

A NEW SPECIES OF *ABUDEFDUF* (PISCES: POMACENTRIDAE)
FROM THE INDO-AUSTRALIAN ARCHIPELAGO

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and

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ABSTRACT

Abudefduf lorenzi n.sp. differs from all other species of *Abudefduf* by the presence of a dark spot on the posterior area of the caudal peduncle and base of the caudal fin. It is known from the northern and eastern coasts of New Guinea, Bismarck Archipelago, Solomon Islands, Ambon, northern Celebes, Palau Islands and Philippine Islands. It is largely or entirely allopatric with its closest relative, *A. bengalensis*.

INTRODUCTION

Major 20th century works on Indo-West Pacific fishes have assigned pomacentrids having teeth with compressed tips and a smooth preopercular margin to the genus *Abudefduf* Forsskål. During the last few years, Indo-West Pacific pomacentrids have been under study by John E. Randall, Alan R. Emery, and the authors. One result of this study has been the recognition of eight genera within the 'genus' *Abudefduf*. Most of these groups were recognised earlier by Bleeker (1877). Allen (1975) presents a key to these genera.

The genus *Abudefduf*, as currently recognised, is equivalent to Bleeker's subgenus *Glyphidodon*. It is a genus of deep-bodied species, usually with a barred colour pattern (except in *A. sparoides*), having uniserial teeth with

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compressed tips and bicuspid or entire margins (in adults), and usually with 13 dorsal spines (rarely 12 or 14). The genus includes *A. saxatilis* (Linnaeus) (tropical Atlantic), *A. taurus* (Müller and Troschel) (western Atlantic), *A. declivifrons* (Gill) (eastern tropical Pacific), *A. troschelii* (Gill) (eastern tropical Pacific), *A. abdominalis* (Quoy and Gaimard) (Hawaiian Islands), *A. whitleyi* (Allen and Robertson) (Great Barrier Reef and New Caledonia), *A. vaigienses* (Quoy and Gaimard) (Indo-West Pacific), *A. sexfasciatus* (Quoy and Gaimard) (Indo-West Pacific), *A. notatus* (Day) (Indo-Australian Archipelago and Indian Ocean), *A. sordidus* (Forsskål) (Indo-West Pacific), *A. septemfasciatus* (Cuvier) (Indo-West Pacific), *A. bengalensis* (Bloch) (Indo-Australian Archipelago and northern and eastern Indian Ocean), *A. margariteus* (Cuvier) (Reunion and Mauritius). This paper describes a new species of this genus which has hitherto been confused with *A. bengalensis*.

All measurements were made with dial calipers and recorded to the nearest 0.1 mm. Methods for counts and measurements generally follow those of Hubbs and Lagler (1949) with the following additions and qualifications: body depth—from midventral point between ventral fins to base of first dorsal spine; interorbital width—least bony width of interorbital; upper caudal lobe length—from bases of upper caudal rays to tip of longest upper caudal ray; lower caudal lobe length—from bases of lower caudal rays to tip of longest lower caudal ray; transverse scale rows—number of scale rows from upper end of gill opening to end of hypural plate; upper lateral line scales—number of tube-bearing scales, any pore-bearing scales following last tube-bearing scale not counted. Lengths of specimens are standard length (SL). The description is based mainly on specimens 80 mm or larger. Where characters differ significantly with size, they are discussed under 'developmental variation'. The term 'angulate', used in describing fin shapes, refers to a condition between 'rounded' and 'pointed'.

The following institutional abbreviations are used in the subsequent text: AM—Australian Museum, Sydney; AMNH—American Museum of Natural History, New York; BMNH—British Museum (Natural History), London; BPBM—Bernice P. Bishop Museum, Honolulu; CSIRO—Commonwealth Scientific and Industrial Research Organisation, Cronulla, Australia; FMNH—Field Museum of Natural History, Chicago; MNHN—Museum National d'Histoire Naturelle, Paris; MRHNB—Koninklijk Museum voor Midden-Afrika, Tervuren, Belgium; RMNH—Rijksmuseum van Natuurlijke Historie, Leiden; SIO—Scripps Institution of Oceanography, La Jolla, California; THUP—Tunghai University, Taichung, Taiwan; UMMZ—University of Michigan, Museum of Zoology, Ann Arbor, Michigan; USNM—National Museum of Natural History, Washington, D.C.; WAM—Western Australian

Museum, Perth; ZMA—Zoologisch Museum, Amsterdam; ZMK—Universitets Zoologiske Museum, Copenhagen.

