A New Species of Rainbowfish (Teleostei: Melanotaenioidei: Bedotiidae) from the Makira Region of Northeastern Madagascar

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***Bedotia alveyi*, a new species of Malagasy rainbowfish, is described from the lower reaches of the Antainambalana and Vohimaro rivers and their tributaries near the village of Maroansetra in the Makira Forest Protected Area, northeastern Madagascar. The new species is distinguished from congeners by the presence of a distinctive crescent-shaped to semicircular spangle on the posterior half of many opercular and flank scales, which creates iridescent golden (occasionally whitish to bluish) highlights. Additional unique pigmentation pattern features include a dark midlateral stripe interrupted by sparse lateral blotching and rust-red caudal-fin lobes. *Bedotia alveyi* is one of several new species that were collected during a brief expedition into the Makira Forest region in 2003. The Makira Forest was designated a Malagasy protected area in December of 2005.**

IN November 2003, researchers from the American Museum of Natural History (AMNH), the Wildlife Conservation Society (WCS), and Antongíl Conservation (Madagascar) conducted freshwater fish surveys in the southeastern region of the Makira Forest. These collections were made around an edge of the 1,350 square-mile Makira Forest Protected Area that was subsequently established (December 2005) in northeastern Madagascar. The Makira Forest Protected Area encompasses one of the largest remaining tracts of intact rainforest habitat on the island, and, as a result, has received much recent attention and investment from conservation agencies (WCS, Conservation International). This investment derives much of its funding via carbon-offset purchases (Forest Carbon Portal; http://www.forestcarbonportal.com/inventory_project.php?item=68) from large corporations (e.g., Mitsubishi Corporation) and representatives of the music industry (e.g., Pearl Jam, Dixie Chicks). Despite considerable attention and financial investment, the fauna of this remote region remains poorly known. In a three-day survey of the lower reaches of the Antainambalana and Vohimaro rivers and their tributaries, northwest of the town of Maroansetra (Fig. 1), significant collections of native and introduced fresh- and brackish-water fishes were made, including at least three species new to science: *Allenbatrachus meridionalis* (Greenfield and Smith, 2004), *Ptychochromis makira* (Stiassny and Sparks, 2006), and the *Bedotia* described herein.

Species of *Bedotia* are small (≤100 mm SL), colorful, and elongate rainbowfishes (Melanotaenoidei) that exhibit subtle to extreme sexual dimorphism and dichromatism. They typically live in small- to medium-sized forested rivers and, to a lesser extent, swamps and marshes along the eastern slope of Madagascar. *Bedotia* was described by Regan (1903) for *B. madagascariensis*; however, it was nearly a century later that the genus was formally diagnosed by several morphological apomorphies (Stiassny, 1990), most prominently by a distinct notch on the dentigerous face of the premaxilla. In a series of papers recounting new discoveries in Madagascar subsequent to Regan's generic description, Pellegrin (1907, 1914, 1932) brought the number of nominal species of *Bedotia* to four. Nearly 70 years later, following a resurgence of field research activity in Madagascar, descriptions of new *Bedotia* by researchers at the AMNH, the University of Michigan, and WCS (Stiassny and Harrison, 2000; Sparks, 2001; Sparks and Rush, 2005; Loiselle and Rodriguez, 2007) has increased the number of nominal species to eight. Despite a doubling of the number of described species of *Bedotia* in the last decade, many novel species remain to be described (Sparks and Stiassny, 2003, 2008). These species are readily distinguishable by pigmentation pattern, coloration, and body shape. In a phylogenetic analysis of Bedotiidae, Sparks and Smith (2004) resolved relationships among the six nominal species of *Bedotia* and 11 undescribed species. Subsequently, both *B. albomarginata* (*B.* sp. ''vevembe'' of Sparks and Smith, 2004) and *B. leucopteron* (*B.* sp. ''beforana'' of Sparks and Smith, 2004) were described (Sparks and Rush, 2005; Loiselle and Rodriguez, 2007, respectively). Herein, we describe a ninth species of *Bedotia*, which was recovered in ''Clade D'' of Sparks and Smith's (2004) phylogenetic study and labeled as *Bedotia* sp. ''makira''.

