

Two new species of *Mogurnda* (Osteichthyes: Eleotrididae) from the Etna Bay Region, Irian Jaya, Indonesia

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Two new species of *Mogurnda* are described from the Etna Bay region of western Irian Jaya. *Mogurnda mbuta*, new species, is described from 32 specimens, 29.2-101.2 mm SL, collected from the Mbuta Basin. It is most similar to *M. magna* from Laamora and Aiwaso lakes (lying about 35 km to the northwest), but differs in having fewer predorsal scales, a much smaller maximum size, and a different pattern of spots on the second dorsal fin. It is also allied to *M. kaifayama*, new species, which is described from 32 specimens, 22.5-99.5 mm SL, collected at nearby Lake Kaifayama. *Mogurnda mbuta* differs from *M. kaifayama* primarily in having larger scales, which are reflected in its lower counts of lateral and transverse body scales, predorsal scales, and circumpeduncular scales. In addition adults of *M. kaifayama* have shorter pelvic fins and there is also a modal difference in pectoral ray counts (more than 60 % of specimens with 17 rays in *M. kaifayama* compared with the usual count of 16 for *M. mbuta*). The new species can also be separated from one another when alive by differences in the pattern of spots on the second dorsal fin.

Introduction

The eleotridid genus *Mogurnda* contains small benthic fishes inhabiting a variety of freshwater environments in Australia and New Guinea. The group contains at least five Australian representatives and 14 species have thus far been recorded from New Guinea (Allen, 1989, 1991; Allen & Hoese, 1991; Allen and Renyaan, 1996). Nearly half the New Guinea species are endemic to Lake Kutubu, Papua New Guinea (Allen & Hoese, 1986). The others are scattered throughout most of the mainland, but appear to be absent on the Vogelkop Peninsula at the western extremity of the island.

The present paper describes two additional

species that were collected on a recent expedition to the Etna Bay region of Irian Jaya (Fig. 1). This part of New Guinea is poorly explored and lies in an interesting region straddling two major zoogeographic subprovinces – the central mainland to the east and Vogelkop Peninsula to the west. The first author had a rare opportunity to collect fishes around Etna Bay for several days in April 1997, while visiting Freeport Indonesia Company's exploratory mineral drilling camp. Helicopter flights were made to previously unexplored Lake Kaifayama and the Mbuta Basin (Figs. 2-3). Due to logistical problems and bad weather it was possible to spend only a few hours at each site, but eight species were obtained, including two new *Mogurnda*, which are described herein.

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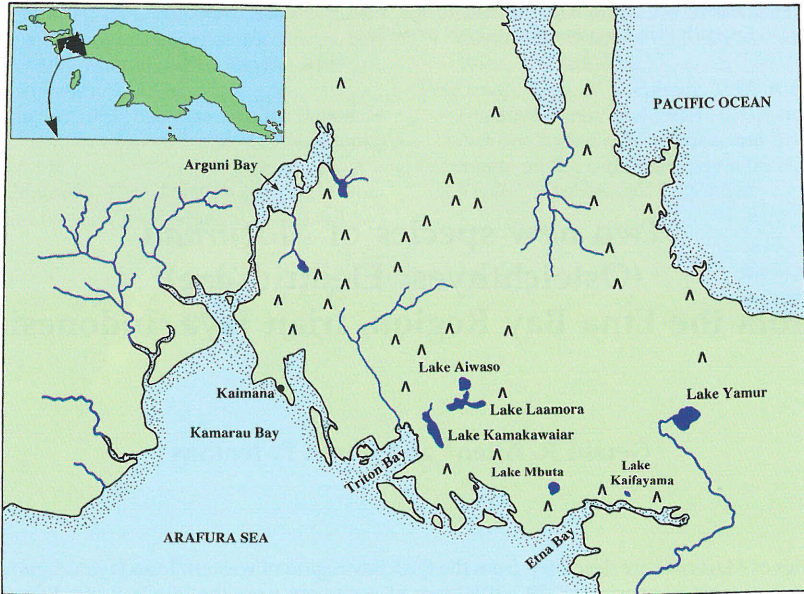


Fig. 1. Map of Etna Bay region, Irian Jaya. Mountain peaks higher than 900 m above sea level are indicated by Δ .

