

## *Cirrhilabrus cenderawasih*, a new wrasse (Pisces: Labridae) from Papua, Indonesia

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### Abstract

*Cirrhilabrus cenderawasih* is described from seven specimens, 38.9-65.1 mm SL, collected at Cenderawasih Bay, Papua, Indonesia. It is closely related to *C. walindi* from Papua New Guinea and the Solomon Islands, but differs with regards to male colour pattern, particularly the number, shape and position of large dark blotches along the back and adjacent dorsal fin. There are 4-5, irregularly rounded blotches that extend well onto the back in *C. cenderawasih* in contrast to only two, rectangular blotches for *C. walindi* that are primarily positioned on the dorsal fin. It is hypothesized that these species arose from a common ancestor that was once widely distributed along the northern margin of the New Guinea-Australian Plate, but land and current barriers formed over the past few million years have facilitated isolation and eventual speciation in the Cenderawasih Bay population.

### Zusammenfassung

*Cirrhilabrus cenderawasih* wird auf der Grundlage von sieben Exemplaren mit 38,9-65,1 mm SL beschrieben, die in der Cenderawasih-Bucht, Papua, Indonesien, gesammelt wurden. Der Lippfisch ist *C. walindi* von Papua-Neuguinea und den Salomon-Inseln nahe verwandt, unterscheidet sich aber durch das Farbmuster bei den Männchen, insbesondere Zahl, Form und Lage dunkler großer Flecken am Rücken und auf der angrenzenden Rückenflosse. Bei *C. cenderawasih* finden sich 4-5 unregelmäßig rundlich geformte Flecken, die sich weit auf den Rücken erstrecken; im Vergleich dazu gibt es bei *C. walindi* nur zwei rechteckige Flecken, die sich hauptsächlich auf der Rückenflosse befinden. Es wird die Vorstellung entwickelt, dass die beiden Arten sich aus einem gemeinsamen Vorfahren entwickelt haben, der früher am Nordrand der neuguinesisch-australischen Platte weit verbreitet war, aus dem sich aber wegen der Isolation über Jahrmillionen durch Landmassen und Strömungen eine eigene Art in der Cenderawasih-Bucht entwickelt hat.

### Résumé

*Cirrhilabrus cenderawasih* est décrit sur base de sept spécimens, de 38,9 à 65,1 LS, collectés à Cenderawasih Bay, Papouasie, Indonésie. L'espèce est très proche de *C.*

*walindi* de Papouasie-Nouvelle-Guinée et des îles Salomon, mais se distingue par le patron de coloration du mâle, surtout par le nombre, la forme et la position de grandes taches sombres le long du dos et de la dorsale adjacente. Il y a 4-5 taches irrégulièrement arrondies qui s'étendent bien sur les dos de *C. cenderawasih*, alors que *C. walindi* ne compte que deux taches rectangulaires surtout situées sur la dorsale. On émet l'hypothèse que ces espèces descendent d'un ancêtre commun qui a dû connaître un jour une large distribution le long de la bordure nord de la plaque d'Australie – Nouvelle Guinée, mais des barrières de terres et de courants ont dû favoriser l'isolation depuis quelques millions d'années et la formation d'une espèce dans la population de Cenderawasih Bay.

### Sommario

*Cirrhilabrus cenderawasih* è descritto sulla base di sette esemplari, 38,9-65,1 mm SL, raccolti nella baia di Cenderawasih, Papua, Indonesia. Appare strettamente imparentato con *C. walindi* presente a Papua New Guinea e alle Isole Salomone, ma si discosta per la colorazione del maschio, in particolare per il numero, la forma e la posizione delle estese macchie scure lungo il dorso e adiacenti alla pinna dorsale. Sul dorso di *C. cenderawasih* ci sono 4-5 macchie rotondeggianti irregolari, in contrasto alle due rettangolari presenti in *C. walindi* che sono principalmente posizionate sulla pinna dorsale. Si ipotizza che queste due specie si siano diversificate a partire da un antenato comune che un tempo doveva essere ampiamente distribuito lungo il margine settentrionale della placca australiana, ma la terra e le correnti hanno formato negli ultimi milioni di anni una barriera che ha favorito l'isolamento e la speciazione della popolazione nella baia Cenderawasih.