MATERIALS AND METHODS

Specimens of the new species described herein were fixed in paraformaldehyde and stored in 70% ethanol. For osteological study, multiple individuals were cleared and double stained (CS) using a modified protocol based on Taylor and Van Dyke (1985). Vertebral counts were obtained from radiographs. Counts and measurements follow Hubbs and Lagler (1964) unless otherwise specified. Vertebral counts exclude the terminal half-centrum. Snout to first dorsal-fin origin length is measured from the tip of the upper lip to the base of first dorsal-fin ray. Snout to second dorsal-fin origin length extends the previous measurement to the base of the first ray of the second dorsal fin. Snout to pelvic-fin origin length is the distance from the tip of the lower lip to the base of the left pelvic fin. Snout to anal-fin origin length extends from the tip of the lower lip to the base of the first anal-fin ray. Lower-jaw length is measured from the symphysis to the posterior end of the dentary. All measurements were recorded to the nearest 0.1 mm with digital calipers. Scales in lateral series are counted from the hypural flexure to the posterodorsal margin of the opercle. The terminal rays of both the anal and second dorsal fins are

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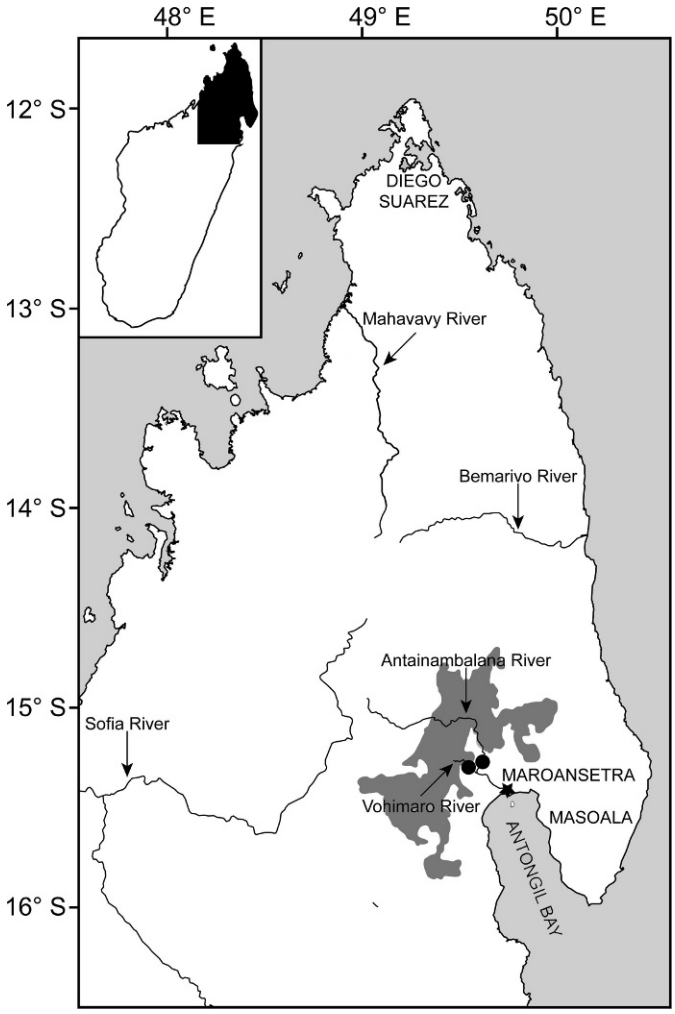

Fig. 1. Map of northeastern Madagascar, illustrating the collection localities of *Bedotia alveyi* (circles), the town of Maroansetra (star), and the extent of the Makira Forest Protected Area (area of dark gray shading along the Antainambalana and Vohimaro rivers).

split to their bases and emerge from a single pterygiophore. Thus, they are treated as one ray. Institutional abbreviations are as listed at http://www.asih.org/codons.pdf.

