

## ***Chaetodontoplus vanderloosi*, A new species of angelfish (Pomacanthidae) from Papua New Guinea**

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### **Keywords**

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### **Abstract**

A new species of pomacanthid fish, *Chaetodontoplus vanderloosi*, is described from 3 specimens, 117.8-125.2 mm SL, collected at Samarai Island, Milne Bay Province, Papua New Guinea in 1972 and 2003. It is closely related to *C. dimidiatus* and *C. melanosoma* from Indonesia and the Philippines, but differs in colour pattern. The new species is mainly black except the head and adjacent dorsoanterior body is light grey to nearly white, with a predominately black caudal fin (except broad yellow posterior margin). Small juveniles are mainly black with a yellow median facial band, a yellow diagonal band from just in front of the dorsal fin to the pelvic fins, a broad yellow margin covering most of the dorsal fin, and a yellow caudal fin with a black submarginal bar.

### **Zusammenfassung**

Unter dem Namen *Chaetodontoplus vanderloosi* wird eine neue Art der Kaiserfische auf der Grundlage von drei Exemplaren beschrieben, die an der Samarai-Insel in Papua-Neuguinea, Milne Bay Province, 1972 und 2003 mit 117,8 bis 125,2 mm SL gesammelt wurden. Die neue Art ist mit *C. dimidiatus* und *C. melanosoma* von Indonesien und den Philippinen eng verwandt, unterscheidet sich aber in der Farbgebung. Sie ist hauptsächlich schwarz, nur Kopf und vorderer Teil des Rückens sind hellgrau bis fast weiß gefärbt, auch die Schwanzflosse ist vorwiegend schwarz, bis auf einen breiten gelben Rand im hinteren Bereich. Kleine Jungtiere sind ebenfalls überwiegend schwarz, zeigen aber in der Mitte des Kopfbereichs einen gelben Streifen, außerdem einen gelben diagonalen Streifen mit dem Ausgangspunkt kurz vor der Rückenflosse bis hin zu den Bauchflossen, einen breiten gelben Rand, der den Großteil der Rückenflosse einnimmt, sowie eine gelbe Schwanzflosse mit einem submarginalen schwarzen Streifen.

### **Résumé**

On décrit ici une nouvelle espèce de Pomacanthidé, *Chaetodontoplus vanderloosi*, sur base de 3 spécimens, 117,8-125,2 mm LS, collectés près de l'île Samarai, province de Milne Bay, Papouasie Nouvelle-Guinée en 1972 et 2003. L'espèce est très proche de *C. dimidiatus* et de *C. melanosoma* d'Indonésie et des Philippines, mais se distingue par le patron de coloration. L'espèce nouvelle est noire pour l'essentiel, mais la tête et la partie dorso-antérieure du corps est gris clair à presque blanc, la caudale étant surtout noire (si ce n'est un large liseré postérieur jaune). Les petits juvéniles sont surtout noirs avec une bande faciale médiane jaune, une bande diagonale jaune de juste avant la dorsale jusqu'aux pelviennes, un large liseré jaune occupant la majeure partie de la dorsale et une caudale jaune avec une barre submarginale noire.

### **Sommario**

Una nuova specie di pomacantide, *Chaetodontoplus vanderloosi*, è descritta sulla base di tre esemplari, 117.8-125.2 mm SL, raccolti all'Isola Samarai, Provincia di Milne Bay, Papua New Guinea tra il 1972 e il 2003. Si tratta di una specie molto vicina a *C. dimidiatus* e *C. melanosoma*, presenti in Indonesia e nelle Filippine, dalle quali si differenzia per la colorazione. Essa è principalmente di colore nero, eccetto il capo e la regione dorso-anteriore ad esso adiacente che sono grigio chiaro o quasi bianchi, come nera è pure la pinna caudale (tranne per una diffusa banda gialla al margine posteriore). Gli individui giovani di piccola taglia sono principalmente neri con una banda facciale mediana gialla, una fascia diagonale anch'essa gialla che si estende dal dorso anteriormente alla pinna dorsale fino alle pinne pelviche, un ampio margine giallo che ricopre la maggior parte della pinna dorsale e una pinna caudale gialla con una banda submarginale nera.