### Introduction

The labrid genus *Cirrhilabrus* Temminck and Schlegel, 1845 contains small, colourful, sexually dimorphic fishes inhabiting mainly rubble bottoms on Indo-west Pacific coral reefs. Allen and Randall (1996) listed 31 species and noted that most were restricted to relatively deep water. Indeed, only

four species were described prior to 1974 and the abundance of new findings is directly related to the widespread use of SCUBA gear by scientists, particularly at depths in excess of 20 m. An additional 11 species have been described over the past decade raising the total to 43 species, and making *Cirrhilabrus* the second most speciose labrid group after *Halichoeres*. Most of the recent discoveries were summarized by Allen *et al.* (2003) with the exception of *C. brunneus* Allen, 2006 from northeastern Borneo.

The present paper describes a new species that was collected by the authors during a recent Conservation International sponsored coral reef survey at Cenderawasih Bay in Papua and Irian Jaya Barat provinces of Indonesia. This large (approximately 59,000 km<sup>2</sup>) bay situated on New Guinea's north coast separates the Bird's Head or Vogelkop Peninsula from the main body of the island. Our recent field investigations revealed a rich reef fish community with several unique peculiarities indicative of isolation from neighbouring areas in the geological past. The most obvious of these include several new or recently described species that appear to be endemic to the bay, additional species that occur widely in neighbouring regions, but exhibit unusual colour variation in the bay, and several deep-reef species that occur in unusually shallow water within the bay. We hypothesize that the bay was essentially isolated for a substantial period over the past five million years and present day geographic and oceanographic conditions continue to provide a degree of isolation (see discussion in Remarks section below).

## Materials and Methods

Counts of fin spines are given in Roman and soft rays in Arabic numerals. Pectoral-ray counts include the rudimentary upper ray. The lateral line is interrupted; the count of the anterior part is given first, followed by a plus sign and the peduncular part. Only lateral-line scales with tubes are counted. All the tubed scales of the peduncular part are counted, even though one is usually located posterior to the base of the caudal fin. The number of scales in the rows on the cheek are counted from where they commence below the front of the orbit to behind the centre of the orbit. Gill-raker counts include all rudiments. Because it may be difficult to determine which raker is at the angle, only the total gill-raker count is given.

Lengths of specimens are given as standard length

(SL) except estimates of total length (TL) of fishes photographed underwater; this is the straight-line measurement from the front of the upper lip to the base of the caudal fin (end of hypural plate). Measurements in Table I are given as percentages of the standard length. Head length is the distance from the front of the upper lip to the posterior end of the opercular membrane. Body depth is the greatest depth to the base of the dorsal fin (adjusting for any malformation of the abdomen due to preservation). Body width is measured just posterior to the opercular flap. Snout length is taken from the front of the upper lip to the fleshy edge of the orbit (if the upper jaw is protruded, it is pressed back to the nonprotractile position before the measurement is taken; the same is true of SL and head length measurements). Orbit diameter is the greatest fleshy diameter. Interorbital width is the least bony width. Caudal peduncle depth is the least depth; caudal peduncle length is the horizontal measurement between verticals at the rear base of the anal fin and the caudal-fin base. Measurements of fin spines and rays are taken to the extreme base of these elements. Caudal concavity is the horizontal distance between the tips of the longest and shortest caudal rays. Pectoral-fin length is taken from the tip of the longest ray to the base of this ray. Pelvic-fin length is measured from the base of the spine to the tip of the longest ray.

Type specimens are deposited at the Australian Museum, Sydney (AMS), Bishop Museum, Honolulu (BPBM), National Museum of Natural History, Washington, D.C. (USNM), Pusat Penelitian dan Pengembangan Oseanologi, Jakarta, Indonesia (NCIP), and Western Australian Museum, Perth (WAM).

## *Cirrhilabrus cenderawasih* n. sp.

Cenderawasih Wrasse (Figs 1-3)

**Holotype:** NCIP 6308, male, 58.7 mm, Pulau Kumbur (02° 59.867'S 135° 03.337'E), Cenderawasih Bay, Irian Jaya Barat Province, Indonesia, 35 m, clove oil and hand net, Mark Erdmann, 18 February 2006.