Materials and methods

The methods of counting and measuring are as follows: Dorsal and anal rays – the last ray of the anal and second dorsal fins is divided at the base and counted as a single ray. Gill raker count – number of gill rakers on the first branchial arch; this count is given in two parts (upper and lower limb); the raker at the angle of the gill arch is included in the lower limb count. Lateral scale count – number of scales from upper pectoral base to caudal-fin base, excluding the small scales posterior to the hypural junction. Transverse scale

rows – number of scales from anal spine obliquely upward and backward to second dorsal-fin base. Predorsal scales – number of scales along midline of nape in front of first dorsal fin. Standard length (SL) – measured from the tip of the upper lip to the caudal-fin base. Head length (HL) – measured from the tip of the upper lip to the upper rear edge of the gill opening. Caudal peduncle depth is the least depth and caudal peduncle length is measured between two vertical lines, one passing through the base of the last anal ray and the other through the caudal-fin base.



Fig. 2. Aerial view of Mbuta Basin, type locality of *Mogurnda mbuta*.



Fig. 3. Aerial view of Lake Kaifayama, type locality of *Mogurnda kaifayama*.



Fig. 4. *Mogurnda mbuta*, paratype, WAM P. 31300-005, 49.0 mm SL, Irian Jaya: Mbuta Basin.



Fig. 5. *Mogurnda mbuta*, paratype, WAM P. 31300-005, 70.0 mm SL, Irian Jaya: Mbuta Basin.

Counts and measurements that appear in front of parentheses in the new species descriptions refer to the holotype, within parentheses refers to the range for paratypes. Type specimens are deposited at the Museum Zoologicum Bogoriense, Bogor (MZB) and the Western Australian Museum, Perth (WAM).

Mogurnda mbuta, new species
(Figs. 4-5)

Holotype. MZB 9352, 101.5 mm SL; Indonesia: Irian Jaya: Lake Mbuta Basin (3°58'06"S 134°57'24"E), about 8 km northwest of Etna Bay, to 1.5 m depth; rotenone; G. Allen, T. Tabuni & M. Warus, 28 April 1997.

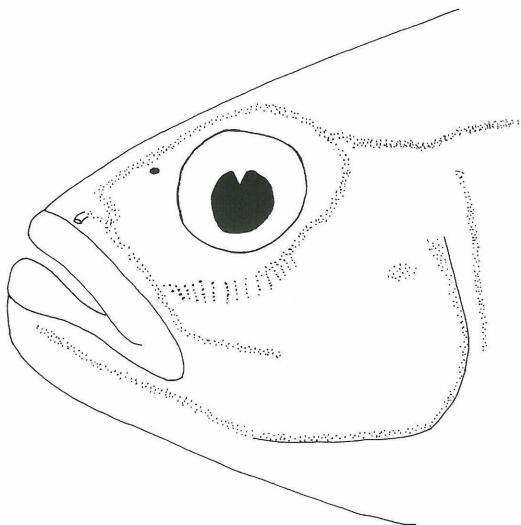


Fig. 6. *Mogurnda mbuta*, holotype, MZB 9352, camera lucida drawing of head showing tracts of cephalic sensory pores.

Paratypes. MZB 9353, 11, 32.1-97.3 mm SL; WAM P. 31300-005, 20, 29.2-92.2 mm SL; collected with holotype.

Diagnosis. A species of *Mogurnda* with the following combination of characters: soft dorsal rays 11-12; soft anal rays usually 12, occasionally 13 or 14; pectoral rays usually 16, occasionally 14 or 15; scales in lateral series 35-38; predorsal scales 17-22; vertebrae 15 + 16 or 17, total vertebrae 31-32; snout profile straight to slightly concave; young specimens with a series of about 9-10 dark bars on sides, becoming increasingly melanistic with age, adults entirely dark brown, nearly blackish (sometimes with hint of darker bars) with narrow white margin on dorsal and anal fins; maximum size to at least 101 mm SL.