Abudefduf lorentzi new species

(Figs. 1 and 2; Tables 1 and 2)

Glyphidodon bengalensis (non Bloch, 1787: 110), Günther (1862: 41; Ambon).

Abudefduf bengalensis (non Bloch, 1787: 110), Montalban (1928: 80-81; in part; Philippine Islands); Fowler and Bean (1928: 128-129; in part; Philippine Islands); Herre (1936: 291; Solomon Islands).

Abudefduf species Allen (1975: 114; Philippine Islands, Palau Islands, Molucca Islands, New Guinea, New Britain, Solomon Islands).

Holotype

FMNH 23564, 100.0 mm, Tunnibuli, Ysabel Island [Tunnibuli Bay, Santa Isabel Island; approximately 8° 25' S, 159° 50' E], Solomon Islands, collected by the Crane Pacific Expedition, 18 April 1929.

Paratypes

AM I.12069, 91.7 mm, Gizo, Solomon Islands, collected by E. Pybus, August 1911; AM I.15360-101, 2 specimens, 68.1 and 69.4 mm, Malaita, Solomon Islands, collected by W. Dawbin, July 1968; AM I.16694-003, 27.0 mm, Madang, New Guinea, collected by G. Allen using quinaldine, depth 1-2 m, 15 May 1972; AM I.16710-001, 2 specimens, 25.6 and 37.5 mm, Urakthapel Island, Palau Islands, collected by G. Allen using rotenone, depth 1 m, 9 January 1972; BMNH 1858.4.21.307, 2 specimens, 61.2 and 115.0 mm, Ambon, collected prior to 1858; BPBM 9501, 4 specimens, 71.0-103.3 mm, Arakabesan Island, Palau Islands, collected by J. Randall using spear, depth 0-1 m, 9 April 1970; BPBM 15998, 88.2 mm, Honiara Harbour, Guadalcanal, Solomon Islands, collected by J. Randall using spear, depth 3 m, 7 July 1973; CSIRO C282, 122.5 mm, Kieta, Bouganville Island, Solomon Islands, collected by I. Munro using beach seine, 21 October 1949; CSIRO C452, 97.8 mm, mouth of Kulineua River, New Hanover, Bismarck Archipelago, collected by I. Munro, 9 November 1949; CSIRO C1778, 94.0 mm, same data as preceding specimen; FMNH 23563, 88.7 mm, collected with holotype; FMNH 40675, 32.7 mm, Nasugbu, Batangus Province, Luzon, Philippine Islands, collected by A. Herre, 12 June 1940; RMNH 886, 108.1 mm, Celebes, collected by E. Forsten, 1840-42; RMNH 11818, 2 specimens,

