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Three new species of the fangblenny genus *Meiacanthus* from Indonesia, with color photographs and comments on other species (Teleostei: Blenniidae: Nemophini)

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Abstract

Three new species of fangblennies are described from Indonesia. *Meiacanthus abruptus* is described based on two specimens, 31.4–36.6 mm SL, from Komodo Island and color photographs of others from Bali. The combination of a white or yellow body color and a single dark mid-lateral stripe that is bluntly rounded at its terminus on the caudal-fin base distinguishes it from other single striped species. This new species closely resembles the allopatric *M. vicinus*, which has the mid-lateral stripe extending farther onto the caudal fin and tapering to a point. *Meiacanthus erdmanni* is described from the only known specimen, 35.8 mm SL, photographed and collected in 65–70 m in Cenderawasih Bay, western New Guinea. One of the deepest known species of *Meiacanthus*, it has two dark mid-lateral stripes and differs from other double-striped species in having a series of dark blotches on the base of the dorsal fin and only 24 segmented dorsal-fin rays. *Meiacanthus cyanopterus*, another deep-water species, is described from seven specimens, 19.8–45.3 mm SL, collected in 40–65 m at three sites in Alor Strait. In life this species has a dorsal fin with a blue-violet stripe bordered above by a wide black stripe. An identification key is provided for all the striped species of *Meiacanthus*, including at least one additional undescribed species previously confused with *M. abditus*. Color photographs of other *Meiacanthus* species and some new distributional records are also given.

Key words: Blenniidae, *Meiacanthus*, taxonomy, Indo-west Pacific

Introduction

The Indo-Pacific fangblenny genus *Meiacanthus* of the blenniid tribe Nemophini is unique among fishes in having a pair of large dentary canines with a deep frontal groove at the base of which is a toxic buccal gland that partially extends into the groove. The toxin delivery system is by mechanical pressure which causes the gland's secretion to flow toward the tip of the canine when the blenny bites a potential predator. As discussed by Springer and Smith-Vaniz (1972) and Smith-Vaniz *et al.* (2001), this action provides an effective defense against most predators, which quickly learn to avoid *Meiacanthus* as prey, thus allowing these small blennies to forage out in the open away from protective cover. At least 11 species of *Meiacanthus* appear to be engaged in mimetic relationships, most as Batesian models, involving 4 families and at least 14 other species of fishes (Smith-Vaniz *et al.* 2001).

A total of 25 valid species of *Meiacanthus* have been described from the Indo-West Pacific. In his monograph of the saber-tooth blennies Smith-Vaniz (1976) recognized three subgenera and 16 species of *Meiacanthus*. In an update of that work (Smith-Vaniz 1987), seven additional new species of *Meiacanthus* were described and the Fijian endemic *Meiacanthus ovalauensis* Günther, previously considered to be a subspecies of *M. atrodorsalis* Günther, was elevated to full species rank. Subsequently, one additional new species, *M. urostigma*, was described from the Similan Islands and northern Sumatra (Smith-Vaniz *et al.* 2001). Three additional species are herein described, bringing the number of currently recognized *Meiacanthus* species to 28 (25 in the subgenus *Meiacan-*

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thus), and making it the second most species-rich blenniid genus after *Ecsenius*, with 53 species (Patzner *et al.* 2009).

During 2009, while attending the 8th Indo-Pacific Fish Conference, the first author had an opportunity to examine the saber-tooth blenny holdings of the Western Australia Museum ichthyological collection. A single specimen of one of the new species, *Meiacanthus abruptus*, described herein had been speared by the second author at Komodo Island in April 1995 but its unique status went unrecognized until recently. A second specimen of *M. abruptus* was photographed underwater and collected by Allen in September 2010 near the same locality, and subsequently additional individuals were photographed but not collected at Menjangan I. off Bali.

The second author and Mark Erdmann, working with Conservation International in close cooperation with local government agencies and the State University of Papua at Manokwari (UNIPA), have been instrumental in focusing attention on the faunal richness of the Bird's Head region of West Papua Province, Indonesia in general and specifically the extraordinary level of endemism at Cenderawasih Bay. Several expeditions to the latter location between 2006 and 2010 have yielded a wealth of new endemic taxa, including at least 10 reef fishes (Allen & Erdmann 2006a,b, 2008a,b,c, 2009, and 2010) and 18 corals (Devantier and Turak, pers. comm.). Based on these data and additional genetic studies currently in progress by Paul Barber of the University of California at Los Angeles, it is evident that the Bay was effectively isolated in the recent geological past, thus facilitating the evolution of a diversity of species that show marked genetic and morphological differences compared to neighboring populations outside the bay. Another new species of *Meiacanthus* was collected during the most recent expedition (September 2010) as part of an ongoing inventory of the bay's faunal resources. It is of special interest because of its depth of capture, 65–70 m, which is the deepest record for the genus, although another new species described herein occurs almost as deep, and at least two species belonging to the nemophine genus *Petroscirtes* have been found at much greater depths (Smith-Vaniz 2005).

In March 2011 a third new species, *Meiacanthus cyanopterus*, was collected at three sites in Alor Strait in 40–65 m and subsequently observed in Bali. We are aware of at least one other undescribed, relatively deep-water *Meiacanthus* known only from Kawajalein Atoll, Marshall Is., which is currently under study by others. The discovery of three previously unknown species of *Meiacanthus*, all from relatively deep reefs, supports the observation of Pyle (1996) that deep-reef fishes of the Indo-Pacific region are largely unsampled.

In addition to describing three new species, we also report on new collections or records of other *Meiacanthus* species that add to previous descriptions or represent range extensions. As an aid to identification, we give a key to species of *Meiacanthus* with lateral body stripes and include color photographs of most of these species. Following Smith-Vaniz (1987), two informal species groups, based solely on lateral stripe patterns, are recognized for these species.

Material and methods

Abbreviations used for institutional specimen depositories are as follows: Bernice P. Bishop Museum, Honolulu, Hawaii (BPBM); Indonesian Institute of Sciences (formally, Lembaga Ilmu Pengetahuan Indonesia, LIPI) and Museum Zoologicum Bogoriense, Bogor, Indonesia (MZB); Museum of Natural History, Washington, D.C. (USNM); Western Australian Museum, Perth (WAM). Measurements and counts follow Smith-Vaniz (1976), except sensory canal and pore terminology as discussed in Smith-Vaniz *et al.* (2001). Specimen lengths are given in standard length (SL).