Description. Dorsal rays VIII-I, 11 (VIII-IX, 11-12); anal rays I, 14 (12-14); pectoral rays 16 (14-16); segmented caudal rays 15 (14-17); branched caudal rays 14 (13-15); scales in lateral series 37 (35-38); transverse scale rows 13 (12-13); predorsal scales 21 (17-22); circumpeduncular scales 21 (18-21); postdorsal scales 11 (10-13); gill rakers on first arch 2 + 11 = 13 (2 + 10-11 = 12-13); vertebrae 15 + 16 = 31 (three paratypes with 15 + 17 = 32).

Body elongate, laterally compressed, more strongly posteriorly; body depth at pelvic fin origin 25.5 (21.8-29.1) % SL; body depth at anal

fin origin 22.2 (19.8-24.8) % SL. Head rounded with relatively short snout, its profile straight or slightly concave; nape strongly arched. Head length 32.8 (28.9-35.8), snout length 8.3 (7.4-9.1), eye diameter 7.8 (6.1-10.0), interorbital width 9.8 (7.8-11.5), all as % SL.

Lower jaw protruding slightly, mouth forming an angle of about 37 (31-42) degrees with longitudinal axis of body; jaw extending to level of anterior edge of pupil; teeth of jaws numerous, in dense bands, outer row enlarged; palate edentulous; tongue, palate and floor of mouth generally pale with faint melanophores. Gill opening extends forward to about level of rear margin of preopercle.

Scales of head, predorsal region, breast, belly, uppermost part of back and bases of caudal and pectoral fins cycloid, remainder of body scales ctenoid. Head entirely scaled except lips, snout tip, preorbital region, lower jaw and chin; preopercle scales smaller than body scales and tend to be embedded; sensory pores absent on head, but tracks of well developed papillae arranged as shown in Figure. 6.

First dorsal fin about same height as second dorsal fin in young specimens and slightly lower than second dorsal in adults; sixth or seventh spine of first dorsal fin tallest; last 2-3 rays of second dorsal fin tallest; pectoral fin length 20.1 (18.0-23.0) % SL; pelvic fins 19.9 (17.4-24.4) % SL; depressed pelvic fin tips falling short of anus. Caudal peduncle relatively elongate, its length 20.2 (18.2-23.7) % SL, and depth 12.1 (10.4-13.1) % SL. Caudal fin rounded, its length 29.6 (27.1-29.9) % SL.

Coloration. Colour in life: Juveniles (Fig. 4) with series of 8-10 alternating yellowish and brown irregular-shaped bars on upper two-thirds of sides, indistinct brown spots and blotches on upper surface of head and along back, including several just below dorsal fin base; a pair of oblique dark bands with whitish area between them, from lower rear corner of eye to lower margin of operculum; additional brown stripe just above and parallel to previous pair, crossing opercle and joining dark brown triangular mark on pectoral fin base; fins translucent to slightly dusky with spotting or blotching on basal half of dorsal fins. Larger individuals (approximately 65-100 mm SL) are darker overall and the juvenile bars are replaced by a complex pattern of irregularly-shaped red-brown spots and blotches on a

Table 1. Frequency distribution of counts for pectoral-fin rays, lateral scales, transverse scales, and predorsal scales in *Mogurnda kaifayama*, *M. magna* and *M. mbuta*.

	pectoral rays			predorsal scales									
	15	16	17	18	19	20	21	22	23	24	25	26	27
<i>M. kaifayama</i>	1	10	19						1	5	7	4	3
<i>M. magna</i>	2	14	2				1	3	8	3	1	1	
<i>M. mbuta</i>	6	20	1	1	3	6	6	1					

	scales in lateral series														
	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
<i>M. kaifayama</i>								2	2	2	3	3	3	2	3
<i>M. magna</i>		1	2	6	3	2	2	1							
<i>M. mbuta</i>	4	7	4	4											

	scales in transverse series					
	12	13	14	15	16	17
<i>M. kaifayama</i>					9	12
<i>M. magna</i>			6	10	2	
<i>M. mbuta</i>		5	11	3		

background of golden yellow (Fig. 5). The oblique dark bands on the head (as described for juveniles) are more intense and the dark marking on the pectoral base is particularly dark and highlighted by yellow-white areas above and below. Median fins are generally dusky with pale edges: first dorsal fin with pair of red-brown spots near base of last two spines; second dorsal fin with 4-5 equal-sized spots near base and additional pair along posterior margin of fin; caudal fin mainly dark brown; anal fin dusky along base and outer portion with central yellowish band. The pectoral and pelvic fins are mainly translucent.