### **Introduction**

Angelfishes of the family Pomacanthidae are among the most conspicuous inhabitants of coral reefs, occurring in both shallow and relatively deep water. Allen *et al.* (1998) reviewed the family, recognizing 83 species

worldwide, including 70 from the Indo-Pacific region. A more recent (2003) treatment of the group by Debelius *et al.*, recognized 75 Indo-Pacific species, including 14 members of the genus *Chaetodontoplus* Bleeker, 1876. The present paper describes a new species in this genus, which was originally collected at Papua New Guinea in 1972 and tentatively identified by the first author as *Chaetodontoplus melanosoma* (Bleeker, 1853). It belongs to a group of four closely-related species that is herein referred to as the “*melanosoma* complex”. The taxonomic status of this assemblage has long been a source of confusion, leading to frequent misidentifications. Subsequent observations of the true *C. melanosoma* and the closely-related *C. dimidiatus* (Bleeker, 1860) in Indonesian seas revealed important colour pattern differences, as well as significant gaps in their allopatric distributions.

### Materials and Methods

Counts of pectoral rays, scales, and gill rakers were made on the left side of specimens. The scales of *Chaetodontoplus* are tiny (the smallest in the family, see Shen and Liu, 1978) and occur in uneven rows, hence are very difficult to count accurately. Therefore, scale row counts are approximations based on the average of repeated counts for each specimen. The upper limb gill raker count is given first; the raker at the angle is included in the lower limb count.

Standard length (SL) was measured from the front of the upper lip to the base of the caudal fin (end of hypural plate). Total length (TL) was measured from the front of the upper lip to the tip of the longest caudal fin ray. The head length was taken from the front of the upper lip to the end of the opercular membrane. The depth was

measured just in front of the anal fin to the extreme base of the dorsal spines. The length of the caudal peduncle was measured horizontally from a vertical at the rear base of the anal fin to the caudal fin base. Measurements of the dorsal and anal spines and soft rays were made from the distal tips to the extreme bases of these elements (aided by x-rays).

Counts and proportions appearing in parentheses apply to the paratypes if different from the holotype. Proportional measurements expressed in thousandths of the standard length are provided in Table I. Type specimens are deposited at the Bernice P. Bishop Museum, Honolulu (BPBM), United States National Museum of Natural History, Washington, D.C. (USNM), and the Western Australian Museum, Perth (WAM). Comparative material of *Chaetodontoplus dimidiatus* and *C. melanosoma* was examined at the Natural Museum of Natural History, Leiden, The Netherlands (RMNH) and Museum of Victoria, Melbourne, Australia (NMV).

### *Chaetodontoplus vanderloosi* n. sp.

(Figs 1-4)

**Holotype:** WAM P.32263-001, 125.2 mm SL, wharf at Samarai Island (10°36.50'S, 150°39.64'E), Milne Bay Province, Papua New Guinea, at depth of 6 m, collected by spear, R. Vanderloos, 12 April 2003.

**Paratypes** (same locality as holotype): BPBM 13657, 122.8 mm SL, at depth of 9 m, spear, G. R. Allen, 16 June 1972; USNM 373887, 117.8 mm SL, same data as BPBM paratype.

### Diagnosis

A species of the pomacanthid genus *Chaetodontoplus*



**Fig. 1.** *Chaetodontoplus vanderloosi*, holotype, 125.2 mm SL, Milne Bay Province, Papua New Guinea. Photo by G. R. Allen.



**Fig. 2.** Underwater photograph of *Chaetodontoplus vanderloosi*, adult, approximately 120 mm SL, Milne Bay Province, Papua New Guinea. Photo by R. Steene.



**Fig. 3.** Underwater photograph of *Chaetodontoplus vanderloosi*, subadult, approximately 80 mm SL, Milne Bay Province, Papua New Guinea. Photo by G. R. Allen.



**Fig. 4.** Underwater photograph of *Chaetodontoplus vanderloosi*, juvenile, approximately 30 mm TL, Milne Bay Province, Papua New Guinea. Photo by M. Strickland.

**Table I.** Proportional measurements of type specimens of *Chaetodontoplus vanderloosi* as percentage of the standard length.