**Paratypes:** AMS I.43830-001, male, 65.1 mm SL, Windesi, (02° 24.871'S 134° 13.433'E), Cenderawasih Bay, Irian Jaya Barat Province, Indonesia, 35 m, clove oil and hand net, Mark Erdmann, 23 February 2006; BPBM 40414, female, 38.9 mm SL and male, 52.7 mm SL, collected with holotype; USNM

385876, male, 56.5 mm SL, Tanjung Kimbo (03° 14.767'S 135° 33.612'E), Cenderawasih Bay, Papua Province, Indonesia, 25-35 m, clove oil, M. Erdmann, 17 February 2006; WAM 32772-001, male, 62.5 mm SL, and female 47.0 mm SL, same data as USNM paratypes, but collected with spear and clove oil by M. V. Erdmann and G. R. Allen.

### Diagnosis

Dorsal rays XI,9; anal rays III,9; pectoral rays 15; lateral-line scales 14-16 + 6-9; median predorsal scales 5; horizontal scale rows on cheek below eye 2; gill rakers 14-17; body depth 2.9-3.2 in SL; head length 2.9-3.2 in SL; snout length 3.8-4.7 in head; caudal fin of male strongly lunate with produced lobes; pelvic fins relatively short, not reach-

ing anal fin origin when depressed; diagnostic live colour pattern features of males include a pink overall coloration with broad, irregular yellow stripe or rectangular blotch on middle of side, and series of 4-5 large, irregular black blotches along back, extending on to adjacent basal portion of dorsal fin; female mainly reddish pink with pupil-sized black spot on upper caudal peduncle.

### Description

Dorsal rays XI,9; anal rays III,9; dorsal and anal soft rays branched except first and second rays of dorsal fin and first ray of anal fin; the last dorsal and anal soft rays branched to base; pectoral rays 15, the upper two unbranched; pelvic rays I,5; principal caudal rays 13, the upper and lower rays



Fig. 1. *Cirrhilabrus cenderawasih*, freshly collected male holotype, 58.7 mm SL, Cenderawasih Bay, Papua. Photo by G. R. Allen.

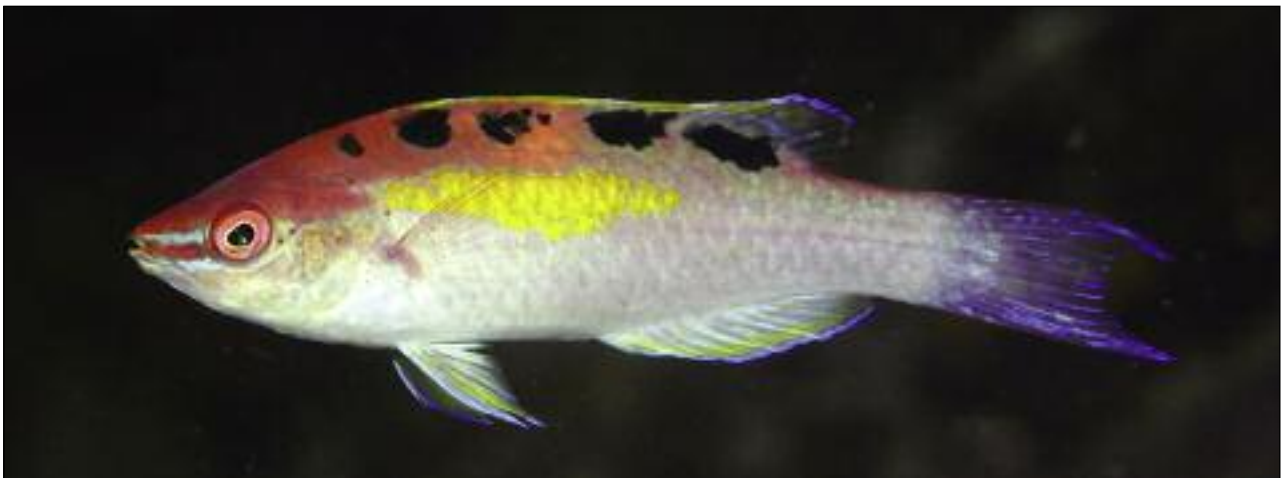


Fig. 2. Underwater photograph of male *Cirrhilabrus cenderawasih*, approximately 70 mm TL, 25 m depth, Cenderawasih Bay, Papua. Photo by G. R. Allen.

**Table I.** Proportional measurements of type specimens of *Cirrhilabrus cenderawasih* expressed as percentage of the standard length.