Colour in alcohol: large specimens (in excess of about 75 mm SL) overall charcoal, including fins, paler ventrally with faint indication of markings as described below for juvenile and intermediate specimens. Juvenile (less than 55 mm SL) and intermediates (55-75 mm SL) charcoal to dark brown becoming whitish on ventral parts; a series of 9-10 evenly spaced dark brown bars on upper two-thirds of side; a pair of oblique dark bands with whitish area between them, from lower rear corner of eye to lower margin of operculum; a diffuse dark brown blotch on upper half of operculum; fins translucent to dusky with spotting or blotching on basal half of dorsal fins; faint spotting on anal fin base. Second dorsal fin often with three distinct semicircular spots. In addition to the pair of oblique dark bands radiating from the lower corner of the eye, there is an additional band above crossing the operculum

and forming a prominent mark on the pectoral fin base. Dark markings become less distinct with increased growth.

Comparisons. *Mogurnda mbuta* is closely allied to *M. magna* Allen & Renyaan (Fig. 7) from Lake Laamora and Lake Aiwaso, which lie approximately 35 km northwest of the Mbuta Basin and only about 6.5 km from the Mbuta drainage system. The lakes in which *M. magna* occur have separate subterranean drainage, as does the Mbuta Basin.

The modal predorsal and transverse scale counts of *M. mbuta* are slightly lower than for *M. magna* (Table 1). Additionally, it appears there is a significant size difference between the two species. The largest specimen of *M. mbuta* is 101 mm SL compared with at least 190 mm SL for *M. magna*, which is the largest species in the genus. A final difference involves the live coloration. *Mogurnda mbuta* has four, more or less equal-sized spots on the basal portion of the second dorsal fin. In contrast, *M. magna* usually has three spots and the posteriormost one is often smaller than the others (compare Figs. 5 and 7).

Mogurnda mbuta is also related to *M. kaifayama* from nearby Lake Kaifayama, which is described below. It differs from *M. kaifayama* primarily in having larger scales, thus lower counts (Table 1): 35-38 scales in lateral series versus 42-49, 12-13 transverse scales versus 16-17, 17-22 predorsal scales versus 24-27, and 18-21 circumpe-



Fig. 7. *Mogurnda magna*, paratype, WAM P.31043-002, 68.5 mm SL, Irian Jaya: Lake Laamora.

duncular scales versus 22-25. There is also a difference in the length of the pelvic fin in adult specimens (> about 70 mm SL). In *M. mbuta*, it is about the same length as the pectoral fin, vs significantly shorter in *M. kaifayama*. There is also a modal difference in pectoral ray counts (Table 1). *Mogurnda kaifayama* usually has 16-17 (rarely 15) rays, with slightly more than 60 % of specimens having 17 rays. In contrast, *M. mbuta* usually has 16 rays, occasionally 15 or 17. Lastly, there are differences in live colour pattern. As mentioned above, *M. mbuta* has four equal-sized spots along the basal portion of the second dorsal fin, whereas *M. kaifayama* has only two spots. In addition, *M. mbuta* typically has brighter yellow color above and below the dark marking on the pectoral fin base, although this may become obscure in large dark-coloured adults.

Distribution and abundance. The type locality (Fig. 2) consists of a roughly circular swampy basin, approximately 5 km in diameter, and located about 8 km north of Etna Bay. It is invariably represented on published maps and charts as a lake, but is actually marshland surrounded by low mountains. Although a lake was probably present in former times there is no indication of recent inundation. Much of the basin floor is covered with 3-4 m tall grass with numerous small ponds, creeks, and at least one small river.