Character	Holotype WAM P.32263 -001	Paratype BPBM 13657	Paratype BPBM 13657
Standard length (mm)	125.2	122.8	117.8
Body depth	50.7	51.5	53.4
Body width	20.8	22.6	22.5
Head length	26.5	28.7	27.4
Snout length	9.5	10.5	8.6
Orbit diameter	7.7	7.2	7.5
Interorbital width	8.1	8.0	8.4
Caudal peduncle depth	12.4	12.1	12.6
Caudal peduncle length	7.7	8.9	9.5
Predorsal length	33.5	32.3	33.9
Preanal length	61.9	61.2	60.4
Prepelvic length	34.5	38.7	37.4
Length dorsal fin base	70.7	70.9	72.2
Length anal fin base	43.5	40.3	41.1
Length 1st dorsal spine	8.3	8.1	8.0
Length 2nd dorsal spine	12.5	12.9	12.3
Length 3rd dorsal spine	17.3	17.8	16.7
Length 4th dorsal spine	18.6	19.2	19.0
Length last dorsal spine	19.2	18.2	19.8
Length longest dorsal ray	18.5	16.7	19.0
Length 1st anal spine	10.5	10.3	9.5
Length 2nd anal spine	16.9	16.3	16.3
Length 3rd anal spine	21.0	20.4	20.2
Length longest anal ray	20.9	19.8	20.2
Length caudal fin	18.0	16.5	19.4
Length pectoral fin	19.7	17.9	19.9
Length pelvic spine	16.3	16.4	17.4
Length pelvic fin	22.3	23.1	24.7
Length preopercular spine	10.0	7.0	7.6

with the following combination of characters: dorsal rays XIII,17; anal rays III,17; pectoral rays 16-17; scales tiny, about 105-116 diagonal scale rows from upper end of gill opening to base of caudal fin; gill rakers on first arch 4-5 +11; maximum body depth 1.9-2.0; length of preopercular spine 2.7-4.1 in head length; adult mainly black with pale grey head and adjacent dorsoanterior part of body; caudal fin black with broad yellow margin posteriorly; juvenile mainly black with yellow median band from snout to forehead, yellow diagonal band from front of dorsal fin origin to pelvic fin, broad yellow margin covering most of dorsal fin, and a yellow caudal fin with black submarginal bar.

**Description**

Dorsal rays XIII,17 (last divided to base); anal rays III,17 (last divided to base); pectoral rays 17 (16 or 17) (upper two and lowermost unbranched); pelvic rays I,5; diagonal scale rows from upper end of gill opening to base of caudal fin about 115 (105-116); scale rows above lateral line to origin of dorsal fin about 20 (18-20); scale rows below lateral line to origin of anal fin about 56 (54-59); vertical scale rows on opercle about 14 (14-15); gill rakers on first branchial arch 4 + 11 (4 or 5 +11), total rakers 15 (15 or 16); vertebrae 10 + 14.

Body ovate, the depth 2.0 (1.9) in SL, and compressed, the maximum width 2.4 (2.3-2.4) in depth; head length 3.8 (3.5-3.6) in SL; dorsal profile of forehead relatively steep, forming an angle of about 50 degrees to the horizontal; snout 2.8 (2.7-3.2) in head length, diameter of orbit 3.4 (3.7-4.0) in head length; interorbital space slightly convex, the bony width 3.3 (3.3-3.6) in head length; caudal peduncle deeper than long, the least depth 2.1 (2.2- 2.4) in head length; length of caudal peduncle 3.4 (2.9-3.2), in head length.



**Fig. 5.** Underwater photograph of *Chaetodontoplus melanosoma*, adult, approximately 150 mm TL, Komodo, Indonesia Photo by J. Randall.

Mouth relatively small, terminal, the gape forming an angle of about 28 degrees to the horizontal, the maxilla reaching a vertical at front of anterior nostril. Upper lip broader than lower, entirely scaled except anterior edge, the maximum width contained 3.1 in diameter of orbit. Teeth slender, elongate (the longest 2.9 in orbit of holotype), close-set, flexible, tricuspid (large central cusp notably longer than smaller lateral ones), in 4-5 rows in each jaw, 48 (45-48) in outer row of lower jaw and 52 (53-56) in outer row of upper jaw. No teeth on roof of mouth. Tongue short and broadly rounded.