	Holotype NCIP 6308	Paratype AMS I.43830	Paratype WAM P.32772	Paratype USNM 385876	Paratype BPBM 40414	Paratype WAM P.32772	Paratype BPBM 40414
Sex	male	male	male	male	male	female	female
Standard length (mm)	58.7	65.1	62.5	56.5	52.7	47.0	38.9
Body depth	33.2	31.5	30.9	31.5	30.9	33.8	34.7
Body width	15.0	15.7	14.7	15.4	13.7	16.6	14.4
Head length	33.7	31.3	32.3	33.5	32.8	32.6	34.4
Snout length	8.0	8.1	8.0	7.6	7.0	7.0	8.2
Eye diameter	7.8	8.9	8.5	8.3	9.1	9.4	10.0
Interorbital width	7.7	7.7	7.7	8.0	6.6	7.7	7.5
Upper jaw	8.0	7.4	7.7	8.0	6.6	6.8	7.2
Depth of caudal peduncle	13.6	12.7	13.3	14.2	13.3	13.6	13.6
Length of caudal peduncle	18.4	16.9	17.4	17.5	17.1	19.1	15.9
Predorsal distance	34.1	32.3	32.3	32.6	33.8	31.3	35.0
Preanal distance	59.6	59.1	56.6	61.1	58.3	59.8	64.0
Prepelvic distance	34.4	33.5	35.2	34.5	34.5	34.7	34.2
Length of dorsal fin base	53.5	55.3	59.2	55.2	53.3	55.3	53.5
1st dorsal spine	6.6	6.6	6.9	5.8	5.7	6.4	5.7
Last dorsal spine	13.6	14.0	13.3	13.1	13.5	13.0	12.9
Longest soft dorsal ray	14.1	14.9	14.4	14.0	14.8	14.9	14.4
Length of anal fin base	26.2	26.6	11.7	26.2	27.3	24.5	55.0
1st anal spine	5.5	5.2	4.2	5.7	5.9	4.5	5.7
2nd anal spine	8.5	7.7	7.5	9.2	9.3	8.3	8.7
3rd anal spine	10.7	9.5	10.1	11.5	11.0	11.3	10.3
Longest soft anal ray	14.0	13.8	14.4	14.7	14.4	13.4	13.1
Caudal fin length	31.5	36.6	32.2	34.9	38.0	28.1	26.7
Pectoral fin length	21.8	20.4	19.2	20.4	21.8	21.1	21.3
Pelvic fin spine length	11.1	11.5	11.2	11.5	11.8	12.3	12.3
Pelvic fin length	21.8	23.0	21.0	23.9	24.7	19.1	20.1
Caudal concavity	6.1	12.9	12.0	11.7	15.7	2.6	0.0

unbranched; upper and lower procurrent caudal rays 3 (3-4); lateral line 16 + 6 (16 + 6-9, except one paratype with 14 + 6); scales above lateral line to origin of dorsal fin 2; scales below lateral line to anus 7 (6-7); median predorsal scales 5; median preopercular scales 6 (5-6); transverse scale rows on cheek 2, the upper row with 6 (5-8) and the lower row with 10 (9-10) scales; circumpeduncular scales 15; gill rakers 15 (14-17).

Body moderately elongate, the depth 3.0 (2.9-3.2) in SL; body compressed, the width 2.2 (2.0-2.4) in depth; dorsal profile of head nearly straight, becoming slightly convex on nape; head length 3.0 (2.9-3.2) in SL; snout moderately pointed, its length 4.2 (3.8-4.7) in head; orbit diameter 4.3 (3.4-4.0) in head; interorbital space slightly convex medially, strongly convex laterally, the least bony width 4.4 (4.1-4.9) in head; caudal-peduncle depth 2.5 (2.4-2.5) in head; caudal-peduncle length 1.8 (1.7-2.2) in head.

Mouth terminal and oblique, forming an angle of about 25 degrees to horizontal axis of body; mouth small, the maxilla just reaching a vertical at posterior nostril, the upper-jaw length 4.2 (4.2-4.9) in head;

dentition of holotype typical of the genus with three pairs of canine teeth anteriorly at side of upper jaw, the first forward-projecting, the next two strongly recurved and outcurved, the third much the longest; an irregular row of very small conical teeth medial to upper canines; side of upper jaw with about 18-20 small conical teeth; lower jaw with a single pair of forward-projecting canines and a row of very small conical teeth in the symphyseal gap; side of lower jaw with a row of about 20 small conical teeth, decreasing in size posteriorly. Gill rakers small, the longest on first branchial arch less than half length of longest gill filaments.

