New South Wales. This abundant species has been confused with *Apogon fasciatus*. The species is compared with other striped *Apogon* species which are similar in coloration. It differs from them in details of coloration and the combination of fin ray, scale and gill-raker counts, serrate free margin of the preoperculum and smooth to slightly serrate anterior preopercular ridge.

It is suggested that species collected by HMS *Herald* from "Victoria", were collected from the Victoria District of Western Australia. The district name was used in the 1800's for the area north of Perth and south of Carnarvon.

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The Apogonidae, popularly known as cardinalfishes, is one of the largest families of perciform fishes. Fraser (1972), whose study of the comparative osteology of the group has provided a foundation for the subfamilial, generic and subgeneric classification, estimated that there are 24 to 26 genera and about 200 species in the family. The largest of the genera is *Apogon* which he divided into ten subgenera. The family is in great need of revision in the Indo-west Pacific region at the species level, and as might be expected, the largest number of taxonomic problems lie within the genus *Apogon*, especially in the largest of the subgenera, *Nectamia*.

Many of the Indo-Pacific species of the subgenus *Nectamia* have several dark stripes on the head and body; these are among those most confused by ichthyologists. Fraser (1974) redescribed one of these species, *A. endekataenia* Bleeker, a name often applied to other striped cardinalfishes. Randall & Lachner (1986) differentiated six similar striped species: *A. angustatus* (Smith & Radcliffe), *A. cookii* Macleay, *A. fasciatus* (Shaw), *A. nigrofasciatus* Lachner, *A. novemfasciatus* Cuvier, and *A. taeniophorus* Regan. They also showed that no specimens are known from existing collections that match the description of *A. aroubiensis* Hombron &

Jacquinet, a striped species from Malaysia, the only type specimen of which has been lost.

From the study of Randall & Lachner it became apparent to the senior author (and independently to the junior author) that one of most common fishes of bays and harbours of New South Wales, a large dark-striped species of *Apogon*, is undescribed. This fish has often been misidentified as *A. cookii* (pl. 129 in Grant, 1982) or more commonly as *Apogon fasciatus* White (1790), the type locality of which is Port Jackson (= Sydney Harbour). White named it *Mullus fasciatus* and described it briefly as follows: "Pale yellow Mullet with longitudinal brown bands. Length about five inches; scales large". His illustration of *fasciatus* (reproduced by Radcliffe, 1911, pl. 21), though poor, is unquestionably a species of *Apogon*. There are three dark stripes – one midlateral and two well above it; no dark spot is present on the caudal-fin base. Because of the mention of pale yellow ground color, the lack of two lower stripes, and no indication of a black caudal spot, it seems likely that the Port Jackson fish was the species most ichthyologists have identified as *A. quadrifasciatus* Cuvier. Since there is no type of *fasciatus* extant, Lachner in Schultz & collaborators (1953: 439, pl. 35A) designated USNM 59972, 80.5 mm SL, from

Table 1. Proportional measurements of type specimens of *Apogon limenus* expressed as a percentage of the standard length.