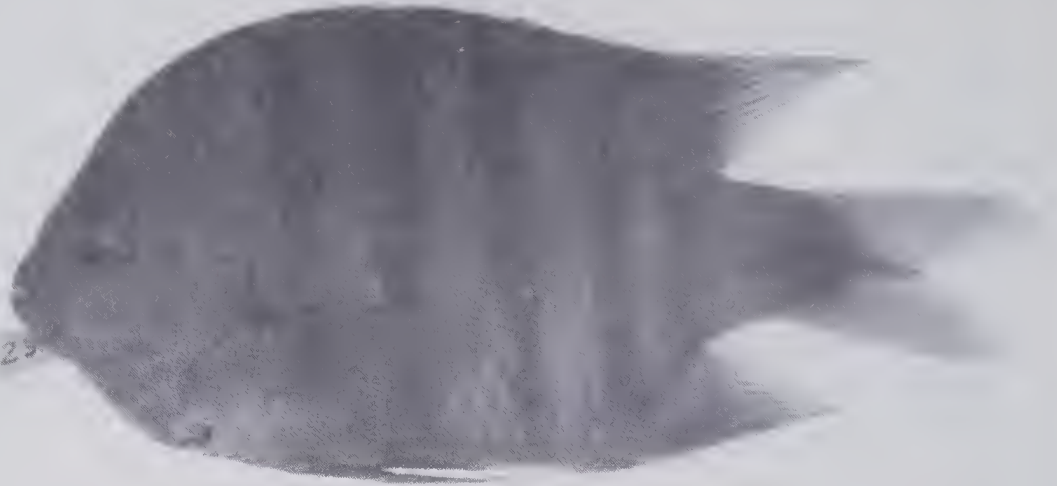


Fig. 1. *Abudefduf lorenzi*, holotype, FMNH 23564, 100.0 mm, from Solomon Islands.

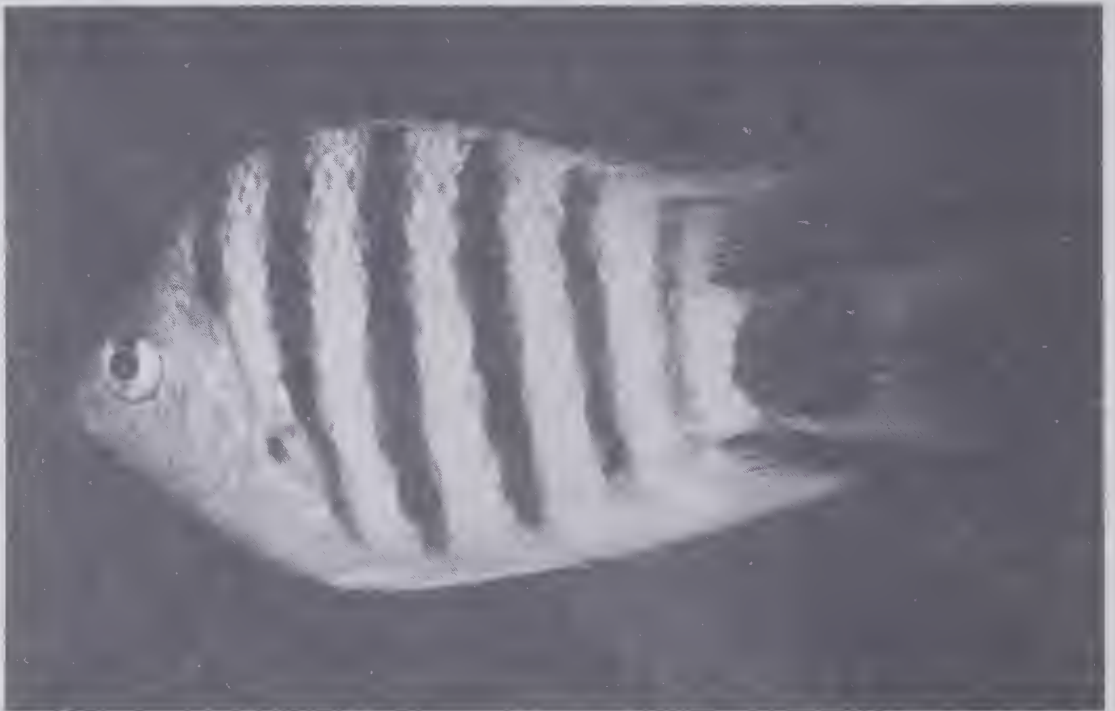


Fig. 2. *Abudefduf lorenzi*, approximately 125 mm TL, photographed underwater at Florida Island, Solomon Islands in depth of one metre.