Nostrils anterior to centre of eye, the posterior opening forming a vertical slit with thin flap-like rims, the slightly smaller anterior opening in a membranous tube with a flap posterodorsally; distance between nostrils about equal to half length of posterior opening; distance from edge of orbit to edge of posterior nostril about equal to length of posterior nostril slit. Head pores inconspicuous due to dense covering of tiny scales. Gill membranes narrowly attached to isthmus. Longest gill filament on first arch contained 1.8 times in orbit of holotype. Gill rakers short, the longest 8.1 in orbit of holotype.

Opercle ending posteriorly in a single flat blunt spine. A prominent large spine at corner of preopercle, longer than orbit, the spine length (measured along upper edge) contained 2.7 (3.6-4.1) times in head length; margin of preopercle with 14 serrae; no serrae on margins of opercular series, supracleithrum, and posttemporal.

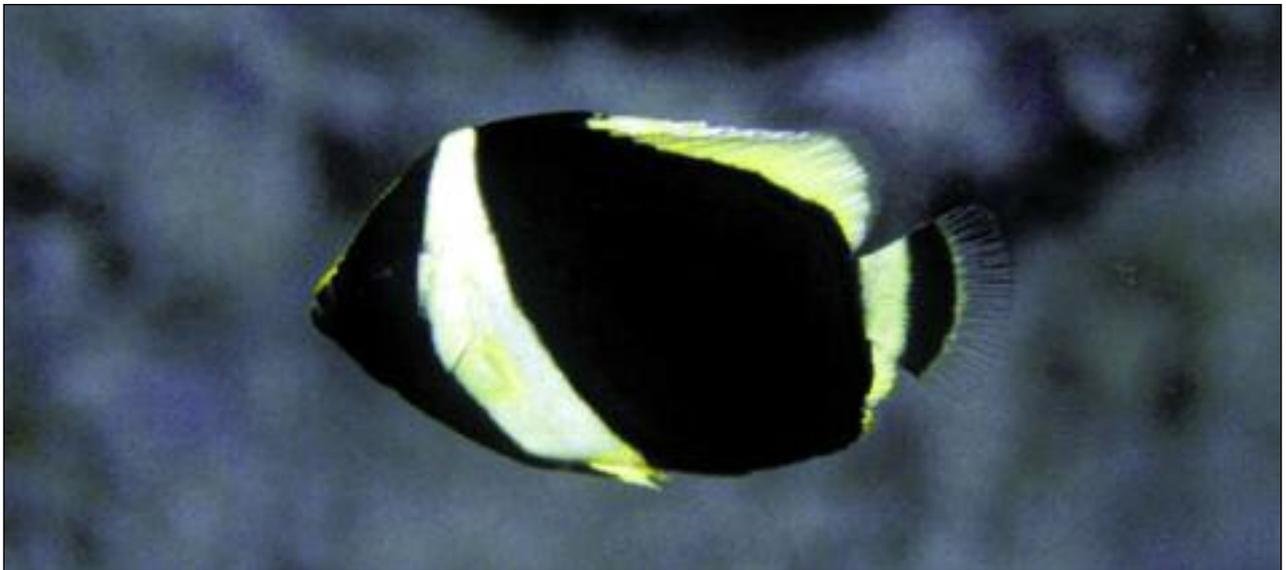
Scales coarsely ctenoid (up to 22 ctenii on posterior margins); auxiliary scales mainly confined to lateral line and dorsoanterior portion of body; head fully scaled except lower lip and anterior edge of upper lip; dorsal and anal fins scaled nearly to margins except anteriorly in spinous portion where fin membranes are deeply incised; caudal fin scaled nearly to posterior margin;

pectoral and pelvic fins densely scaled at base, with tiny scales extending on surface of rays (but not on membranes) nearly to posterior margin.

Lateral line relatively inconspicuous, its presence indicated by smaller scales (including tiny auxiliary scales), gently arching across back, originating at upper corner of gill opening and terminating below end of soft dorsal fin; additionally, about 5-6 scattered tubed scales mid-laterally on caudal peduncle.