Drainage is apparently subterranean, which is typical of other lakes in this limestone region. There is no apparent outflow to nearby Etna Bay. The basin is uninhabited by humans, but supports large numbers of wild pig and deer.

The type specimens were collected with rotenone in a 2-3 m-wide creek with depths to about 2 m. The collection was made over a 50 m-long section immediately above its confluence with a small turbid river. The water was very clear, but darkly stained (tea-coloured), with relatively fast flow through forest that almost formed a closed canopy. The bottom consisted mainly of mud with occasional rocks and log debris with sparse aquatic vegetation. A water temperature of 25.8°C and pH of 6.4 were recorded. Other inhabitants of the creek included two rainbowfishes (*Melanotaenia goldiei*, *Pelangia mbutaensis*), a plotosid catfish (*Neosilurus brevidorsalis*), an atherinid (*Craterocephalus* sp.), a gobiid (*Glossogobius* sp.), an additional eleotrid (*Oxyeleotris fimbriata*), and a parastacid crayfish (*Cherax* sp.). The new species rated fifth in abundance after *Melanotaenia*, *Craterocephalus*, *Neosilurus*, and *Pelangia*. It was about one-fifth as abundant as *Melanotaenia goldiei* (167 specimens collected).

Etymology. The species is named *mbuta* with reference to the type locality. A noun in apposition.



Fig. 8. *Mogurnda kaifayama*, paratype, WAM P.31301-003, 41.5 mm SL, Irian Jaya: Lake Kaifayama.



Fig. 9. *Mogurnda kaifayama*, paratype, WAM P.31301-003, 85.0 mm SL, Irian Jaya: Lake Kaifayama.



Fig. 10. *Mogurnda kaifayama*, holotype, MZB 9354, 99.5 mm SL, Irian Jaya: Lake Kaifayama.

Mogurnda kaifayama, new species
(Figs. 8-10)

Holotype. MZB 9354, 99.5 mm SL; Indonesia: Irian Jaya: Lake Kaifayama (3°53'18"S 134°46'18"E), about 3 km north of Etna Bay, to 2 m depth; rotenone; G. Allen, T. Tabuni & M. Warus, 29 April 1997.

Paratypes. MZB 9355, 15, 29.1-87.2 mm SL; WAM P.31301-003, 16, 22.5-88.8 mm SL; collected with holotype.

Diagnosis. A species of *Mogurnda* with the following combination of characters: soft dorsal rays 11-12; soft anal rays 12 (rarely 11-13); pectoral rays 16-17 (rarely 15); scales in lateral series 42-49; predorsal scales 23-27; vertebrae 15 + 16 or 17, total vertebrae 31-32; snout profile straight to slightly convex; young specimens with series of about nine dark bars on side, the bars becoming irregular in shape and general coloration increasingly melanistic with age, some larger sub-adults with vague bars on upper two-thirds of sides, adults entirely blackish with narrow white margin on dorsal and anal fins; maximum size to at least 99.5 mm SL.

Description. Dorsal rays VIII-I, 12 (11-12); anal rays I, 12 (11-13); pectoral rays 17 (15-17); segmented caudal rays 15 (15-16); branched caudal rays 15 (14-15); scales in lateral series 42 (42-49); transverse scale rows 17 (16-17); predorsal scales 26 (23-27); circumpeduncular scales 22 (23-25); postdorsal scales 14 (14-16); gill rakers on first arch 2 + 11 = 13 (2 + 9-11 = 11-13); vertebrae 15 + 16 = 31 (four paratypes with 15 + 17 = 32).

Body elongate, laterally compressed, more strongly posteriorly; body depth at pelvic fin origin 25.3 (23.9-28.3) % SL; body depth at anal fin origin 23.1 (20.8-25.5) % SL. Head rounded with relatively short snout, its profile straight or slightly convex; nape strongly arched. Head length 31.8 (30.8-33.3), snout length 8.3 (7.4-9.4), eye diameter 7.5 (6.2-8.6), interorbital width 9.7 (8.6-11.3), all as % SL.