65.5 and 78.8 mm, Gorontalo, northern Celebes, collected by Rosenberg, 1865; RMNH 14932, 118.8 mm, Geelvink Bay, New Guinea, collected by Rosenberg, 1864; RMNH 14933, 80.7 mm, Ambon, collected by E. Ludeking, 1861-67; RMNH 27463, 96.5 mm, Ambon, no date; USNM 216250, 32.3 mm, Kuia Island, Trobriand Islands, New Guinea, collected by B. Collette using rotenone, depth 0-0.6 m, 10 June 1970; WAM P24924, 86.7 mm, off Cape Tawui, Rabaul, New Britain, collected by G. Allen using rotenone, depth 2 m, 9 August 1973.

Diagnosis

A species of *Abudefduf* with the following combination of characters: dorsal soft rays 11-13 (usually 12); anal soft rays 11 or 12 (usually 12); preorbital naked; suborbital with row of scales on posterior $1/3-1/2$ of series in specimens larger than about 35 mm; interorbital scales reaching to level of nostrils; most of inferior preopercular limb broadly naked; pattern of six dark, narrow, vertical bars on sides and a dark spot on posterior area of caudal peduncle and basal portion of caudal fin; upper caudal lobe angulate to pointed with straight to slightly curved posterior margin.

Description

(Based on the holotype and 26 paratypes.) Data from the holotype are presented, followed in parentheses by the range and, for morphometrics, the mean from the holotype and paratypes. Morphometrics expressed as % SL are presented in Table 1.

Dorsal XIII,12 (XIII,11-13 except one specimen with XIV spines, usually XIII,12); anal II,12 (II,11-12, usually 12); total pectoral rays 18 (17-19); transverse scale rows 27 (26-30, usually 27-29); upper lateral line scales 20 (20-22, usually 20); gill rakers 8 + 18 (6-8 + 15-18, usually 6 or 7 + 16 or 17), totalling 26 (22-26, usually 22-24).

Depth of body 1.8 (1.6-2.0, 1.7), length of head 3.2 (2.7-3.2, 3.1), both in standard length. Snout 3.2 (3.0-4.2, 3.3), orbit 3.1 (3.0-3.6, 3.3) in specimens larger than 80 mm (see below for developmental variation in orbit length), length of upper jaw 3.3 (3.2-3.6, 3.3), interorbital width 2.8 (2.7-3.5, 3.1), caudal peduncle depth 1.7 (1.6-2.1, 1.7), length of first dorsal spine 4.0 (3.7-5.4, 4.3), of sixth dorsal spine 2.0 (1.6-2.2, 2.0), of thirteenth dorsal spine 1.7 (1.7-2.4, 1.9), of longest dorsal ray (third, fourth, or fifth, usually fourth) 1.1 (0.9-1.4, 1.1), of first anal spine 4.4 (3.5-5.4, 4.4), of second anal spine 2.1 (1.7-2.4, 2.0), of longest anal ray (fifth or sixth) 1.2 (1.1-1.6, 1.2), of upper caudal lobe 0.8 (0.8-0.9, 0.9), of lower caudal lobe

0.9 (0.9-1.1, 1.0), of pectoral fin 0.9 (0.9-1.2, 1.0), of pelvic fin 0.8 (0.8-1.0, 0.9), all in length of head. Depth of caudal peduncle in its length 0.9 (0.8-1.0, 0.9).

Jaw teeth with compressed tips, bicuspid or entire margins (see below for developmental variation in tooth margins); interorbital scales extending anteriorly to a point even with or, rarely, slightly anterior to nostrils; pre-orbital naked, posterior $1/3-1/2$ of suborbital series with a row of scales (see below for developmental variation in suborbital squamation); preopercle with three regular rows of large scales and dorsally one row of small scales ventral to suborbital series, upper limb naked, lower limb mostly naked but frequently with 1-3 small scales anteriorly.

Dorsal spines increasing in length posteriorly from first through 4th-6th, fourth, fifth, or sixth through twelfth subequal, thirteenth usually slightly longer than twelfth; soft dorsal fin pointed; anal fin angulate to pointed; upper caudal lobe angulate to pointed, posterior margin straight to slightly curved; lower caudal lobe rounded to pointed, posterior margin straight to curved (see below for developmental variation in shape of lower caudal lobe); adpressed pectoral fin reaching to transverse level of ninth, tenth, or eleventh dorsal spine; ventral fin with filamentous outer ray, reaching to bases of anal spines or first three anal rays.