	Holotype		Paratypes						
	AMS I.26325-001	WAM P27082-006	BPBM 30588	BPBM 14955	BPBM 30588	BPBM 30588	BPBM 14995	BPBM 30588	
Standard length (mm)	87.3	81.0	85.6	88.0	87.0	93.2	96.2	100.2	
Body depth	38.4	48.5	37.4	39.1	38.5	41.0	39.4	38.8	
Body width	17.2	18.8	18.1	16.6	16.4	17.1	17.5	17.3	
Head length	38.6	40.5	39.7	37.7	38.8	40.7	40.6	39.1	
Snout length	9.9	10.0	9.5	9.2	10.1	10.2	9.9	10.0	
Orbit diameter	11.7	12.3	11.5	11.1	11.3	11.4	11.6	11.3	
Interorbital width	7.8	8.3	7.3	7.6	7.8	8.2	8.3	7.8	
Upper jaw length	18.6	18.7	18.4	18.8	18.5	19.2	19.5	19.0	
Caudal peduncle depth	17.2	18.2	16.6	17.0	16.5	18.0	16.9	16.1	
Caudal peduncle length	23.9	23.5	23.6	23.1	23.8	23.7	23.9	22.7	
Predorsal length	41.4	41.2	38.2	39.5	40.1	42.3	42.5	40.5	
Preal length	60.6	62.4	62.8	60.8	62.0	61.5	60.6	61.5	
Prepelvic length	38.4	42.2	43.2	39.2	41.1	39.8	39.1	42.9	
Length of first dorsal spine	3.0	3.4	3.6	3.0	3.1	3.2	3.2	broken	
Length of second dorsal spine	9.8	9.4	9.5	8.9	9.0	8.8	10.7	aberrant	
Length of third dorsal spine	19.5	20.6	19.8	19.6	20.6	21.7	22.5	19.5	
Length of spine of second dorsal fin	16.6	15.9	15.8	15.9	17.9	17.0	18.6	17.5	
Length of longest dorsal ray	26.4	26.8	28.6	26.4	29.3	27.8	28.7	broken	
Length of last dorsal ray	12.0	13.0	13.7	13.3	13.6	12.6	13.5	13.4	
Length of first anal spine	3.5	3.1	3.5	3.6	4.2	3.4	3.9	4.1	
Length of second anal spine	13.2	13.7	13.6	13.1	15.0	13.9	14.8	14.4	
Length of longest anal ray	20.7	broken	23.9	21.6	22.8	21.5	23.0	broken	
Length of last anal ray	13.4	14.2	14.5	14.9	15.4	13.8	15.1	15.2	
Caudal fin length	28.7	broken	29.3	28.8	30.2	29.2	31.1	broken	
Caudal concavity	7.9	-	7.0	7.4	7.1	6.8	7.5	-	
Pectoral fin length	24.8	25.9	25.4	24.7	25.2	25.8	26.5	24.9	
Pelvic spine length	13.9	14.0	14.6	15.0	15.5	15.2	16.3	15.8	
Pelvic fin length	22.0	22.2	22.3	21.8	23.3	22.5	23.8	21.9	

Table 2. Gill-raker counts of four dark-striped species of *Apogon* from the Indo-Pacific region. N = specimens from Japan, Taiwan and Hong Kong. S = specimens from New Caledonia, Lord Howe Island and Great Barrier Reef.

	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>	<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>
<i>A. victoriae</i>	17	32	33	3				
<i>A. doederleini</i>								
N		2	10	6	2			
S	2	10	7	3				
<i>A. fasciatus</i>		1	14	10	2		1	
<i>A. limenus</i>				3	11	8	7	1

Port Jackson as the neotype. This is a fish which fits the description of *A. quadrifasciatus* Cuvier; therefore *A. fasciatus* (Shaw) is a senior synonym of *A. quadrifasciatus*. The purpose of the present paper is to provide a description of the common cardinalfish formerly called *A. fasciatus*. Both *Apogon fasciatus* and the new species described here are common in Sydney Harbour.

Methods and Materials

All lengths of specimens are standard length (SL), measured from the median anterior point of the upper lip to the base of the caudal fin (end of hypural plate). Body depth is the maximum depth, and body width the greatest width just posterior to the gill opening. Head length is taken from the front of the upper lip to the posterior end of the opercular

membrane; snout length is measured from the same anterior point to the nearest fleshy edge of the orbit. Orbit diameter is the greatest fleshy diameter. Interorbital width is the least bony width. Caudal peduncle depth is the least depth, and caudal peduncle length is the horizontal distance from the rear base of the anal fin to the caudal-fin base. The lengths of the dorsal and anal spines and rays are measured from the point where they emerge from the scaled part of the body. Caudal-fin and paired-fin lengths are the lengths of the longest rays of these fins (the horizontal distance for the caudal fin; from the base of the initial spine to the tip of the longest ray for the pelvic fin). Caudal concavity is the horizontal distance between the tips of the longest and shortest caudal rays.

The last dorsal and anal rays are a composite of two elements divided from the base; these are



Fig.1. Holotype of *Apogon limenus*, AMS I.26325-001, female, 87.3 mm SL Sydney Harbour, N.S.W.

counted as a single ray. Pectoral-ray counts include the upper rudimentary ray. Lateral-line scale counts are made to the caudal-fin base. Gill-raker counts include all rudiments; the raker at the angle is contained in the lower-limb count.

Specimens of the new species have been deposited at various museums, the abbreviations of which follow Leviton *et al.* (1985).

In the description of the new species, data in parentheses refer to paratypes. Table 1 gives the measurements of selected type specimens as percentages of the standard lengths. Many of these measurements are repeated in the text as quotients of larger measurements such as standard length or head length; these are rounded to the nearest .05. Table 2 provides the total gill-raker counts of the new cardinalfish and those of other larger dark-striped species that occur in eastern Australia with which it might be confused.

Apogon limenus n.sp.