Lower jaw protruding slightly, mouth forming an angle of about 32 (32-38) degrees with longitudinal axis of body; jaw extending to level of anterior edge of pupil; teeth of jaws numerous, in dense bands, outer row enlarged; palate edentulous; tongue, palate and floor of mouth generally pale with faint melanophores. Gill opening

extends just forward of posterior margin of opercle.

Scales of head, predorsal region, breast, belly, uppermost part of back and bases of caudal and pectoral fins cycloid, remainder of body scales ctenoid. Head entirely scaled except lips, snout tip, preorbital region, lower jaw and chin; preopercle scales smaller than body scales and tend to be embedded; sensory pores absent on head, but tracks of well developed papillae arranged as shown in Figure 11.

First dorsal fin about same height as second dorsal fin in young specimens and slightly lower than second dorsal in adults; sixth or seventh spine of first dorsal fin tallest; last 2-3 rays of second dorsal fin tallest; pectoral fin length 21.8 (20.4-23.0) % SL, longer than pelvic fins; pelvic fins 17.9 (16.9-20.4) % SL; depressed pelvic fin tip falling well short of anus. Caudal peduncle relatively elongate, its length 21.5 (19.6-23.8) % SL, and depth 13.8 (12.6-15.3) % SL. Caudal fin rounded, its length 28.6 (26.7-33.0) % SL.

Coloration. Colour in life: Juveniles (Fig. 8) with alternating brown and yellowish-white bars, dark bars about twice width of pale ones; lower third of body generally white or yellowish; two pairs of oblique dark bands, with yellow-white area between them, one pair from lower rear corner of eye to lower margin of operculum and the other from upper rear corner of eye to top of head; first dorsal fin with pair of broad dusky brown bands, one along outer margin and the other on basal portion of fin; second dorsal fin with white outer edge and broad submarginal brown band, two large brown spots on basal half of fin and smaller rectangular brown spot on membrane between base of first two fin rays; caudal fin mainly translucent or slightly dusky; anal fin similar to soft dorsal fin except lacking spots, but with solid brown basal band; pectoral and pelvic fins mainly translucent; middle of pectoral fin base with brown triangular marking (intensely dark along base of pectoral rays) with pearl-white area immediately above and below. Larger individuals (approximately 50-85 mm SL) are darker overall, the ground colour more or less light purple or brownish (Fig. 9); dark bars on sides becoming less distinct with increased growth, eventually forming maze of blotches; a series of up to 5-6 large dark brown blotches sometimes evident on the upper back; two pairs of diagonal dark stripe radiating from rear part of eye as described above

and additional brown stripe just above and parallel with lower pair, extending across opercle and forming link with dark mark on middle of pectoral fin base; fins mainly dusky brownish with white margin on both dorsal fins and anal fin; pair of prominent red-brown spots at base of second dorsal fin with several smaller spots above posterior one; anal fin with broad red-brown basal band. Large adults (> about 90 mm SL) dark brown with irregular dark markings as shown in Figure 10.

Colour in alcohol: Juveniles (less than about 55 mm SL) and intermediates (55-75 mm SL) creamy yellow to tan becoming whitish on ventral parts; a series of 9-10 evenly spaced dark brown spots along the middle of side becoming more distinct posteriorly (rarely forming full bars on upper two-thirds of side); pair of oblique dark bands (often faint) with pale area between them, from lower rear corner of eye to lower margin of operculum; additional dark band sometimes apparent crossing operculum to pectoral fin base; a short oblique dark stripe on upper rear corner of eye; median fins translucent to dusky with spotting or blotching on basal half of dorsal fins; series of large spots along base of second dorsal fin, more evident in freshly preserved specimens; upper half to two-thirds of pectoral fin base dark brown to black. Markings become less distinct with increased growth. Adults in excess of about 75 mm SL overall charcoal, including fins, without indication of markings as described above; dorsal and anal fins with thin pale margin.