Colour in alcohol: ground colour of head and body tan to dark brown, snout, interorbital, nuchal region, and frequently lips and lower jaw, darker; a pattern of six dark bars present on body, width of each bar approximating distance from anterior surface of one dorsal spine to posterior surface of following spine; bars located as follows: 1) across nape to dorsal angle of opercular opening (frequently indistinct or absent), 2) from bases of 1st-3rd dorsal spines to behind pectoral axil, 3) from bases of 4th-6th dorsal spines to lower abdomen, 4) from bases of 8th-10th dorsal spines to area just dorsal to anal-urogenital region, 5) from bases of twelfth and thirteenth dorsal spines to bases of anterior anal rays, 6) from bases of middle soft dorsal rays to bases of last anal rays and anteroventral area of caudal peduncle; caudal peduncle with large dark spot posteriorly which extends onto base of caudal fin, remainder of caudal fin tan to brown; dorsal and anal fins similar to ground colour of adjacent body surfaces; pectoral fins tan to hyaline with small dark spot superiorly on base; ventral fins with brown rays, membranes partially whitish, causing extended ventral fins to be similar to or slightly darker than ground colour of lower abdomen, and retracted ventrals to be whitish.

Colour when alive: Allen (1975) presented an underwater colour photograph of this species, which is reproduced here in black and white as Fig. 2.

Table 1: Morphometric proportions (% SL) of holotype and paratypes of *Abudefduf lorenszi*.

Standard length (mm)	25.6-37.5			61.2-78.8			80.7-97.8			103.3-122.5			(holotype)	
	\bar{X}	Range	N	\bar{X}	Range	N	\bar{X}	Range	N	\bar{X}	Range	N	100.0	N
Body depth	56.9	55.7-58.9	5	56.8	48.8-61.4	3	58.3	54.6-62.0	9	57.5	55.6-59.3	5	56.1	5
Head length	37.2	35.7-39.1	5	32.4	31.8-32.7	3	32.5	31.1-33.7	10	32.4	31.7-33.2	5	31.1	5
Snout length	9.6	8.5-11.9	5	9.3	8.8-9.8	3	9.8	9.1-10.4	10	10.2	9.9-10.6	5	9.8	5
Orbit length	15.2	14.1-17.4	5	11.3	10.4-11.9	3	10.0	8.9-10.7	10	9.5	9.1-9.7	5	10.0	5
Upper jaw length	11.8	10.5-12.9	5	9.9	9.8-10.1	3	9.7	9.4-10.0	10	9.6	9.2-10.1	5	9.5	5
Interorbital width	9.9	8.6-11.3	5	10.6	9.8-11.9	3	10.3	9.8-11.2	10	10.6	9.8-11.2	5	10.9	5
Caudal peduncle depth	17.7	16.8-19.0	5	18.6	18.4-18.8	3	18.7	17.8-19.6	10	18.0	16.8-19.2	5	18.1	5
Caudal peduncle length	14.4	12.5-17.0	5	17.4	16.5-18.3	3	16.1	13.7-18.2	10	16.0	14.5-17.6	5	16.5	5
Upper caudal lobe length	40.1	39.3-41.9	5		37.7	1	36.4	34.9-39.8	8	35.7	34.1-37.6	4	37.1	4
Lower caudal lobe length	38.2	36.8-39.8	5		34.6	1	34.1	31.0-36.8	9	33.1	31.3-34.8	4	33.3	4
Pectoral fin length	33.2	31.0-34.1	5	33.5	32.7-34.1	3	33.5	30.3-37.1	10	32.0	29.1-34.8	5	32.8	5
Pelvic fin length	36.8	34.8-39.8	5	36.8	35.7-37.4	3	37.7	34.4-40.1	9	36.2	33.6-38.7	5	37.9	5
First dorsal spine length	9.3	7.8-10.7	5	7.8	7.6-8.1	2	7.8	6.9-8.7	10	6.8	5.9-8.1	3	7.7	3
Sixth dorsal spine length	17.8	16.4-19.9	5	17.6	16.6-18.6	2	17.1	15.3-18.6	10	15.4	14.1-17.4	4	15.5	4
Thirteenth dorsal spine length	15.7	14.1-16.8	5	17.6	17.4-17.9	2	18.3	16.6-19.8	10	17.1	16.2-19.4	4	17.8	4
First anal spine length	8.4	6.8-10.1	5	7.5	6.7-8.4	2	7.7	5.8-9.3	10	6.6	6.2-7.2	3	7.0	3
Second anal spine length	18.5	18.0-20.0	5	16.5	15.4-17.6	2	17.0	15.0-19.0	10	14.9	13.3-17.4	4	15.1	4
Longest dorsal ray length	26.0	24.6-26.1	4	28.6	28.5-28.8	2	30.4	26.2-34.0	10	31.0	27.8-36.7	5	28.7	5
Longest anal ray length	25.1	24.2-27.0	4	26.7	25.9-27.8	3	27.4	23.3-30.1	10	25.0	23.1-27.8	4	26.0	4