Figs 1, 2

Material examined. HOLOTYPE: AMS I.26325-001, 87.3 mm, female, Australia, NSW, Sydney Harbour, Bottle and Glass Rocks (33°52'S, 151°16'E), rock face with ledges 5–8 m, rotenone, Rudie H. Kuitert *et al.*, 6 Sept 1981. PARATYPES: BPBM 30588, 5: 85.6–100.2 mm, same locality as holotype, J.R. Paxton and class, 6 Aug 1972; BMNH 1986.9.4.129, 93.0 mm, same data as preceding;

BPBM 14955, 2: 88.0–96.2 mm, Australia, NSW, Port Hacking, Little Turriel Point, Ship Rock, 12–15 m, spear, J.E. Randall, 6 Mar 1973; CAS 58973, 94.1 mm, same data as preceding; AMS I.19103-032, 30: 29.8–110.2 mm, NSW, Parsley Bay, Sydney Harbour, rotenone, J.R. Paxton and class, 8 May 1976; AMS I.19700-008, 2: 87.6–88.6, NSW, North Solitary Island, B.C. Russell and J. Bell, 26 Sept 1976; AMS I.19499-001, 94.4 mm, NSW, Vaucluse Bay, Sydney Harbour, R.H. Kuitert, 5 Sept 1979; WAM P27082-006, 5: 81.0–96.3 mm, NSW, Solitary Island, W side (30°01'S, 153°16'E), rotenone, J.B. Hutchins, 29 Dec 1980.

Diagnosis. Dorsal rays VII–I,9; anal rays II,8; pectoral rays 14; lateral-line scales 24; gill rakers 5–7 (rarely 5) +14–17; body moderately deep, depth 2.45–2.7 in SL; broad band of villiform teeth in jaws; palatine teeth present; free margin of preopercle serrate, anterior ridge smooth to partially serrate; caudal fin emarginate with rounded lobes; purplish brown with five dark brown stripes on body, midlateral one leading to black spot the size of pupil on basal fourth of caudal fin.

Description. Dorsal rays VII–I,9; anal rays II,8; pectoral rays 14, upper ray rudimentary, second and last rays unbranched; pelvic rays I,5; principal caudal rays 17, upper and lower unbranched; upper and lower procurrent caudal rays 7; lateral-line scales 24; scales above lateral line to origin of dorsal fin 2; scales below lateral line to origin of anal fin 6; median predorsal scales 2; circumpeduncular scales



Fig.2. Underwater photo of *Apogon limenus* from Port Hacking, N.S.W., photo J.B. Hutchins.

12; gill rakers 6+16 (5-7+14-17); pseudobranch lamellae 20 (20-24); branchiostegal rays 7; predorsal bones 3; vertebrae 10+14.

Body moderately deep, depth 2.6 (2.45-2.7) in SL, and compressed, width 2.25 (2.05-2.4) in depth. Head length 2.6 (2.45-2.7) in SL; snout length 3.9 (3.85-4.2) in head. Orbit diameter 3.3 (3.3-3.55) in head. Interorbital space flat to slightly convex, the width 4.95 (4.9-5.45) in head. Caudal peduncle depth 2.25 (2.2-2.4) in head; caudal peduncle length notably longer than depth, the depth contained 1.4 (1.3-1.4) times in peduncle length.

Mouth terminal and slightly oblique, maxilla reaching posterior to a vertical through centre of eye, upper jaw length 2.1 (2.05-2.15) in head. Broad band of villiform teeth in jaws, with no enlarged teeth; vomer with rows of small teeth forming a V; palatines with 2 rows of very small teeth, narrowing posteriorly to a single row. Tongue short and pointed, upper surface with 3 converging bands of papillae. Gill rakers moderately long, the longest (at angle) longer than longest gill filaments on first arch, about 2.5 in orbit diameter.

Anterior nostril a small membranous tube in front of centre of eye; posterior nostril a small aperture in diagonal line connecting anterior nostril to top of orbit, nearly half the distance to upper edge of orbit.

Opercle with single, flat, obtuse spine; inner ridge of preopercle smooth or with some irregular weak serrae, particularly at corner and lower edge; free margin of preopercle finely serrate; margins of subopercle and interopercle smooth.

Scales finely ctenoid; head largely naked, only few scales posteriorly on nape, on upper opercle, and in 2 diagonal rows on preopercle (anterior row of 6 scales

and posterior row of 1); no scales on fins except small scales basally on caudal fin.