Comparisons. Differences between *M. kaifayama* and the closely related *M. mbuta* are given above in the comparisons section for the latter species. *Mogurnda magna* is also similar, but grows to nearly twice as long. Additionally, it generally has larger scales, thus lower counts for predorsal scales, lateral body scales, and transverse body scales (see Table 1). There is also a difference in modal pectoral-ray counts (most specimens of *M. magna* with 16 rays, over 60% of *M. kaifayama* specimens with 17 rays).

Distribution and abundance. Lake Kaifayama, the type locality (Fig. 3), lies at an elevation of about 50 m above sea level approximately three km north of Etna Bay, being separated from the sea by a 500 m high ridge. The lake is approximately 2 km long and 0.6 km across the widest point. It is situated in a narrow valley surround-

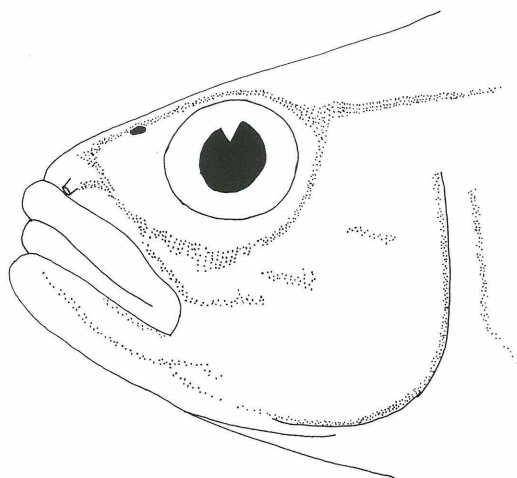


Fig. 11. *Mogurnda kaifayama*, holotype, MZB 9354, camera lucida drawing of head showing tracts of cephalic sensory pores.

ed by steep mountains in an area of karst topography. The valley narrows into a canyon that extends nearly in a straight line for almost 40 km in a northwesterly direction. A small river flows down the canyon terminating in the lake. There are no apparent outlet streams, indicating a subterranean drainage. Water levels in the lake apparently undergo huge fluctuations depending on local rainfall. The lake was extremely low, approximately 30 m below its maximum level (judging from lakeside vegetation) when the type specimens were collected.

Specimens were collected with rotenone from a 1-2 m wide steep-gradient creek that eventually flowed into a small side branch of the main lake. The rocky creek was punctuated with rapids and pools (to 5 cm depth). However, most specimens were taken in a narrow arm of the lake in a section up to 10 m wide and 2-3 m deep. The water was slightly turbid and green in colour. The lake bottom consisted mainly of mud with sparse aquatic vegetation. Most of the fishes were collected from a partially submerged thicket of dead bushes along the margin. A water temperature of 29.0°C was recorded. Other inhabitants of the type locality included a rainbowfish (*Melanotaenia goldiei*), a plotosid catfish (*Neosilurus brevidorsalis*), a gobiid (*Glossogobius* sp.), and an additional eleotrid (*Oxyeleotris fimbriata*). *Mogurnda kaifayama* rated second in abundance after *Melanotaenia goldiei* (112 specimens collected).

Etymology. The species is named *kaifayama* with reference to the type locality. A noun in apposition.

Acknowledgements

We are grateful for the support of our home institution, the Western Australian Museum. Special thanks are due the PT. Freeport Indonesia Company for their extraordinary logistic support while in the field. Freeport personnel who were instrumental in the success of the Etna Bay visit included Paul Murphy, Bruce Marsh, Howard Lewis and Kent Hortle. The first author is especially indebted to Tenius Tabuni and Martin Warus, who aided with the Mbuta Basin collections, and to helicopter pilot Joe Driver and the staff of the Etna Bay geological exploration camp. We are also grateful to the Indonesian Institute of Sciences (LIPI), for sponsoring the first author's studies of the freshwater fishes of Irian Jaya. We thank the National Geographic Society (Washington) for providing funds for the fieldwork of this study.

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Received 20 April 1998
 Revised 7 October 1998
 Accepted 17 November 1998

Verlag Dr. Friedrich Pfeil
ISSN 0936-9902

Ichthyological Exploration of Freshwaters

An international journal for field-orientated ichthyology

Volume 10
Number 3