Geminatus-species Group

With the addition of *Meiacanthus abruptus*, the *M. geminatus* group now includes five allopatric species (Fig. 1), all with a single mid-lateral stripe. The Red Sea-Gulf of Aden endemic *Meiacanthus nigrolineatus* Smith-Vaniz also has a single lateral stripe, but it differs in being relatively narrow and extending obliquely from the eye to the upper margin of the caudal peduncle or below the posterior third of the dorsal fin.

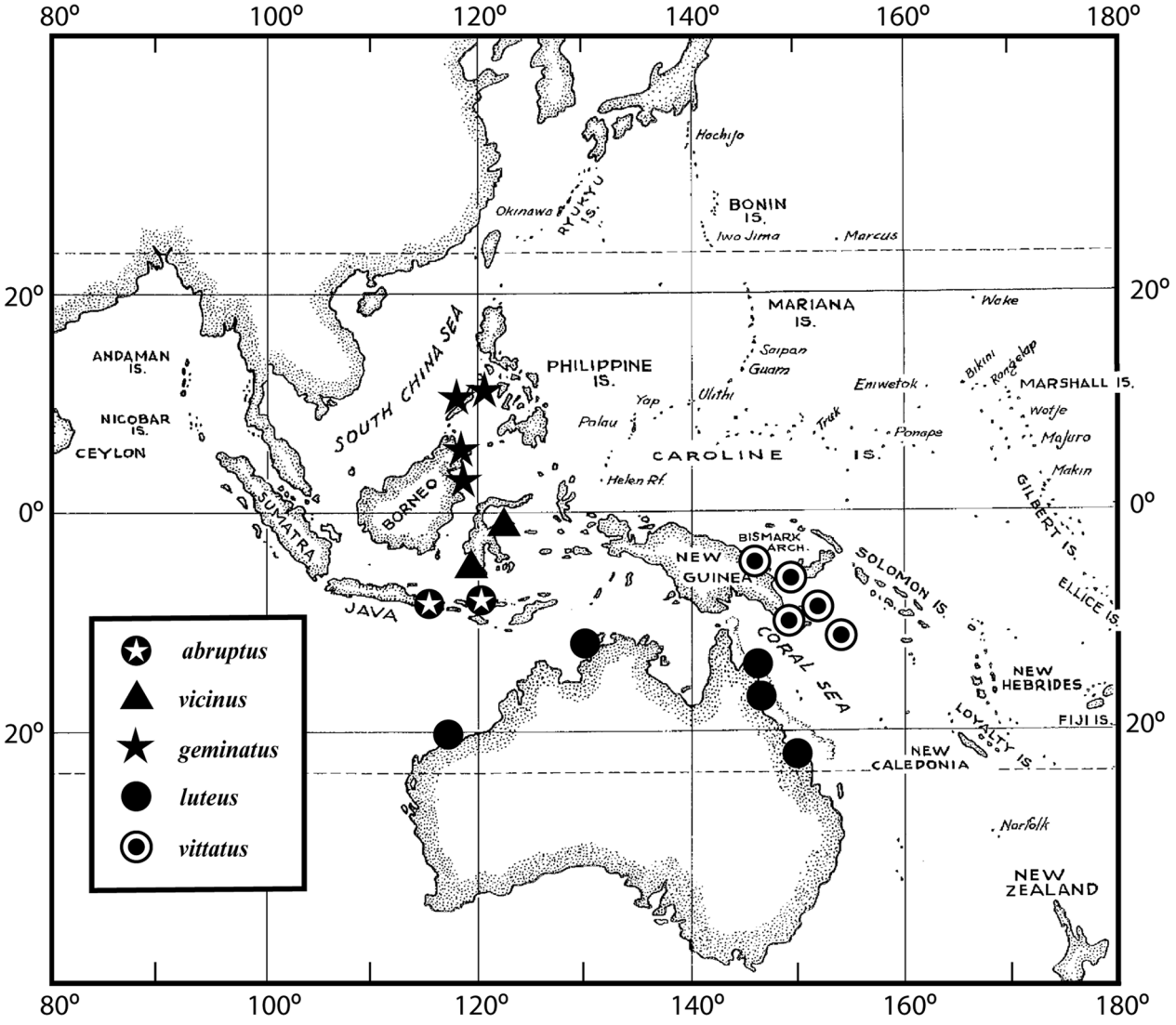

FIGURE 1. Distribution of the *Meiacanthus geminatus* species group.

Meiacanthus abruptus new species

Figures 2–5, Table 1

Holotype. MZB 20022, 36.6 mm SL, male, Indonesia, Komodo Island, Slawi Bay, 8°36.746'S, 119°29.338'E, 1.5 m, mangrove shore, clove oil and hand-net, Gerald R. Allen and Mark V. Erdmann, 6 Sept. 2010.

Paratype. WAM P.30964.003, 31.4 mm SL, female, Indonesia, Komodo Island, mangrove shore at Point Slawi, 8°37'S, 119°29'E, 2 m, spear, Gerald R. Allen, 2 April, 1995.

Diagnosis. A species of *Meiacanthus* (subgenus *Meiacanthus*) with major portion of dentary gland dorsally positioned and held in place laterally by dorsolateral flange of dentary; dorsal fin IV, 25 or 26; color pattern characterized by a single black mid-lateral stripe that is bluntly rounded at its terminus on the caudal-fin base; dorsal fin pale distally with a wide black proximal stripe; white or yellow stripe above and below dark mid-lateral stripe; belly and flanks pale to rich yellow.

Description. (when values differ, those of holotype are given first). Dorsal fin IV, 26 (25). Anal fin II, 15 (14). Pectoral fin 13-13. Caudal fin: procurrent rays 6+5; segmented rays 13, inner rays not elongated or deeply incised. Vertebrae: precaudal 13 + caudal 20. A pair of canines posteriorly in each jaw, those in lower jaw very large with a

deep frontal groove; incisor teeth in lower jaw 22 (20); in upper jaw 19 (18). Lateral line present, terminating below 5th or (7th) dorsal-fin ray; mandibular and posttemporal pores 3; median supratemporal pores a very closely spaced pair (single pore).