Dorsal fins well separated, origin of first over base of third lateral-line scale; first dorsal spine small, 6.5 (5.5-7.0) in length of third dorsal spine; third dorsal spine longest, 2.0 (1.8-2.1) in head; longest dorsal soft ray (usually the first) 1.45 (1.3-1.5) in head. Origin of anal fin slightly posterior to origin of second dorsal fin; first anal spine small, 3.8 (3.5-4.2) in second spine; second anal spine 2.9 (2.6-2.95) in head; longest anal soft ray (the first) 1.85 (1.65-1.9) in head. Caudal fin emarginate with rounded lobes, its length 1.35 (1.3-1.4) in head; caudal concavity 4.9 (5.1-5.9) in head. Third or fourth pectoral rays longest, 1.55 (1.5-1.55) in head. Pelvic fins reaching to or beyond origin of anal fin, their length 1.75 (1.65-1.8) in head.

Colour of holotype. Fresh: purplish brown with 5 dark brown stripes; first stripe mid-dorsal on head (beginning in interorbital space), passing along base of dorsal fins, continuing dorsally onto caudal peduncle; second stripe from front of snout, along upper edge of eye, passing just above and parallel to lateral line anteriorly on body, diverging slightly upward from lateral line below second dorsal fin, parallel to dorsal contour of caudal peduncle, and ending on upper base of caudal fin; third stripe about twice as broad as upper two, midlateral from front of snout through eye to a black spot the size of pupil on caudal fin about one fourth distance from base to end of fin and continuing faintly on caudal rays posterior to spot; fourth stripe from front of chin, across mouth, through lower edge of eye, to lower base of caudal fin, this stripe anteriorly on body and postorbital head broader than third stripe, but more

diffuse; fifth stripe from lower chin and posterior maxilla across thorax and abdomen to posterior base of anal fin, this stripe less distinct than others; upper edge of third (midlateral) stripe and space between third and fourth stripes iridescent blue green and yellow; stripes on head yellowish brown, interspaces iridescent blue green and yellow; short yellowish brown stripe on postorbital head between second and third stripes; fins light red, suffused with pale blue, first dorsal with a wash of yellow anteriorly, second dorsal and anal fins with brown band near base; caudal fin with aforementioned centrobasal black spot and terminal ends of 3 median dark stripes (second and fourth stripes yellowish brown within fin).

When viewed underwater live, individuals appear whitish with dark brown or blackish stripes.

Colour in alcohol: light brown, stripes as described above dark brown, midlateral stripe most heavily pigmented; interspaces light brown; basal spot on caudal fin black; peritoneum pale, gut black; intestine black, but lighter than stomach.

Remarks. This species is named *limenus* from the Greek *limen* for harbour or refuge, in reference to its frequent occurrence in harbours and bays.

Apogon limenus is known only from between latitudes 27° and 36°35'S, from Moreton Bay, Queensland to Bermagui, New South Wales. It occurs on rocky bottom at depths of 1 to 20 m. Like other species of the genus it is nocturnally active, remaining in crevices and caves during daylight. Males brood the egg mass in the mouth. It is one of the larger species of *Apogon*; our largest specimen measures 110.2 mm SL.

Apogon limenus might be confused with three other large, dark-striped species of the genus which occur in the sea off eastern Australia: *A. fasciatus* (Shaw), *A. cooki* Macleay, and *A. doederleini* Jordan & Snyder. *Apogon fasciatus* is distinctive in having three dark stripes instead of five, no black spot on the caudal fin base, 15 or 16 (usually 16) pectoral rays (14 for *A. limenus*), and a lower average number of gill rakers (see Table 2). It also differs in its habitat of more open, soft-bottom habitat and is typically taken in trawls. *Apogon cooki* may be differentiated from *A. limenus* by having a dark stripe anteriorly on the body between the second and third stripes (this stripe confined to the head on *A. limenus*), in having 15 pectoral rays, and 20–23 gill rakers (17–20 in *A. limenus*). *Apogon cooki*, although overlapping with *A. limenus* is primarily tropical. *Apogon limenus* is perhaps closest to *A. doederleini*, an antitropical species which occurs in the Northern Hemisphere in Japan, Taiwan, China, and in the Southern Hemisphere on the Great Barrier Reef, Lord Howe Island (the *Apogon* sp. A of Allen *et al.*, 1976), Sydney Harbour, NSW, and New Caledonia [*Apogon angustatus* (non Smith & Radcliffe) of Fourmanoir & Laboute, 1976] and the Kermadec Islands. The latter has five dark brown stripes and a black caudal base

spot, but the stripes are much thinner, and the second stripe follows the lateral line anteriorly on the body (above lateral line on *A. limenus*). The black caudal spot of *A. doederleini* lies on the base of the caudal fin whereas it is centered about one-fourth the way out on the fin in *A. limenus*. In addition, *A. doederleini* has 15 or 16 (usually 15) pectoral rays. The two species sometimes occur together at the same locality and juveniles are particularly difficult to separate, since the bands are often thinner in juveniles of *A. limenus*. Juveniles are separable on the basis of pectoral-ray counts, black caudal spot position, and the dorsal black stripes below the dorsal fins which converge immediately before the first dorsal fin in *A. doederleini*, rather than on the head above the operculum as in *A. limenus*.