Caudal fin rounded, its length 5.6 (5.2-6.0) in SL. Origin of dorsal fin slightly anterior to a vertical at upper end of gill opening. Dorsal spines progressively longer to about sixth spine, remaining spines more or less subequal, 1.4 (1.4-1.6) in head length; membranes between first four dorsal spines and anal spines deeply incised; posterior margin of soft portions of dorsal and anal fins rounded, the longest dorsal and anal rays reaching as far posterior as base of caudal fin; origin of anal fin below base of eleventh dorsal spine; third anal spine the longest, 1.3 (1.4) in head length; pectoral fins relatively short and moderately pointed, reaching a vertical between base of pelvic fins and anal fin origin, slightly closer to pelvic fin base, their length 1.3 (1.4-1.6) in head length; pelvic fins reaching posterior to between anus and anal fin origin, their length 1.2 (1.1-1.2) in head length.

**Colour in life** (from 35 mm colour transparency, see Fig. 2): body overall velvety black; head and nape region pale (nearly white) to medium grey except snout, interorbital and apex of nape region yellowish with wavy blue lines; mouth dark grey surrounded with yellow; all fins blackish, with relatively broad yellow margin posteriorly on caudal, narrower yellow margin posteriorly on dorsal fin, and fine blue margin posteriorly on anal fin. The caudal fin of subadults (approximately 80-100 mm SL,



**Fig. 6.** Underwater photograph of *Chaetodontoplus melanosoma*, juvenile, approximately 30 mm TL, Mabul, Sabah, Malaysia. Photo by R. Kuitert.

Fig. 3) is yellow with a prominent crescent-shaped black marking in the centre. This central marking expands with increased growth, until most of the fin is black. Small juveniles (Fig. 4) black with broad median yellow facial band from chin to middle of nape, prominent yellow diagonal band from front of dorsal fin origin to pelvic fins, broad yellow margin covering most of dorsal fin, and yellow caudal fin with broad black sub-marginal bar.

**Colour in alcohol:** holotype (Fig. 1) overall black with head and dorsoanterior portion of body (above pectoral fin to below base of fourth dorsal spine) grey; fins black except posterior margin of caudal broadly pale grey, and posterior margins of dorsal and anal fin narrowly pale grey. After more than 30 years in preservative the paratypes are overall dark brown with the head and dorsoanterior body tan. There are also indications of the wavy dark lines (bluish in life; see colour in life) on the

snout, interorbital and nape regions. The larger paratype has a large yellow area on the basal half of the caudal fin, a remnant of the juvenile coloration.

### Etymology

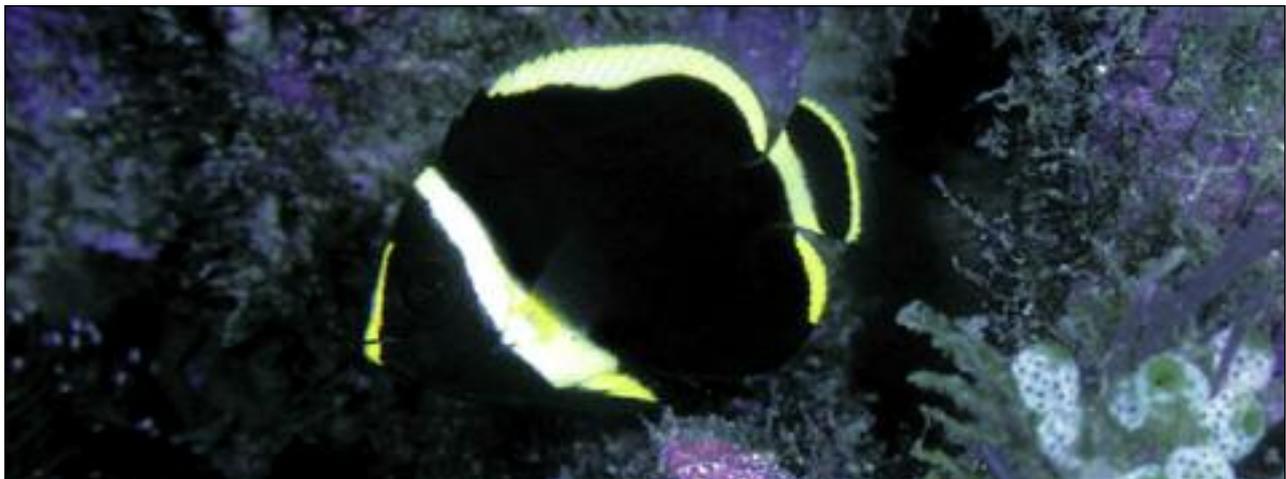
The species is named *vanderloosi* in honour of Mr. Robert ("Rob") Vanderloos, owner and operator of the live-aboard dive vessel *Chertan*. He also collected the holotype.