Bedotia alveyi, new species

Makira Rainbowfish

Figures 2, 3; Table 1

Bedotia sp. ''makira''.—Sparks and Smith, 2004:723.—Sparks and Rush, 2005:40, 52.

Bedotia ''makira''.—Sparks and Smith, 2004:726.

Holotype.—AMNH 249487, 84.9 mm SL, Madagascar, Province of Toamasina, small stream just north of Ambodivoankongy, tributary of Antainambalana River, Sahavilory, 15°17′24.0″S, 49°37′02.4″E, 8 November 2003, field number JSS-03-03, J. S. Sparks, W. L. Smith, K. L. Tang, and party.

Paratypes.—AMNH 240829, 2, 43.0–84.9 mm SL, data as for holotype; AMNH 240830, 59 (5 CS), 19.4–50.8 mm SL, Madagascar, Province of Toamasina, medium-sized tributary of Vohimaro River, 9 November 2003, field number JSS-03-05, J. S. Sparks, W. L. Smith, K. L. Tang, and party; FMNH 118296, 2, 57.7–67.7 mm SL, data as for holotype; FMNH 118295, 20 (1 CS), 38.1–63.9 mm SL, data as for AMNH 240830.

Diagnosis.—A species of *Bedotia* that uniquely possesses a distinctive crescent-shaped to semicircular spangle on the posterior half of many opercular and flank scales, forming golden (occasionally whitish to bluish) iridescent highlights. *Bedotia alveyi* is further distinguished from congeners by a single diffuse broad midlateral band (versus two distinct bands in *B. geayi* and *B. madagascariensis*, and absence of bands in *B. masoala* and *B. marojejy*), sparse and irregular lateral blotching between scales when alive (versus extensive spots and/or blotches present in life and preservation in *B. leucopteron*, *B. marojejy*, and *B. masoala*), the absence of broad white margins on the second dorsal and anal fins (versus white margins in *B. albomarginata*), and rust-red caudal-fin lobes (versus hyaline to orange in *B. longianalis* and broadly outlined in black in *B. tricolor*).

Description.—Average-sized bedotiid, reaching approximately 90 mm SL. Shallow bodied and laterally compressed, standard length on average 4.5 times greatest body depth (range 3.9 to 4.8). General appearance and a summary of morphometric and meristic data appear in Figure 2 and Table 1, respectively. Mouth oblique and moderately to strongly prognathous. Posterior tip of maxilla reaches vertical midway between anterior orbital margin and pupil. Snout acute in lateral profile, depressed and concave between premaxilla and orbit. Eye moderate in size, orbit diameter approximately equal to one-fourth to one-third of head length. Premaxillary ''*Bedotia* notch'' of Stiassny (1990) pronounced. First dorsal fin inserted slightly posterior to vertical through anal-fin origin. Second dorsal fin inserted posterior to vertical through anal-fin origin, a distance approximately equal to one-third of anal-fin base. First dorsal fin with five to seven weak unbranched rays (modally six). Second dorsal fin with 11 to 18 rays (modally 13). Anal fin with 17 to 22 rays (modally 19). First two to four rays of second dorsal fin unbranched (modally three). Anal fin with three to five unbranched rays (modally four). Caudal fin emarginate to moderately forked. Posterior margin of second dorsal and anal fins pointed and elongated in males, rounded in females. Scales large, imbricate, and cycloid, reduced in size on breast and caudal-fin base. Hypural flexure followed by three or four rows of small cycloid scales extending onto base of caudal fin. Head asquamate from snout to posterior of orbit, with exception of large embedded pre-dorsal scale along dorsal midline, which may reach midorbit. Cheek and operculum scaled. Lachrymal, interopercle, and subopercle asquamate. Predorsal scales number 16 to 18. Scales in lateral series 36 to 39 (modally 37). Interior and exterior surfaces of premaxilla, maxilla, and dentary covered with small, slightly recurved, cylindrical teeth, with largest teeth located on dorsal surface of dentary opposite ''*Bedotia* notch'' of premaxilla. Three or four rows of similar teeth on vomer, arrayed in narrow crescentic patch extending to palatine. Palatine teeth present. Tooth patch present on endopterygoid, extending to quadrate. Small ectopterygoid tooth patch present. Tooth patches present on basibranchials one and three. Three or four short, stout hypobranchial rakers on first gill arch, becoming more elongate posteriorly. Seven to nine slender, triangular ceratobranchial rakers, including raker in angle of arch. Three or four short epibranchial rakers with bases approximately equal to length. All rakers, except epibranchial, denticulate for length of mesial surface. Epibranchial rakers denticulate apically. Total vertebrae modally 36,