Also related is *Apogon victoriae* Günther, which occurs in southwestern Australia. It differs from *A. limenus* in having 5 instead of usually 6 or 7 upper-limb gill rakers and in having broader stripes which are brownish red in life. It also has an extra stripe on the anterior body between the second and third stripes and a black spot on the base and axil of the pectoral fins.

There is some uncertainty regarding the type locality of *Apogon victoriae*. Günther (1859) described the species from a specimen collected by the HMS *Herald* from Victoria. McCulloch (1929) regarded the type locality as the Victoria River in the Northern Territory. However, G. Allen (in litt.) has noted that other species described by Günther (1859) from Victoria are largely tropical and suggested that the type locality might be the Victoria settlement at Port Essington, north of Darwin. If *Apogon victoriae* was described from northern Australia, then *Apogon cooki* would become a synonym of *A. victoriae*. We have been informed by T. Fraser that the dried holotype of *A. victoriae*, although in poor condition, appears to match the Western Australian species, particularly in the black spot at the base of the pectoral fin. In early explorations to Western Australia Grey (1841) named a large area between Perth and Carnarvon as the Province of Victoria. The province is clearly marked on a map produced from early expeditions (Grey, 1841) and this map probably would have been used aboard HMS *Herald*. The clinid, *Heteroclinus antinectes* Günther, was also collected by HMS *Herald* from Western Australia in Freycinet Harbour and is only known from the Shark Bay region of Western Australia; and it is apparent that the *Herald* worked on the Western Australian coast. Consequently, until further evidence becomes available we accept *Apogon victoriae* as the Western Australian species and distinct from the tropical *A. cooki*.

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References

- Allen, G.R., D.F. Hoese, J.R. Paxton, J.E. Randall, B.C. Russell, W.A. Starck II, F.H. Talbot & G.P. Whitley. 1976. Annotated checklist of the fishes of Lord Howe Island. *Records of the Australian Museum* 30(15): 365-454.
- Fourmanoir, P. & P. Laboute. 1976. *Poissons de Nouvelle Calédonie et des Nouvelles Hébrides* 376 pp., Les Éditions due Pacifique, Papeete.
- Fraser, T.H. 1972. Comparative osteology of the shallow water cardinal fishes [Perciformes: Apogonidae] with reference to the systematics and evolution of the family. *Ichthyological Bulletin of the J.L.B. Smith Institute of Ichthyology* 14: 105 pp.
- 1974. Redescription of the cardinal fish *Apogon endekataenia* Bleeker (Apogonidae), with comments on previous usage of the name. *Proceedings of the Biological Society of Washington* 87(1): 3-10.
- Grant, E.M. 1982. *Guides to Fishes*. Department of Harbours and Marine, Brisbane. Edn 5 896 pp.
- Grey, 1841. *Journals of Two Expeditions of Discovery in North-west and Western Australia during the years 1837, 1838 and 1839*. Vol. 2. T.W. Boone, London, 482 pp.
- Günther, A.E. 1859. *Catalogue of the Acanthopterygian Fishes in the Collection of the British Museum*. Vol. 1. British Museum, London. 524 pp.
- McCulloch, A.R. 1929. A check-list of the fishes recorded from Australia. *Memoirs of the Australian Museum* 5: 145-329.
- Radcliffe, L. 1911. Notes on some fishes of the genus *Amia*, family of Cheilodipteridae, with descriptions of four new species from the Philippine Islands. *Proceedings of the U.S. National Museum* 41: 245-261.
- Randall, J.E. & A. Lachner. 1986. The status of the Indo-West Pacific cardinalfishes *Apogon aroubiensis* and *A. nigrofasciatus*. *Proceedings of the Biological Society of Washington* 87(1): 3-10.
- Schultz, L.P. & collaborators. 1953. *Fishes of the Marshall and Marianas Islands*. Bulletin U.S. National Museum 202 vol. 1: xxxii + 655 pp.
- White, J. 1790. *Journal of a Voyage to New South Wales*: xiii + 282 pp. Angus and Robertson, Sydney (reprint edition, 1962).

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