### Remarks

The genus *Chaetodontoplus* contains 14 species, which are mainly distributed in the Indo-Australian Archipelago, ranging northward to Japan (Debelius *et al.* 2003). A group of four closely-related species (referred to here as the "*melanosoma* complex") includes *C. cephalareticulatus* Shen and Lim, 1974, *C. dimidiatus* (Bleeker, 1860), *C. melanosoma* (Bleeker, 1853), and



**Fig. 7.** Underwater photograph of *Chaetodontoplus dimidiatus*, adult, approximately 150 mm TL, Raja Ampat Islands, Indonesia. Photo by G. Allen.



**Fig. 8.** Underwater photograph of *Chaetodontoplus dimidiatus*, juvenile, approximately 30 mm TL, Lembeh Strait, Sulawesi, Indonesia. Photo by R. Kuiter.

*C. vanderloosi*. Their similar appearance and paucity of specimens in museum collections has created confusion, resulting in misidentifications and the failure to recognize some of the species as valid entities. For example, Allen *et al.* (1998) misidentified a photograph of *C. cephalareticulatus* as *C. chrysocephalus* (Bleeker, 1854), and following previous authors such as Fraser-Brunner (1933) and Weber and de Beaufort (1936), did not recognize *C. dimidiatus* as distinct from *C. melanosoma*.

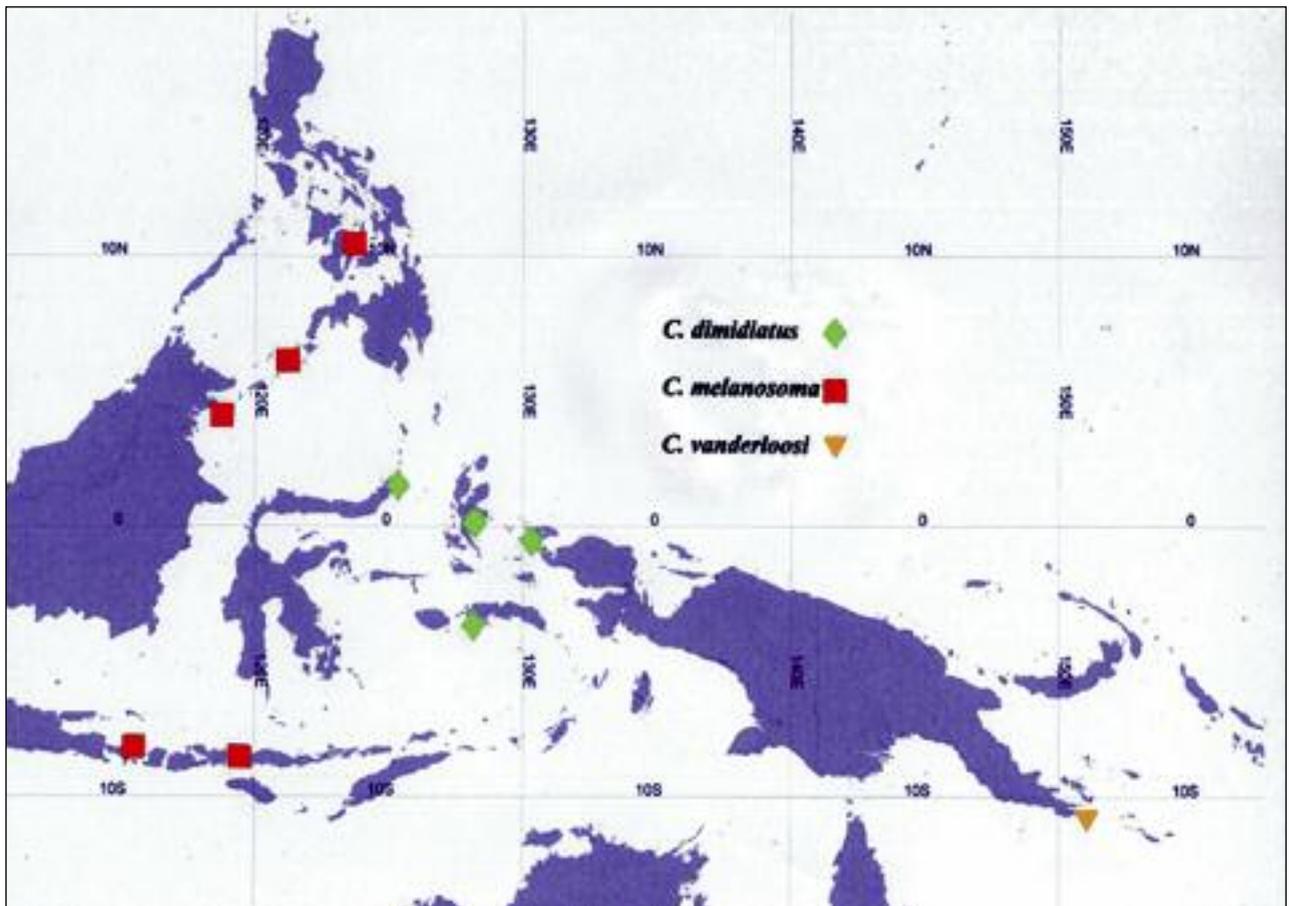
Colour pattern differences constitute the principal means of separation. All four species in the *melanosoma* complex possess a yellowish area with wavy blue lines on the front of the head. They also have a very similar juvenile colour pattern. *C. cephalareticulatus* from southern Japan and Taiwan (see Masuda *et al.* 1988, Plate 177D-F) is perhaps the most readily distinguishable species, at least in the adult stage. It has a series of wavy blue stripes on the body and a blue reticulum on the head. However, subadults (Masuda *et al.* 1988, Plate 177C; Debelius *et al.*, 2003, page 108, Figure J) are very similar in general appearance to *C. dimidiatus*. Differences in caudal fin coloration, in combination with the distribution of light grey on the head and body of adults, provide