Sexual dimorphism moderately developed in pelvic and caudal fins: pelvic fin 27.0 (15.3) % SL; longest caudal-fin ray 33.6 (18.9) % SL; inner caudal-fin ray 23.2 (22.1) % SL.

FIGURE 2. *Meiacanthus abruptus*, holotype, MZB 20022, 36.6 mm SL, male, Indonesia, Komodo Island. Photo by S. J. Raredon.

FIGURE 3. *Meiacanthus abruptus*, WAM P.30964.003, 31.4 mm SL, female, Indonesia, Komodo Island. Photo by S. J. Raredon.

FIGURE 4. *Meiacanthus abruptus*, holotype, Indonesia, Komodo Island. Photo by G. R. Allen.

FIGURE 5. *Meiacanthus abruptus*, Bali. Photo by G. R. Allen.

Color pattern in preservation: The most distinctive feature of the color pattern is a dark stripe extending through the eye to the center of the caudal fin where it is bluntly rounded at its terminus on the caudal-fin base. The stripe is about half the width of the eye diameter, completely envelops the gill opening but does not extend onto the pectoral-fin base. On the postorbital region of the snout, the stripe is slightly wider than the pupil diameter but becomes narrower as it extends onto the snout. Another dark stripe, which gradually becomes narrower posteriorly, extends from above the eye, along the dorsal contour of the body, onto the dorsum of the caudal peduncle and a short distance onto the bases of several of the upper caudal-fin rays. A narrow, pale, predorsal stripe separates the dorsalmost dark stripe from its counterpart and extends anteriorly to interrupt the dark mid-lateral stripe as it partially encircles the snout (Fig. 4). The body is otherwise pale but sprinkled with fine dark brown chromatophores. The dorsal fin is conspicuously bicolored, pale distally with the dark dorsal contour body stripe extending uninterrupted onto the basal half of the fin. The other fins are mostly pale, except for the dark stripe on the caudal-fin base; caudal- and pectoral-fin rays are darkly outlined.

Color in life (Figs. 4–5): The color pattern of the live holotype is very similar to that described above. The dark stripes are blackish with an intervening white stripe. There also is a white stripe of equal width immediately below the dark mid-lateral stripe. The breast and adjacent lower portion of the side are yellowish, and the cheeks and lower half of the head are light pinkish grey. Fish from the Bali region differ from those from Komodo Island most notably in having a much richer yellow coloration that also includes the cheeks and belly; the white stripe that borders the dark mid-lateral stripe ventrally is also narrower.

Comparisons. *Meiacanthus vicinus* closely resembles the new species, except in life the lateral stripe is dark brown (versus bluish-black), and it tapers to a point at its terminus on approximately the anterior fourth of the caudal fin (versus being bluntly rounded and terminating on the caudal-fin base); *M. vicinus* also has more total vertebrae 34 (vs. 33). Life colors of *M. abdustus* differ from the remaining three species of *Meiacanthus* with a single mid-lateral stripe as follows: the body of *M. geminatus* is golden yellow below the brown lateral stripe and the dorsal fin is mostly dark brown except for a very narrow pale margin; in *M. luteus* the pale area above the lateral stripe is golden yellow and there is no wide, dark, proximal dorsal-fin stripe; *M. vittatus* has a grey body and fins and the lateral stripe is bordered above by a distinct narrow white stripe. *Meiacanthus vittatus* further differs in having the inner caudal-fin rays of males elongate, and the mid-lateral stripe moderately encroaching onto the pectoral-fin base (slightly encroaching in *M. luteus*), versus no encroachment in the other species; *M. luteus* also differs in having more pectoral-fin rays, 15 or 16 (versus 13); and *M. geminatus* differs from all four species in having the mid-lateral stripe distinctly positioned below the center of the caudal-fin base (versus centered on the base).

Habitat and distribution. The habitat at the Komodo type locality consists of a shallow (1–2 m) coral reef adjacent to a thin band of mangroves along the shoreline of a large sheltered bay. Live coral cover was estimated at about 30 percent. The holotype was captured when it entered an abandoned worm tube in a small *Porities* coral formation. *Meiacanthus abruptus* has also been observed and photographed in depths of 2–4 m at Secret Bay, Gilimanuk, 8°9.771'S, 114°27.116'E, a large mangrove-lined bay on the western end of Bali across the narrow channel from Java. About 15 individuals were encountered on an isolated patch reef consisting of almost 100 percent live coral.

Etymology. From the Latin *abruptus*, meaning broken off, in allusion to the mid-lateral stripe that abruptly ends on the caudal-fin base. The name is here used as a noun in apposition.

TABLE 1. Frequency distributions of certain counts in selected species of *Meiacanthus*.

	Dorsal-fin rays				Anal-fin rays			Total vertebrae				Total pectoral-fin rays				
Species	24	25	26	27	14	15	16	33	34	35	36	26	27	28	29	30
M. abruptus		1	1		1	1		2				2				
M. vicinus		1	1		1	1			2			1	—	1		
M. abditus			8	6		3	11		1	10	3			10	—	4
M. cyanopterus		3	4		3	2	2	2	3	2		1	—	3	1	2
M. erdmanni	1				1			1						1		

Meiacanthus (*Meiacanthus*) *vicinus* Smith-Vaniz

The original description of this species (Smith-Vaniz 1987) was based only on the 41.3 mm SL male holotype from Barang Lompo, Sulawesi. Color photographs, one shown here (Fig. 6), and collection of a female specimen allows a slightly expanded description: WAM P.31500-001 (35.0 mm SL), Banggai Islands, Kembongan I., 1°53'S, 123°41'E, 14–15 m).

FIGURE 6. *Meiacanthus vicinus*, Indonesia, Banggai Is. Photo by G. R. Allen.

Data for the male holotype, if different, are given first with those of the female in parentheses. Dorsal fin IV, 26 (IV, 25); anal fin II, 15 (II, 14); pectoral fin 14-14 (13-13); Vertebrae 13+21 (14+20); incisor teeth in lower jaw 23 (20); in upper jaw 22 (20). Pelvic fin 23.7 (13.5)% SL; caudal-fin rays: outer 34.2 (29.0)% SL and inner 23.9

(22.9)% SL. These data indicate that the length of the pelvic fin is sexually dimorphic but the caudal fin probably is not. As discussed above under comparisons, *M. abruptus* and this species have very similar color patterns, differing primarily in details of the mid-lateral stripe termination. The dark stripe along the dorsal body contour is highly variable in width in *M. vicinus* such that the pale area of the body between it and the mid-lateral stripe is very narrow in some individuals (Fig. 7).