There are two major differences in coloration between living and preserved specimens; the ground colour of live specimens is pale silvery-grey to whitish (*vs.* tan to dark brown), and the anteriormost dark bar (across nape) is much more distinct than in preserved specimens.

Developmental variation: The ratio head length/orbit length has a mean of 2.8 and a range of 2.6-3.1 for specimens less than 80 mm. Three juvenile specimens (25.6-32.3 mm) have not developed suborbital scales. Adult specimens of *Abudefduf* usually have bicuspid or entire tooth margins. However, apparently all or most of the teeth (except for the posteriormost in each jaw, which remain peglike) originate in a tricuspid condition. The bicuspid shape results from the reduction of the central cusp and/or enlargement of lateral cusps. The entire or flattened condition probably results from wear on bicuspid teeth. If one considers tricuspid, bicuspid, and entire tooth margins as early, middle, and late developmental stages, respectively, in any one individual the most advanced tooth type is usually found near the symphyses, earlier types being found more laterally and posteriorly. In *A. lorenzi* tricuspid and bicuspid teeth are found in the five smallest specimens (26.5-37.5 mm); larger specimens (61.2-122.5 mm) have the typical adult condition with a combination of bicuspid and entire teeth. It is possible that the shape of the lower caudal lobe changes with an increase in standard length (Fig. 3a, b). The two largest specimens examined (118.8 and 122.5 mm) have rounded lower caudal lobes; smaller specimens (25.6-115.0 mm) have angulate to pointed lobes.

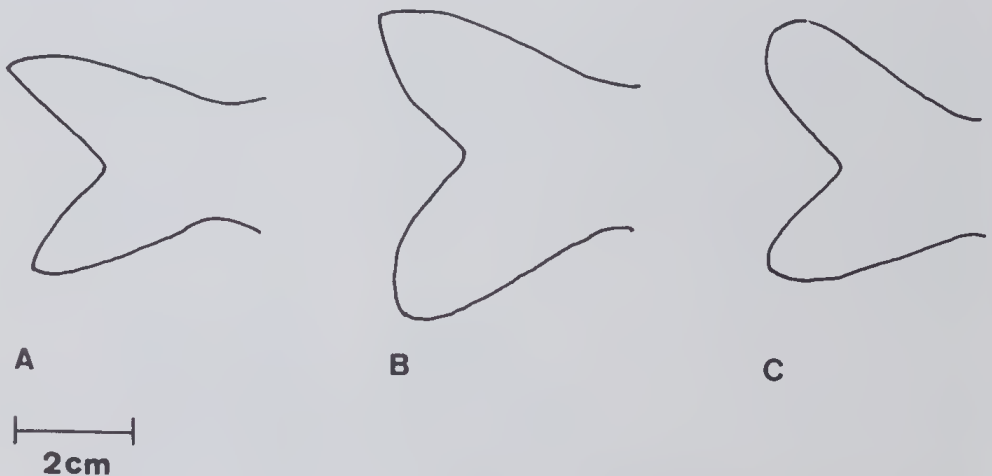


Fig. 3. Outlines of caudal fins: a) *Abudefduf lorenzi*, 100.0 mm; b) *A. lorenzi*, 118.8 mm; c) *A. bengalensis*, 104.3 mm.