the best means of separation of the remaining three species.

The new species is most similar to *C. melanosoma*. Both species possess a black caudal fin with a broad yellow margin. However, unlike *C. melanosoma*, which has the entire dorsal half of the body light grey, *C. vanderloosi* has a mainly jet black body with the light grey coloration confined to the head and adjacent dorso-anterior body. Moreover, the juvenile of *C. vanderloosi* has a yellowish diagonal band behind the head, compared with the white band of *C. melanosoma*. It also possesses a yellow tail with a relatively narrow black submarginal bar, which gradually expands with growth until the entire tail is black with the exception of the margin. In contrast, juvenile *C. melanosoma* have a relatively broad black bar on the tail that fades with growth, with the black coloration of the body gradually expanding onto the caudal.

*Chaetodontoplus dimidiatus* is similar in general body colour to *C. melanosoma*, particularly with respect to the proportion of black and light grey. However, the broad black bar on the caudal fin of juveniles gradually disappears and adults are distinguished by a uniform yellow caudal.

The three species appear to have non-overlapping allopatric distributions (Fig. 9): *C. melanosoma* (Flores



**Fig. 9.** Known distributions of *Chaetodontoplus dimidiatus*, *C. melanosoma*, and *C. vanderloosi*.

and Solor Island westward to Bali, Indonesia and northward to the Philippines), *C. dimidiatus* (Raja Ampat Islands off western New Guinea, Halmahera, Moluccas, and north-eastern Sulawesi), and *C. vanderloosi* (Milne Bay Province, Papua New Guinea). The record of *C. melanosoma* from Japan by Masuda *et al.* (1988) is based on a misidentification of subadult *C. cephalareticulatus*. Randall *et al.* (1997) included *C. melanosoma* from the northern Great Barrier Reef of Australia, but we now question this record as it appears to be unsubstantiated.

We have examined four of Bleeker's five type specimens of *Holacanthus dimidiatus* from Ambon, Indonesia (RMNH 5839, 3 specimens: 158-172 mm TL, and NMV A880, 136 mm TL) and the holotype of *Holacanthus melanosoma* from Solor, Indonesia (RMNH 5828, 120 mm TL). The two species are also clearly illustrated in the Bleeker's Atlas Ichthyologique (1877-1878, Vol. 9, Plate 369, Figs. 1 and 4).