FIGURE 7. *Meiacanthus vicinus*, WAM P. 31500-001, 35.0 mm SL, female, Indonesia, Banggai Is. (round blemish on lateral stripe is spear damage). Photo by S. J. Raredon.

Meiacanthus (*Meiacanthus*) *geminatus* Smith-Vaniz

The cardinal fish *Chileodipterus zonatus* Smith and Radcliffe is a remarkably similar appearing mimic of this species (Smith-Vaniz *et al.* 2001). The same color photograph of *Meiacanthus vittatus* given in Allen *et al.* (2003:339) is here reproduced as Fig. 8. An excellent color photograph of this species also appears in Eichler and Myers (1997:373). Two additional specimens of *M. geminatus* are available from Sabah, and agree well with Smith-Vaniz's (1987) expanded description of the species: WAM P.30403-006 (47.0 mm SL, female) and WAM P.30409-004 (44.9 mm SL, male). The second author also observed this distinctive species at two additional locations at northeastern Kalimantan, Indonesia (2°20.804'N, 118°11.031'E and 1°32.378'N, 118°23.443'E) during a survey in 2003.

FIGURE 8. *Meiacanthus geminatus*, Sabah, Malaysia. Photo by R. C. Steene.

Meiacanthus (*Meiacanthus*) *luteus* Smith-Vaniz

This Australian endemic was originally described (Smith-Vaniz 1987) without color photographs. Randall *et al.* (1990:369) include a photograph of a male, and Kuiter and Debelius (2006) provide one of a female, here reproduced as Fig. 9.

FIGURE 9. *Meiacanthus luteus*, Keppel Island, Queensland, Australia, female. Photo by R. H. Kuiter.

Meiacanthus (*Meiacanthus*) *vittatus* Smith-Vaniz

FIGURE 10. *Meiacanthus vittatus*, Madang, Papua New Guinea. Photo by G. R. Allen.

The cardinal fish *Chileodipterus parazonatus* Gon and *Meiacanthus vittatus* are another remarkably similar mimic pair (Smith-Vaniz *et al.* 2001). No color photographs were given in the original description (Smith-Vaniz 1976), although many photographs of this blenny have since been published, and we include one here as Fig. 10.

Lineatus-species Group

This informal grouping includes *Meiacanthus* species with two dark lateral stripes, one immediately above and one below the pectoral fin. As here recognized, and with the addition of *Meiacanthus erdmanni* and *M. cyanopterus*, the group includes at least seven mostly allopatric species (Fig. 11), with several others yet to be described due to unavailability of specimens. *Meiacanthus grammistes* perhaps should be included in this group but differs from those species in having a spotted caudal fin and often caudal peduncle. Its wide western and central Pacific distribution overlaps the ranges of all the other species. *Meiacanthus kamoharai*, endemic to Japan and the Ryukyu Islands, is probably most closely related to *M. grammistes* but differs from it and members of the *lineatus* species-group in having dark body stripes that are partially or completely coalesced, and the belly and underside of head dark or strongly vermiculated. Motomura and Matsuura (2010:Fig. 458) give a color photograph of a specimen from Yaku-shima I.

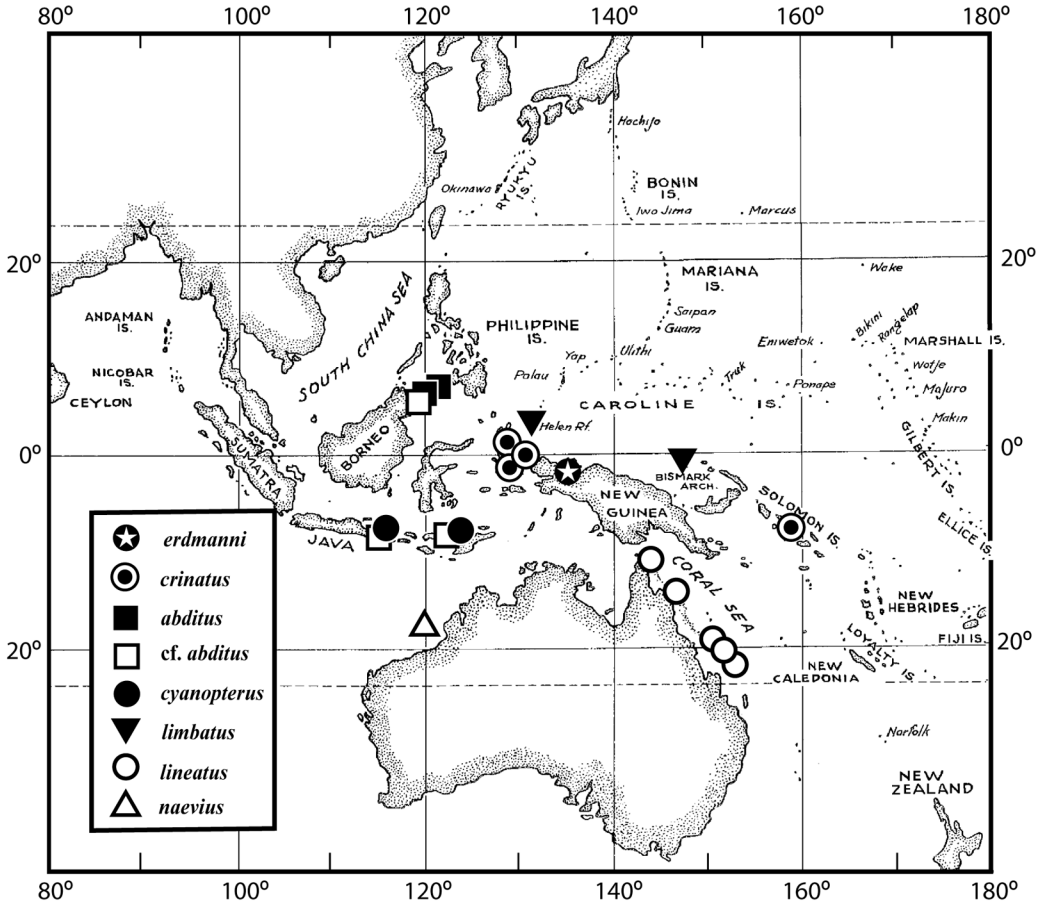

FIGURE 11. Distribution of the *Meiacanthus lineatus* species group.