Table 1. Morphometric and Meristic Data for *Bedotia alveyi*. Numerals in parentheses represent number of specimens with particular meristic values.

Character	*n*	Holotype	Range	Mean	SD
Standard length (in mm SL)	25	84.9	40.5–84.9		
Percentage of SL					
Head length (HL)	25	27.1	25.8–29.2	27.5	0.9
Head width (maximum)	25	14.6	12.9–15.2	14.0	0.6
Body depth	25	24.0	20.7–25.7	22.1	1.1
Snout to first dorsal-fin origin length	25	54.0	46.6–55.0	52.5	1.9
Snout to second dorsal-fin origin length	25	66.0	60.4–67.9	65.1	1.9
Snout to anal-fin origin length	25	57.9	53.0–63.1	58.1	2.3
Snout to pelvic-fin origin length	25	42.0	39.5–44.2	42.0	1.3
Caudal-peduncle length	25	15.7	14.7–18.7	16.9	1.1
Caudal-peduncle depth	25	9.9	8.9–10.7	9.6	.5
Pectoral-fin length	25	18.0	17.4–22.7	19.4	1.4
Second dorsal-fin base length	25	17.5	14.2–18.1	16.2	.9
Anal-fin base length	25	29.6	24.6–33.7	28.6	1.7
Percentage of HL					
Snout length	25	39.2	28.3–39.7	33.3	3.3
Upper-jaw length	25	45.4	35.1–46.7	42.0	2.5
Lower-jaw length	25	54.8	44.3–56.3	49.9	3.5
Orbit diameter	25	26.0	24.3–34.1	28.2	2.3
Caudal peduncle length/depth	25	1.6	1.4–1.9	1.8	.2
Meristics					
Vertebrae (precaudal + caudal)	25	19+17	19+16(2), 19+17(3), 20+15(3), 20+16(12), 20+17(3), 21+16(2)		
Second dorsal-fin rays	25	12	11(2), 12(9), 13(10), 14(3), 18(1)		
Anal-fin rays	25	18	17(1), 18(10), 19(11), 20(2), 22(1)		

comprising the following precaudal and caudal elements, respectively: 20+16 (12), 19+17 (3), 20+17 (3), 20+15 (3), 21+16 (2), and 19+16 (2). Posterior six or seven caudal vertebrae show typical marked thickening and crenulation characteristic of bedotiids as described by Stiassny (1990).

Coloration in life.—Refer to Figure 3 for general coloration. Base coloration yellowish-tan (females) to olive (males) dorsally, becoming lighter ventrally. Broad diffuse midlateral stripe irregularly interrupted by iridescent, golden spangling on scales, resulting in a somewhat blotchy appearance midlaterally. Opercle also with iridescent golden spangling on scales. Iridescent golden coloration may extend above lateral stripe. Thin silver or golden reflective line apparent in most specimens from pectoral-fin insertion to caudal flexure, merging with dark midlateral stripe below second dorsal-fin insertion to caudal-fin base. Pupil surrounded by bright golden ring. Breast ventral to midlateral stripe variably iridescent golden or silvery. Pectoral-fin base dark black. Caudal-fin lobes rust-red. Triangular spot at caudal flexure. Procurrent caudal-fin rays pigmented, forming opposing spots dorsally and ventrally at caudal-fin base. Central rays of caudal fin iridescent golden. Anal fin with wide white submarginal band anteriorly, becoming yellow or rust-red posteriorly. Anal fin with black marginal band. Black stripe present along anal-fin base.