The new species is apparently confined to a very limited area. Despite extensive searching in other parts of Milne Bay Province (which includes approximately 265,000 km<sup>2</sup> of ocean) during five visits, it was only seen in a small area encompassing about 275 km<sup>2</sup>, extending between Samarai Island (10°36.50'S, 150°39.64'E) and the south-eastern corner of Basilaki Island (10°39.68'S, 151°04.50'E). The species is apparently associated with relatively cool temperatures. Allen (1998) reported the occurrence of lower water temperatures in this area, between 22-24°C, compared with 26-28°C in other parts of Milne Bay Province. Perhaps strong currents that sweep southward through narrow passes between islands cause displacement of surface waters and consequent upwelling of colder water from below. This phenomenon also occurs in the Komodo region and off eastern Bali in Indonesia, where the closely-related *C. melanosoma* occurs. Similarly, a species of surgeonfish, *Prionurus chrysurus* Randall, is restricted to cool upwelled seas at Komodo and Bali (Randall, 2001).

The new species is generally encountered alone or in pairs. Most individuals have been sighted in depths ranging between 5 and 40 m. It is usually found on rocky bottoms with scattered hard and soft corals, or at Samarai Island in the vicinity of the wharf.

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### References

- Allen, G. R.** 1998. Reef and shore fishes of Milne Bay Province, Papua New Guinea. in A rapid biodiversity assessment of the coral reefs of Milne Bay Province, Papua New Guinea (Werner, T. B. and Allen, G.R., eds.). RAP Working Papers 11, Conservation International, Washington, DC: 39-49, 67-107.
- Allen, G. R., Steene, R. & M. Allen.** 1998. Guide to Angelfishes and Butterflyfishes. Odyssey Press, San Diego.
- Bleeker, P.** 1853. Bijdrage tot de kennis der ichthyologische fauna van Solor. *Natuurkd. Tijdschrift Neder. Indië*, **5**: 67-96.
- Bleeker, P.** 1860. Elfde bijdrage tot de kennis der vischfauna van Amboina. *Acta Soc. Sci. Indo-Neerl.*, **8** (5): 1-14.
- Bleeker, P.** 1875-1878. Atlas ichthyologique des Indes Orientales Néerlandaises, publié sous les auspices du Gouvernement colonial néerlandais. Tome IX. Toxotoidei, Pempheridoidei, Chaetodontoidi, Nandoidei, etc. Atlas Ichthyol. v. 9: 1-80, Pls. 355-360, 363-420. (Text published 1877-1878, plates published 1875-1878).
- Debelius H., Tanaka, H. & R. H. Kuitert.** 2003. *Angelfishes, A comprehensive Guide to Pomacanthidae*. TMC, Chorleywood, UK.
- Fraser-Brunner, A.** 1933. A revision of the chaetodont fishes of the subfamily Pomacanthinae. *Proceedings of the Zoological Society of London 1933* (part 3, no. 30): 543-599.
- Masuda, H., Amaoka, K., Uyeno T., & T. Yoshino.** 1988. *The fishes of the Japanese Archipelago* (2nd edition). Tokai University Press, Tokyo.
- Randall, J. E., Allen, G. R. & R. C. Steene.** 1997. *Fishes of the Great Barrier Reef* (2<sup>nd</sup> edition). Crawford House Press, Bathurst, Australia.
- Randall, J. E.** 2001. *Prionurus chrysurus*, a new species of surgeonfish (Acanthuridae) from cool upwelled seas of southern Indonesia. *Journal of South Asian Natural History*, **5** (2): 159-165.
- Shen, S.-C. & P.-C. Lim** 1975. An additional study on chaetodont fishes (Chaetodontidae) with description of two new species. *Bulletin of the Institute of Zoology Academia Sinica (Taipei)*, **14** (2):79-105.
- Shen, S.-C. & C.-S., Liu.** 1978. *Clarification of the genera of the angelfishes (Family Pomacanthidae)*. Taiwan Scientific Report, National Taiwan University: 57-77.
- Weber, M. & L. F. de Beaufort.** 1936. *The fishes of the Indo-Australian Archipelago. VII. Perciformes (continued) families: Chaetodontidae, Toxotidae, Monodactylidae, Pempheridae, Kyphopsidae, Lutjanidae, Lobotidae, Sparidae, Nandidae, Sciaenidae, Malacanthidae, Cepolidae*. E. J. Brill Ltd., Leiden. Fish. Indo-Aust. Arch. v. 7: i-xvi + 1-607.