Meiacanthus erdmanni new species

Figs 12–13, Table 1

Holotype. MZB 20023, 35.8 mm SL, male, Indonesia, West Papua Province, Cenderawasih Bay, patch reef north

of Tridacna Atoll, 2°25.830'S, 134°54.409'E, 65 m, at base of steep outer reef slope, clove oil and hand-net, Mark V. Erdmann, 20 Sept. 2010.

Diagnosis. A species of *Meiacanthus* (subgenus *Meiacanthus*) with major portion of dentary gland dorsally positioned and held in place laterally by dorsolateral flange of dentary; dorsal fin IV, 24; color pattern characterized by two mid-lateral dark stripes, and dorsal fin with a dark submarginal stripe and about 10 dark proximal blotches.

Description. Dorsal fin IV, 24. Anal fin II, 14. Pectoral fin 14-14. Caudal fin: procurrent rays 5+5; segmented rays 11, inner rays not elongated or deeply incised. Vertebrae: precaudal 13 + caudal 20. A pair of canines posteriorly in each jaw, those in lower jaw very large with a deep frontal groove; incisor teeth 16 in lower and upper jaws. Lateral line present, terminating below 5th dorsal-fin ray; mandibular and posttemporal pores 3; single median supratemporal pore.

FIGURE 12. *Meiacanthus erdmanni*, holotype, MZB 20023, 35.8 mm SL, male, Indonesia, West Papua Province, Cenderawasih Bay. Photo by S. J. Raredon.

FIGURE 13. *Meiacanthus erdmanni*, holotype, Photo by M. V. Erdmann.

Sexual dimorphism probably well developed in pelvic and caudal fins based on their relative lengths in the male holotype compared to other species of *Meiacanthus*: pelvic fin 37.7% SL; longest caudal-fin ray 52.8% SL; inner caudal-fin ray 21.5% SL.

Color pattern in preservation. Head and body with three dark stripes, separated by pale interspaces. Dorsalmost stripe very incomplete, extending on head and along dorsal body contour to first dorsal-fin ray and then as an irregular series of blotches, those on the posterior half of the fin only slightly extending onto dorsum; all of these blotches extend onto the basal third of the fin, and all except the first blotch and the last four connected basally to an adjacent blotch. The middle stripe extends from the margin of the upper lip through the eye, encroaches slightly onto the dorsal part of the pectoral-fin base and bluntly terminates on the base of the caudal fin. The ventral stripe extends from the lower jaw, beneath the eye, through the lower half of the pectoral-fin base and bluntly terminates on the caudal-fin base. The posteriodorsal region of the caudal peduncle is also dark. On the head a narrow, poorly

defined, pale predorsal stripe separates the dorsalmost dark stripe from its counterpart. Dorsal fin with a narrow pale margin anteriorly which gradually widens and becomes dusky, below which is a dark submarginal stripe that is darkest anteriorly and tapers as it extends to the end of the fin. Remainder of fin is white except for a series of about ten, irregular, dark blotches along the basal third of the fin, with those on the posterior half of fin smaller and only slightly extending onto the dorsal body contour. Other fins pale except the pectoral-fin rays which are narrowly outlined in black.

Colour in life (Fig. 13). The live color pattern is similar to that described above. The dark stripes are reddish brown to nearly blackish with intervening white stripes on the body. The two main body stripes have light brown margins. The belly region is light blue. The pale ground color of the dorsal fin is bluish and the distal margin of the fin is brown. The other fins are mainly pale gray to hyalin.

Comparisons. Among species of *Meiacanthus* with a pair of mid-lateral stripes, only *M. erdmanni* has a series of dark blotches proximally on the dorsal fin. Other double-striped species also have more (25–27) segmented dorsal-fin rays. *Meiacanthus grammistes*, the only other species of *Meiacanthus* known from Cenderawasih Bay, occurs in shallower depths, usually in 3–15 m.

Etymology. Named for Mark V. Erdmann, who collected the holotype, and in acknowledgement of his efforts to promote conservation of the Bird's Head biodiversity hot spot and document the fishes of the region.

Meiacanthus cyanopterus new species

Figures 14–16, Table 1

Holotype. MZB 20021, male 45.3 mm SL, Alor Strait, Pura Island, 8°16.944'S, 124°19.543'E, 44 m, clove oil and hand-net, Mark V. Erdmann, 27 March 2011.

Paratypes. WAM P.33398-002 (3, 19.8-30.9 SL), Beang Abang, East Pantar I., 8°29.386'S, 124°10.736'E, 65 m, Mark V. Erdmann, 26 March 2011; USNM 402709 (34.8 SL) and WAM P.33400-002 (2, 37.5–40.8 SL), Alor Strait, Pancoran, Teluk Kalabahi (Kalabahi Bay), 8°17.451'S, 124°24.944'E, 40 m, Mark V. Erdmann, 28 March 2011.

Diagnosis. A species of *Meiacanthus* (subgenus *Meiacanthus*) with major portion of dentary gland dorsally positioned and held in place laterally by dorsolateral flange of dentary; dorsal fin IV, 25 or 26; color pattern characterized by a pair of dark mid-lateral stripes that extend onto the caudal-fin base, and another dark stripe along the dorsal body contour and dorsal-fin base that encroaches onto the fin posteriorly; dorsal fin with black submarginal stripe bordered below by pale stripe, which is blue-violet in life and best developed in males.

Description. (values for the holotype are given first followed by the range of the paratypes). Dorsal fin IV, 25 (IV, 25–26). Anal fin II, 14 (II, 14–16). Pectoral fin 14-14 (13-13 to 15-15). Caudal fin: procurrent rays 4+4 (4–5+5–6); segmented rays 11, inner rays not elongated or deeply incised. Vertebrae: precaudal 12 + caudal 21 (12–13+21–22). A pair of canines posteriorly in each jaw, those in lower jaw very large with a deep frontal groove; incisor teeth in lower jaw 17 (16–17); in upper jaw 14 (15–16). Lateral line present, terminating below 5th (3–5) dorsal-fin ray; mandibular and posttemporal pores 3; single median supratemporal pore.