Coloration in alcohol.—Base coloration light tan to cream, becoming darker dorsally. Dark, but diffuse, black midlateral stripe approximately one scale in height extends from snout to caudal-fin base. Midlateral stripe interrupted across preopercle at level of orbit. In larger specimens, midlateral stripe becoming gradually less distinct anteriorly. Melanophores on flanks concentrated at scale margins, producing reticulate pattern. Reticulate pattern less distinct below lateral stripe. Thin line of melanophores visible beneath squamation, following division between hypaxial and epaxial musculature, forming narrow stripe beginning six to eight scales posterior to angle of opercle and extending to hypural flexure. This line bifurcating into two subparallel lines beneath midpoint of second dorsal fin. Caudally directed triangular patch at hypural flexure. Upper and lower caudal rays pigmented at base, creating two distinct dark blotches, with pigmentation extending to both dorsal and ventral procurrent caudal rays. Central rays of caudal fin pigmented and forming distinct stripe. Stripe darkest at fin base. Caudal-fin lobes hyaline distally. First dorsal fin with white to hyaline interradial membranes. White pigmentation patchy on distal half of fin. First dorsal rays pigmented except tips of first and second rays, which are white or hyaline. Second dorsal fin with melanophores on membranes and ray margins, forming central stripe between translucent basal and marginal zones. Central zone of pigmentation on second dorsal with narrow projections ''radiate'' outward to fin margin, creating serrated appearance. Margin of membrane between penultimate and last ray with dense black pigment. Ray tips generally hyaline. Anal fin with four bands of pigment from base to distal margin, comprising distinct narrow dark basal stripe, followed by lighter pigmented band, clear band, and elongate black marginal splotches on interradial margins, in most cases confined to anterior half of fin. Membrane between penultimate and last ray generally with similar black pigmentation at margin. Each pectoral-fin ray outlined with two rows of minute melanophores. Axil of pectoral fin liberally blotched with black pigment. Pelvic fins hyaline.

Fig. 2. *Bedotia alveyi*, new species, holotype, AMNH 249487, 84.9 mm SL (top) and, paratype, FMNH 118296, 67.7 mm SL (bottom).

Sexual dimorphism and dichromatism.—Compared to congeners, *Bedotia alveyi* exhibits a typical degree of sexual dimorphism. Males darker in coloration, tending toward olive, whereas females lighter and tending toward tan to yellowish. Anal and second dorsal fins pointed in males, becoming elongate in specimens over 50 mm SL. In larger individuals, adpressed anal- and second dorsal-fin rays may reach caudal-fin base. Anal and second dorsal fins rounded in females, adpressed terminal rays reach only to middle of caudal peduncle. In both sexes, interradial membranes of second dorsal fin lightly pigmented at base, with pigmentation becoming more pronounced distally. Females generally with vertical blotches of white on first to seventh interradial membranes. Broad submarginal region of anal fin hyaline to white anteriorly, becoming rust-red posteriorly in males and yellow in females. Adults of both sexes about equal in size, and reaching nearly 85 mm SL.