Posterior margin of preoperculum with 20 (16-28) very fine serrae; margins of posterior and ventral edges of preoperculum free to about level of middle of pupil. Anterior nostril small and inconspicuous, in a short membranous tube with a posterior flap, located anterior to upper edge of eye nearly one-half distance to front of upper lip; aperture of posterior nostril much larger than any head pores, without elevated rim, located posterior and slightly dorsal to anterior nostril on a vertical with anterior, bony edge of orbit. Pores of cephalic lat-

eralis system adjacent to ventroposterior half of orbit 15; a series of nine pores along margin of preoperculum linking with three on mandible to front of chin; a series of 12 pores from above upper edge of preoperculum passing dorsal to orbit and ending in front of anterior nostril; a series of nine pores on each side of head from first lateral-line scale to front of scaled part of nape, plus three mid-interorbital pores.

Scales cycloid; head scaled except snout, interorbital space, and ventrally; lowermost of two transverse rows of scales below eye larger than upper; naked flange of ventral edge of preoperculum about half height of lower row of scales; base of dorsal and anal fins with a row of large elongate

scales, one per membrane (except first scale, which covers membranes of first and second spines), the longest about two-thirds spine length (basal scales progressively shorter posteriorly on membranes of soft portion of fin); peduncular lateral-line scales followed by one slightly larger pored scale (included in lateral-line count) on base of caudal fin with a slightly posterior scale above and below, these three scales followed by a vertical row of three enormous scales, the middle one overlapping the ones above and below, reaching two-thirds distance to central, posterior margin of fin; pectoral fins scaleless; pelvic fins with a median ventral process of two elongate scales, the more pointed posterior scale about two-thirds length of pelvic



Fig. 3. Underwater photograph of female *Cirrhilabrus cenderawasib*, approximately 50 mm TL, 25 m depth, Cenderawasih Bay, Papua. Photo by G. R. Allen.



Fig. 4. Underwater photograph of male *Cirrhilabrus walindi*, approximately 70 mm TL, 20 m depth, Kimbe Bay, New Britain, Papua New Guinea. Photo by G. R. Allen.

spine; slender axillary scale of each pelvic fin extending about one-third to one-half length of pelvic spine.

Origin of dorsal fin above third lateral-line scale; first dorsal spine 5.1 (4.7-5.8) in head; remaining dorsal spines progressively longer, the last 2.5 (2.2-2.7) in head; interspinous membranes of dorsal fin extending above spine tips, supported by the terminal cirrus projecting upward from just behind each spine tip; first to third dorsal soft rays the longest, 2.4 (2.1-2.4) in head; origin of anal fin on a vertical with base of penultimate dorsal spine; first anal spine 6.2 (5.6-7.8) in head; second anal spine 4.0 (3.5-4.3) in head; third anal spine 3.1 (2.9-3.4) in head; fourth and fifth anal soft rays longest, 2.4 (2.2-2.6) in head; caudal fin of males strongly lunate with protruding upper and lower lobes (damaged in holotype), its length 1.1 (0.9-1.3) in head; caudal fin of females truncate; damaged caudal concavity of holotype 5.5 (2.1-2.9 for undamaged male paratypes) in head; third and fourth pectoral rays longest, 1.5 (1.5-1.7) in head; origin of pelvic fins below pectoral-fin base; pelvic-fin length 1.5 (1.3-1.5 in males, 1.7 in females) in head, the pelvic-fin tips falling well short of anal fin origin when depressed; length of pelvic-fin spine 3.0 (2.6-2.9) in head.

**Colour of freshly collected male holotype** (Fig. 1): mainly pink with yellowish suffusion especially noticeable on anterodorsal portion of body and dorsal surface of caudal peduncle; prominent, broad yellow stripe or rectangular blotch on middle of side from dorsal-posterior margin of operculum to below soft portion of dorsal fin; series of five large, irregular blackish blotches along back (third and fourth blotches coalesced), extending on to adjacent basal half of dorsal fin; snout tip brownish; pair of short, pale blue stripes on snout, the first from anterior part of upper lip to anterior margin of eye, second from rictus of mouth to lower anterior margin of eye; scattered, irregular, small orange spots on cheek and operculum; dorsal fin pink on basal half interrupted by dorsal extension of black blotches along back, and yellow on distal half with narrow blue margin; anal fin pale pink on basal half, yellow on distal half with faint blue stripe separating the two colours and narrow blue outer margin; caudal fin bluish; pelvic fins whitish with narrow blue anterior margin and adjacent yellow streak.