Sexual dimorphism well developed in pelvic and caudal fins (outer rays only) based on their relative lengths compared to other species of *Meiacanthus*. Values for two largest males, 45.3 holotype and 40.8 mm SL paratype, and two largest female paratypes, 37.5 and 34.8 mm SL, (values for females in parentheses) as follows: pelvic fin 27.2, 27.7% SL (11.7, 12.1% SL); longest caudal-fin ray 50.3, 38.2% SL (20.8, 21.3% SL); inner caudal-fin ray 20.3, 21.8% SL (19.8, 20.4% SL).

Color pattern in preservation. Male holotype with three dark stripes on head and body, separated by pale interspaces. The dorsalmost stripe extends along the dorsal body contour, base of the dorsal fin (distinctly encroaching onto the fin posteriorly), onto the dorsum of the caudal peduncle, and for a short distance onto the bases of several of the upper caudal-fin rays. A very narrow, pale, predorsal stripe separates the dorsalmost dark stripe from its counterpart and ends near or slightly forward of the anterior margin of the eye. The mid-lateral stripe extends across the snout, through the eye, completely enveloping the gill opening, encroaches slightly onto the upper margin of pectoral-fin base, and narrows posteriorly where it terminates on the caudal-fin base. In dorsal view the snout has a faint, V-shaped area (more distinct in life) that is a continuation of the pale stripe immediately above the dark mid-lateral stripe. The ventral stripe extends from the lower jaw, but does not meet at the mid-line

of the chin, through the lower half of the pectoral-fin base and onto the caudal-fin base. The dorsal fin has a narrow, pale distal margin, followed by a relatively wide submarginal dark stripe, which extends the length of the fin, and is bordered by a similar pale stripe of equal length; posteriorly the pale proximal stripe abuts a second dark stripe that is a continuation of the dark stripe that follows the dorsal body contour. The other fins are without obvious markings.

Females differ from males primarily in having the dark submarginal dorsal-fin stripe narrower and indistinct posteriorly, and the dark stripe along the dorsal-fin base not as strongly encroaching onto the fin posteriorly.

FIGURE 14. *Meiacanthus cyanopterus*, holotype, MZB 20021, 45.3 mm SL, male, Indonesia, Alor Strait. Photo by H. L. Jelks.

FIGURE 15. *Meiacanthus cyanopterus*, male, Indonesia, Alor Strait. Photo G. R. Allen.

Colour in life (Figs. 15–16): The dark stripes on the body and dorsal fin are dark brown to black and the narrow intervening stripes on the body and head are white; the throat and belly are also white. The dorsal fin has a narrow blue distal margin anteriorly which gradually widens and changes to yellow posteriorly; in adult males the submarginal pale stripe in the dorsal fin is blue-violet the entire length of the fin but in females it becomes almost colorless near the end of the fin. In both sexes the anal fin is mostly pale blue-violet but the colour is lighter in females which also have a narrow, pale yellow, proximal stripe. The other fins are pale gray to nearly hyalin.

Comparisons. Among species of *Meiacanthus* with a pair of mid-lateral stripes *M. cyanopterus* is apparently

unique in having a blue-violet stripe in the dorsal fin (best developed in males); life colors of *M. abditus* are unknown. Meristic characters of these two species broadly over-lap (Table I) and males of both species have elongate (sexually dimorphic) pelvic and outer caudal-fin rays (lengths of these fins are 25.7 and 41.8% SL, respectively, in the 48.3 mm SL and only adult male paratype of *M. abditus*), but neither species has elongate inner caudal-fin rays. Despite the strong similarity of *M. cyanopterus* and *M. abditus*, at least in preserved specimens, and assuming their allopatric distributions are not a collecting artifact, we believe that two species are represented. The position of the dark body stripe along the dorsal body contour appears to be consistently different in *M. abditus* with the stripe not extending onto the base of the fin posteriorly (Smith-Vaniz 1987: Figs. 7b, 8b), versus distinctly encroaching onto the fin. *Meiacanthus cyanopterus* may also inhabit deeper reefs; its known depth range is 40–65 m.

FIGURE 16. *Meiacanthus cyanopterus*, female, Indonesia, Alor Strait. Photo G. R. Allen.

Habitat and distribution. *Meiacanthus cyanopterus* is known only from deep reef habitats. In addition to the Alor Strait localities, this species was observed by Mark Erdmann at Tulamben, off the north coast of Bali, 8°17.603'S, 115°36.599'E in 65 m.

Etymology. The name is a combination of the Greek *Kyanos* (blue) and *pterus* (fin) in reference to the blue dorsal-fin stripe.

Meiacanthus (*Meiacanthus*) *abditus* Smith-Vaniz and *M.* cf. *abditus*.

Meiacanthus abditus was originally described (Smith-Vaniz 1987) from the Sulu Archipelago based on juveniles (10.2–29.3 mm SL) obtained at Jolo Island with dynamite in 3–6 m, and one 48.3 mm SL adult male from Sirun Island, trawled in 31–38 m. Although the color pattern is somewhat faded in all these specimens (collected by the M/V *Albatross* in 1908–1909), no dark stripe is evident on the anal-fin base and the pair of dark mid-lateral stripes extends a short distance onto the caudal fin. In the adult male the inner rays of the caudal fin are only weakly incised and not elongated, the dorsal fin has a dark stripe that extends the entire length of the fin and is about twice the width of the pale proximal area of the fin; in the 29.3 mm SL female the dark dorsal-fin stripe is about equal to the width of the anterior pale proximal area of the fin but it narrows posteriorly and fades completely before reaching the end of the fin. In both sexes the dark snout stripe contacts the margin of the upper lip anteriorly (see Smith-Vaniz 1987: Fig. 3b).

Smith-Vaniz (1987:9) briefly discussed a species of *Meiacanthus* occurring at Flores Island (8°35'S, 122°13'E), based on a photograph provided by Rudie Kuiter, noting that it shares with *M. crinitus* the elongate inner caudal-fin rays of adult males and has a head pattern most like *M. abditus* but differs from that species in several other aspects of its color pattern. Kuiter and Debelius (2006:644) subsequently published a color photograph of "*M. abditus*" from Flores Island, here reproduced as Fig. 17. This species is clearly not *M. abditus* based on the elongate inner caudal-fin rays of males, presence of a dark stripe along the anal-fin base and different pigmentation of the dorsal fin in both sexes (compare Figs. 17–18 with description of *M. abditus* dorsal fins in above paragraph). Females (Fig. 18), like other sexually dimorphic species of *Meiacanthus*, have relatively short pelvic fins and lack elongate inner caudal-fin rays. Kuiter (pers. comm.) noted that *Meiacanthus* sp. is relatively common at Flores on the outer islands, mainly Pomana, along walls near and in caves in about 20–25 m in current prone areas.