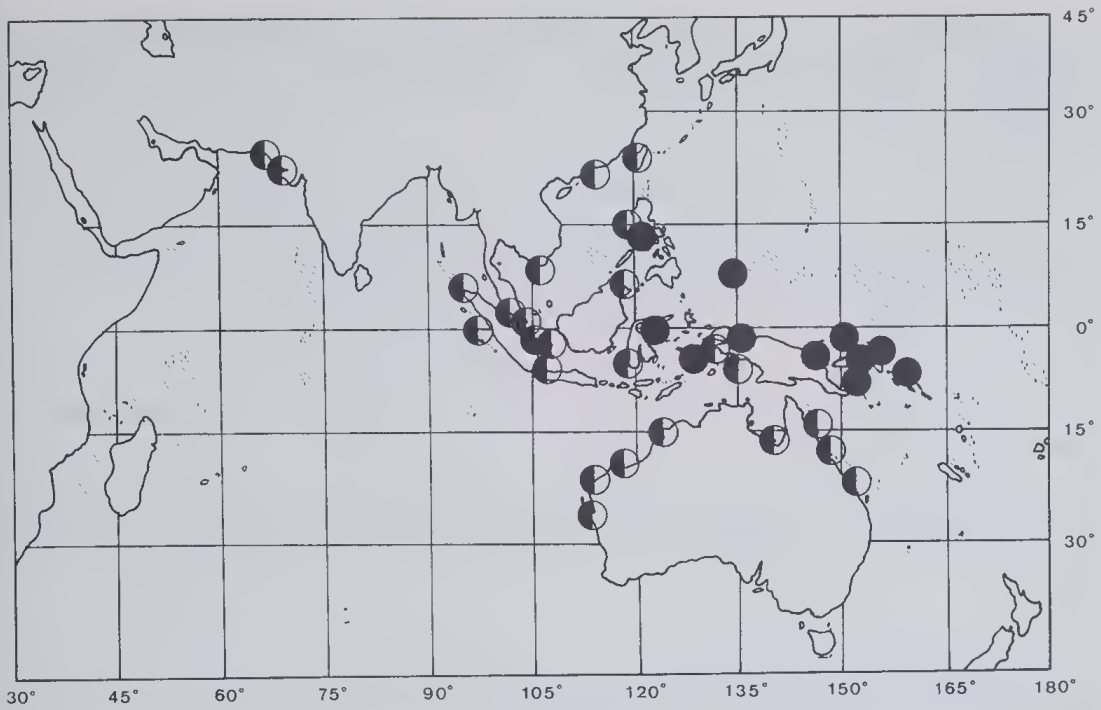


Fig 4. Localities for specimens of *Abudedefduf lorenzi* and *A. bengalensis* examined in the present study: Shaded circles = *A. lorenzi*; half-shaded circles = *A. bengalensis*.



Fig 5. *Abudedefduf bengalensis*, approximately 150 mm TL, photographed underwater at One Tree Island, Great Barrier Reef in depth of two metres (note characteristic rounded upper lobe of caudal fin).

Distribution (see also Fig. 4): Known from the northern and eastern coasts of New Guinea, Bismarck Archipelago, Solomon Islands, Maluku Islands (Ambon), northern Celebes (Gorontalo), Palau Islands, and Philippine Islands.

Habitat: *A. lorenzi* inhabits protected lagoon areas and sheltered coastal reefs, usually near shore in 0.5 to six metres depth. It is also common around docks and breakwaters, occurring individually or in aggregations containing about 20-30 fish. The diet consists chiefly of benthic algae.