There is considerable variation in the shape of the large black blotches on the upper sides and in

some individuals two to three blotches may be coalesced. The anteriormost blotch is particularly variable in size and shape. It is sometimes barely larger than pupil size. In addition, several individuals were observed underwater that possessed only four blotches.

**Colour of male holotype in alcohol:** after two months of preservation overall tan with series of five large, irregular blackish blotches along back, extending on to adjacent basal half of dorsal fin (see photo of fresh specimen); an additional pair of very small blackish spots on upper right side of caudal peduncle; head slightly dusky brownish; fins translucent with purplish rays, the darkened rays especially prominent on caudal fin, which also has dusky upper and lower margins. Paratypes exhibit same general colouration except large black blotches along back highly variable in size and shape with each fish possessing a slightly different pattern (e.g. Fig. 2); some specimens with additional smaller spots adjacent to the larger ones.

**Colour of female paratype in alcohol:** after two months of preservation overall yellowish tan with pupil-sized black spot on upper side of caudal peduncle.

**Live colour of female from digital underwater photograph** (Fig. 3): reddish pink with faintly yellowish scale margins, shading to bluish white on thorax and abdomen; irregular black spot, about pupil size, posteriorly on upper caudal peduncle; snout tip brownish, iris red with golden outer rim and narrow yellow ring around pupil; cheek and operculum with an area of lavender blue; spinous portion of dorsal fin pink grading to translucent yellowish posteriorly on soft portion; anal fin mainly translucent yellow; caudal and pectoral fins translucent yellow; pelvic fins whitish.

## Remarks

The new species is closely related to *C. walindi* Allen & Randall, 1996 from northern and eastern Papua New Guinea and the Solomon Islands. Both species share similar meristic features and morphometric proportions, which is typical for the various members of the genus, which are best separated on the basis of colour pattern differences in adult males. The two species also share similar colour patterns with the notable exception of the black blotches on the body and adjacent dorsal fin. *Cirrhilabrus walindi* (Fig. 4) invariably possesses two horizontally elongate blotches that are typically on the basal part of the dorsal fin, extending only

slightly on to the back. In contrast, *C. cenderawasih* has four to five irregularly rounded blotches that extend much farther onto the body.

It appears likely the ancestral species that gave rise to *C. walindi* and *C. cenderawasih* was widely distributed along the northern margin of the New Guinea-Australian plate. The majority of present day reef species appear to have evolved over the past five million years (Briggs 2006). This same geological period must have therefore provided opportunities for isolation and consequent speciation within Cenderawasih Bay. In fact a number of significant events that have shaped the present landscape of northern New Guinea did occur, foremost of which was the collision of the Australian and Pacific plates and resultant westerly drift of the latter, along with large island fragments, including the South Caroline Arc that eventually accreted along the northern margin of New Guinea. Although details are sketchy at best, it appears that the Tosem Block of the South Caroline Arc slid across the entrance of Cenderawasih Bay between about three to five million years ago before finally docking along the northern edge of the Bird's Head Peninsula (Hill & Hall 2004). Certainly this formidable barrier could have provided an isolating mechanism to account for the apparent endemism and other faunal peculiarities mentioned in the introduction of this paper. The case for isolation is further strengthened by a host of apparently new, possibly endemic corals that were discovered during our 2006 expedition, as well as several new stomatopods.

Present day ocean current patterns (see Carpenter & Springer 2005 for overview) and the presence of large islands or island groups in the outer half of the bay including Biak, Paidado Islands, Yapen, Mios Num, and Numfor continue to form at least partial barriers to marine larval dispersal or may deflect current flow from the surrounding Pacific. Similarly the configuration of the Bird's Head Peninsula may also play a deflection role, essentially shielding the bay from eastward flowing currents that predominate during the summer.

The new species is currently known only from Cenderawasih Bay. It is common on sheltered seaward reefs, primarily on the inner and eastern portions of the bay at depths between about 22 to 60

m, although it is more abundant below about 35 m. Groups of about 10 to 20 individuals, including one to five males, were typically encountered on rubble slopes or on rubble substrates at the base of slopes. The species apparently feeds on zooplankton a short distance above the bottom, which is typical for the genus.

### Etymology

This species is named *cenderawasih* (treated as a noun in apposition) with reference to the type locality of Cenderawasih Bay.

### Acknowledgements

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