FIGURE 17. *Meiacanthus* cf. *abditus* = **n. sp.**, male (in front) and female (behind), Flores Island. Photo by R. H. Kuiter.

FIGURE 18. *Meiacanthus* cf. *abditus* = **n. sp.**, large female, Flores Island. Photo by R. H. Kuiter.

Allen *et al.* (2003:340) published a color photograph (Fig. 19) of what appear to be relatively small individuals, identified as *Meiacanthus abditus*, from Sabah, Malaysia, that had formed aggregations among gorgonians and

black coral. A slightly less cropped image of the same photograph shows two individuals with a dark anal-fin stripe and another one with it very faint or absent. What may be the same species of *Meiacanthus* was also observed and photographed (Fig. 20) on a vertical wall in 16–20 m at Menjangen I. off Bali. These juvenile *Meiacanthus* were aggregating in small groups of 20–30 fish around gorgonian sea fans, a behavior like that of the Sabah fish. It is possible that these are juveniles of the adult Flores *Meiacanthus* but in the absence of specimens or observations of both juveniles and adults together at any locality, we are unable confidently make that determination. We anticipate resolution of this quandary once specimens become available, followed by a formal description of the new species.

FIGURE 19. *Meiacanthus* cf. *abditus*, Sabah, Malaysia. Photo by G. R. Allen.

FIGURE 20. *Meiacanthus* cf. *abditus*, Menjangan I., off Bali. Photo by G. R. Allen.

Meiacanthus limbatus is the only other double-striped species of *Meiacanthus* that has a dark stripe on the anal-fin base but it differs most notably in having a completely dark chin and a yellow caudal fin.

Meiacanthus (*Meiacanthus*) *crinitus* Smith-Vaniz

Originally described from 11 specimens (Smith-Vaniz 1987) from two localities in West Irian (now West Papua Province, Indonesia), the following additional collections are now available, the Solomon Is. one representing a significant range extension: WAM P.31442-003 (34.5 mm SL), Raja Ampat Islands, Kri I., 0°33'S, 130°41'E, 5–10 m.; WAM P. 31443-004 (34.2 mm SL), Raja Ampat Islands, Wai I., 0°41'S, 130°43'E, 1–3 m.; WAM P.32538-001 (2, 36.4–41.9 mm SL) and USNM 396703 (2, 41.7–42.0 mm SL), Solomon Is., Santa Ysabel I., 7°24'S, 158°8'E, 2–4 m. The second author has also photographed *M. crinitus* at Halmahera, Buli Bay (0°47.378'N, 128°21.568'E) and at Lembeh Strait, North Sulawesi (1°27.014'N, 125°12.358'E). These photographs and specimens agree well with the original description, especially in the pattern of the lateral stripes on the caudal peduncle or caudal-fin base which terminate as narrow lines, the lower stripe typically ending in a small separated spot, Fig. 21.

FIGURE 21. *Meiacanthus crinitus*, female, Raja Ampat Islands. Photo by G. R. Allen.

Meiacanthus (*Meiacanthus*) *limbatus* Smith-Vaniz

The original description of *Meiacanthus limbatus* was based only on the 37.0 mm SL female holotype from Manus I., Bismarck Archipelago. The following collection represents a northern range extension, at a locality where it was the only species of *Meiacanthus* seen: USNM 397427 (5, 10.4–26.3 mm SL), South West Islands, Hatohobei, Helen Reef, 2°47'57"S, 131°45'18"E, vertical drop off from reef top, 22–34 m. Although adult *Meiacanthus* were also observed at this location, they rapidly swam away from the ichthyocide station and could not be captured (J. T. Williams, pers. comm.). The Helen Reef specimens agree with the holotype (for which life coloration was not recorded) in having the diagnostic dark brown chin and anal fin with a narrow dark stripe at its base. Meristic data for the holotype followed by the three largest Helen Reef specimens, in parentheses, are: dorsal fin IV, 26 (IV, 25, IV, 25, IV, 26), anal fin II, 17 (II, 16, II, 16, II, 16); pectoral fin 14-14 (same); vertebrae 13+ 22 (13+22, 13+23, 14+23).

The only available color photographs of *M. limbatus* (Fig. 22) are based on a juvenile and two subadults. The only other member of the *M. lineatus* group known to have a yellow caudal fin (life colors unknown for *M. naevius* and M. *abditus*) is the eastern Australian endemic, *M. lineatus* (Fig. 23).

FIGURE 22A–C. *Meiacanthus limbatus*, USNM 397427, size measurements before preservation, A, 12.1 mm SL; B, female, 23.6 mm SL, C, male, 27.2 mm SL (dorsal fin damaged), Helen Reef. Photographs by J. T. Williams.

FIGURE 23. *Meiacanthus lineatus*, BPBM 14414, 47 mm SL, male, Great Barrier Reef, One Tree Island. Photo by J. E. Randall.

Key to species of *Meiacanthus* with lateral body stripes

1a. Dentary gland ventrally positioned and encapsulated in dentary; mandibular and posttemporal canal series each with 2 pores; lateral line absent (subgenus *Allomeiacanthus*) 2

1b. Dentary gland dorsolaterally positioned and not encapsulated in dentary; mandibular and posttemporal canal series each with 3 pores; short lateral line present 3

2a. Dark mid-lateral stripe forked at front of pectoral fin, with dorsal arm extending through eye and ventral arm extending to gape; dark lateral stripe continuous posteriorly and caudal peduncle not conspicuously colored in life (western and central Pacific) . . . . . *Meiacanthus ditrema* Smith-Vaniz, 1976

2b. Dark lateral stripe not forked at front of pectoral fin; dark lateral stripe typically interrupted near beginning of bright orange-yellow caudal peduncle and replaced by an elongate black spot (northeastern Indian Ocean) . . . . . *Meiacanthus urostigma* Smith-Vaniz, Satapoomin & Allen, 2001