Comparisons: *A. lorenzi* is readily separable from all other *Abudefduf* on the basis of the dark spot on the posterior region of the caudal peduncle and base of the caudal fin. *A. sparoides* has a dark ovoid spot on the caudal peduncle, but in this species the spot is located more anteriorly, below the soft dorsal fin and on the anterior part of the caudal peduncle. In addition, *A. sparoides* is the only species in the genus which lacks a pattern of dark bars.

A. lorenzi is most closely related to *A. bengalensis* (Fig. 5), the species with which it has been confused by most previous authors. *A. lorenzi* differs, however, in several characters, in addition to having the large dark spot on the caudal peduncle and fin. The two species possess a similar pattern of narrow, dark bars, but *A. bengalensis* has an additional bar (often indistinct or absent in preserved specimens) at the base of the caudal fin in place of the large blotch found in *A. lorenzi*. Locations of the six anteriormost bars in *A. bengalensis* are very close to those of *A. lorenzi*, with the frequent exception of the sixth bar, which is often located on the anterior or middle region of the caudal peduncle (*vs.* below the soft dorsal fin in *A. lorenzi* and some *A. bengalensis*). In adult specimens of *A. bengalensis*, both lobes of the caudal fin are rounded with strongly curved posterior margins (Figs. 3c and 5); in *A. lorenzi* the upper caudal lobe is angulate to pointed with its posterior margin straight to only slightly curved (Fig. 3a, b). Differences also exist between these species in numbers of dorsal and anal soft rays (Table 2); 11-13 (usually 12) dorsal soft rays in *A. lorenzi vs.* 13-15 (usually 13 or 14) in *A. bengalensis*, and 11 or 12 (usually 12) anal soft rays in *A. lorenzi vs.* 13 or 14 in *A. bengalensis*. In addition, most specimens of *A. bengalensis* possess 19 pectoral rays compared with a usual count of 18 for *A. lorenzi*.

We have examined 233 specimens of *A. bengalensis*, 21.3-138.1 mm SL from the following localities: northern Australia (Queensland to Western Australia), West Irian, Aru Islands, Celebes, Sabah, Java, Belitung and Bangka (off southeastern Sumatra), Batu Island (off west coast of Sumatra), We (off northwestern end of Sumatra), Singapore, Strait of Malacca, Vietnam

Philippine Islands, Hong Kong, Taiwan, India, and West Pakistan (Karachi); this total includes 116 specimens from northern Western Australia examined at WAM. We have also examined the type specimens of *Glyphidodon affinis* Günther and *Glyphisodon palmeri* Ogilby at BMNH and AM respectively. Both species are junior synonyms of *A. bengalensis*.

Seven specimens from the Indonesian region (MRHNB 18470-71, 18473; RMNH 10117, 27462) cannot be identified as either *A. bengalensis* or *A. lorenzi*, but probably belong to the latter species on the basis of fin ray counts. The specimens are faded making it impossible to detect the dark spot at the base of the caudal fin. In addition, the caudal fin lobes are damaged and precise locality data is missing for most of the specimens.

It is not known if the distributions of *A. lorenzi* and *A. bengalensis* overlap. They appear to be largely allopatric (Fig. 4), but may possibly co-occur in the vicinity of West Irian.

The holotype and one paratype of *A. lorenzi* (FMNH 23563 and 23564) are two of four specimens described by Herre (1936) from the Solomon Islands as *A. bengalensis*. The two specimens (BMNH 1858.4.21.307) from Ambon described by Günther (1862) as *G. bengalensis* are also among the paratypes of *A. lorenzi*.

Etymology: Named in honour of Konrad Lorenz for his contributions to the science of ethology.

Table 2. Soft dorsal, soft anal, and pectoral fin ray counts for *Abudefduf lorenzi* and *A. bengalensis*.

Species	Dorsal Soft Rays					Anal Soft Rays				Pectoral Rays				
	11	12	13	14	15	11	12	13	14	16	17	18	19	20
<i>Abudefduf lorenzi</i>	2	23	2			1	26			2	23	2		
<i>Abudefduf bengalensis</i>			23	85	2		56	53		1	1	33	66	5

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