3a. Dorsal-fin spines 6–10 (rarely 6); segmented dorsal-fin rays 20–24; supratemporal canal typically with 2 median pores, 3 of 205 specimens with a single pore; dentary gland supported by dentary and anguloarticular bones and held in place laterally by flange of dentary; infraorbital bones 4 (subgenus *Holomeiacanthus*) (western and central Pacific) . . . . . *Meiacanthus anema* (Bleeker, 1852)

3b. Dorsal-fin spines 3–6 (rarely 6); segmented dorsal-fin rays 23–28; mid-point of supratemporal canal typically ending in a single pore; dentary gland supported solely by dentary bone; infraorbital bones 3 (subgenus *Meiacanthus*) 4

4a. Belly and underside of head dark or strongly vermiculated; dark body stripes partially or completely coalesced (Japan and Ryukyu Is.) . . . . . *Meiacanthus kamoharai* Tomiyama, 1956

4b. Belly and underside of head not dark or strongly vermiculated; dark body stripes distinct 5

5a. Adults with one dark lateral stripe in addition to one which may or may not be present at dorsal body contour 6

5b. Adults with two dark lateral stripes in addition to one at dorsal body contour. 10

6a. Dark lateral stripe extends at least slightly onto dorsal part of pectoral-fin base; dark stripe along dorsal body contour, if present, not extending onto caudal peduncle and caudal-fin base 7

6b. Dark lateral stripe does not extend onto dorsal part of pectoral-fin base; dark stripe along dorsal body contour extending onto caudal peduncle and caudal-fin base. 8

7a. Dark lateral stripe extends well onto dorsal part of pectoral-fin base; pectoral-fin rays usually 13; in life, body coloration above dark mid-lateral stripe pale gray; adult males with inner caudal-fin rays elongated and interradial membranes deeply incised (Papua New Guinea and New Britain) . . . . . *Meiacanthus vittatus* Smith-Vaniz, 1987

7b. Dark lateral stripe extends very slightly onto dorsal part of pectoral-fin base; pectoral-fin rays usually 15 or 16; in life, body coloration above mid-lateral stripe bright yellow; adult males with inner caudal-fin rays not elongated and interradial membranes not deeply incised (Australia) . . . . . *Meiacanthus luteus* Smith-Vaniz, 1987

8a. Dark lateral stripe not centered as it extends onto caudal fin, at most only dorsal margin of stripe aligned with center of fin; dorsal fin not conspicuously bicolored; in life, body golden yellow ventrally (Sabah, northeastern Kalimantan, and Philippine Is.) . . . . . *Meiacanthus geminatus* Smith-Vaniz, 1976

8b. Dark lateral stripe approximately centered as it extends onto caudal fin; dorsal fin conspicuously bicolored, distal half of fin pale and basal half abruptly dark brown; in life, body white ventrally. 9

9a. Dark lateral stripe terminating near caudal-fin base and its end bluntly rounded (Komodo I.) . . . . . *Meiacanthus abruptus*, new species

9b. Dark lateral stripe tapered as it extends onto caudal fin, and its end distinctly pointed (Sulawesi and Banggai Is.) . . . . . *Meiacanthus vicinus* Smith-Vaniz, 1987

10a. Caudal fin with middle rays distinctly spotted and dorsal and ventral margins of fin very dark or spotted; dark stripes on body interrupted posteriorly and replaced by conspicuous dark spots (western and central Pacific) . . . . . *Meiacanthus grammistes* (Valenciennes, 1836)

10b. Caudal fin with middle rays unspotted and dorsal and ventral margins of fin unspotted and usually pale; dark stripes on sides clearly defined posteriorly (except in *M. naevius*, see couplet 13) 11

11a. Dorsal-fin base with series of prominent dark blotches (West Papua) . . . . . *Meiacanthus erdmanni*, new species

11b. Dorsal-fin base without a series of dark blotches 12

12a. Chin, including lower lip, completely dark; anal-fin base with narrow dark stripe; in life, caudal fin yellow (Bismarck Archipelago and Helen Reef) . . . . . *Meiacanthus limbatus* Smith-Vaniz, 1987

12b. Chin, including lower lip, pale or only narrowly dusky; anal-fin base with or without narrow dark stripe; in life, caudal fin hyaline (except yellow in *M. lineatus*) 13

13a. Caudal peduncle pale except for elongate basicaudal spot; pectoral-fin rays 12 or 13 (western Australia, Rowley Shoals) . . . . . *Meiacanthus naevius* Smith-Vaniz, 1987

13b. Caudal peduncle typically with two dark stripes that extend at least to caudal-fin base pectoral-fin rays usually 14–16 (except 12 or 13 in *M. crinitus*) 14

14a. Pectoral-fin rays 12 or 13; dark stripes on caudal peduncle or caudal-fin base terminating as thin lines, the lower stripe typically ending as a small separated spot; anal-fin base without a dark stripe (Sulawesi, Halmahera, Irian Jaya and Solomon Is.) . . . . . *Meiacanthus crinitus* Smith-Vaniz, 1987

14b. Pectoral-fin rays 14–16 (exceptionally 13); dark stripes on caudal peduncle or caudal fin base not terminating as thin lines and lower stripe not ending as a small separated spot; anal-fin base with or without a dark stripe, although usually present 15

15a. Dark stripe on snout that extends through eye separated from margin of upper lip by wide pale area approximately equal to or wider than width of stripe; in life, pale area between dark body stripes yellow (eastern Australia) . . . . . *Meiacanthus lineatus* (DeVis, 1884)

15b. Dark stripe on snout that extends through eye separated from margin of upper lip by pale area distinctly narrower than width of stripe; in life, pale area between dark body stripes white to pale yellow 16

16a. Anal fin of adults with a dark basal stripe; inner rays of caudal fin distinctly elongated at least in Flores adult males (Sabah, Flores I. and Bali) . . . . . .*Meiacanthus* cf. *abditus*

16b. Anal fin of adults without a dark basal stripe; inner rays of caudal fin not distinctly elongated in adult males 17

17a. Dark stripe along dorsal contour of body distinctly encroaching onto base of dorsal fin; in life, dorsal fin of adults with blue-violet stripe (Alor Strait and Bali) . . . . . *Meiacanthus cyanopterus*, new species

17b. Dark stripe along dorsal contour of body not encroaching onto base of dorsal fin; in life, dorsal fin presumably without a blue-violet stripe (Sulu Archipelago) . . . . . *Meiacanthus abditus* Smith-Vaniz, 1987

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