Habitat and distribution.—*Bedotia alveyi* is known only from tributaries of the Antainambalana and Vohimaro rivers (Fig. 1), and the species was also seen frequently in the open-air markets of Maroansetra (WLS and JSS, pers. obs.). These rivers run from northwest (or west) to southeast through the center of the Marika Forest Protected Area and empty into the ecologically and economically important Antongil Bay. Specimens were only encountered in relatively undisturbed tributaries of both drainages and were not seen in the more highly disturbed and turbid main river channels. Tributaries harboring the new species were generally shallow, clear, and cool, with a moderate rate of flow, and low turbidity (Fig. 3B). The substrate ranged from rocky (small rocks to large boulders) to somewhat sandy. These tributaries were characterized by rather dense forest cover generally, although deforested regions known locally as ''tavy'' (a form of slash and burn agriculture used for rice production) and secondary growth forest were regularly interspersed. The Makira Forest Protected Area is the largest contiguous tract of principally lowland rainforest remaining in Madagascar. Currently this area is not subject to intense logging pressure, but it has suffered considerable effects from other agricultural developments. A high population growth rate in the area will presumably increase degradation due to the demands of irrigation and deforestation for rice cultivation and land clearing for livestock grazing and other agricultural uses (Albietz, 2007). Ideally, recent efforts to protect this vast area will minimize threats to this bedotiid species, although all of Madagascar's freshwater fishes face increasing threats due to the pressures of a rapidly growing population in combination with limited resources and competition from exotic species (Sparks and Stiassny, 2003, 2008).

Fig. 3. Images of freshly collected *Bedotia alveyi* from (A) AMNH 240829 and (B) AMNH 240830 and the type locality for AMNH 240830 and FMNH 118295 (C), a medium-sized tributary of the Vohimaro River.

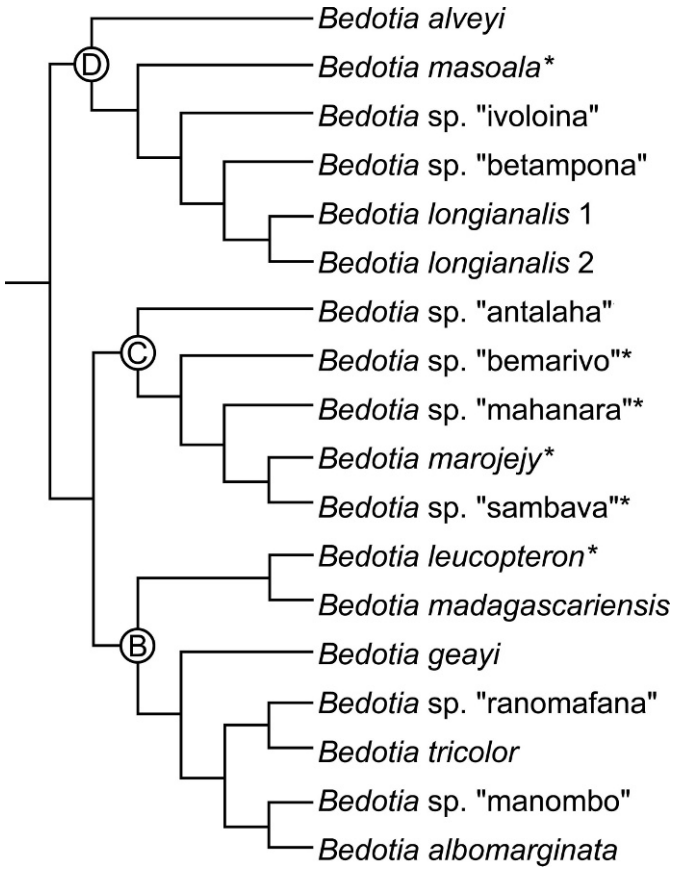

Fig. 4. Species-level phylogeny for *Bedotia* based on the simultaneous analysis of eight mitochondrial and nuclear genes (after Sparks and Smith, 2004). Letters at nodes follow Sparks and Smith (2004) and refer to clades discussed in the text. Asterisks indicate species or undescribed populations that have marked lateral spotting.

Local name.—The new species is known locally as *zono* (pronounced *zoo new*). This Malagasy word translates as 'small fish' in English and is used to refer to bedotiids and other atheriniforms throughout much of Madagascar.

Etymology.—We take great pleasure in naming this new species in honor of Dr. Mark Alvey (FMNH) in recognition of his tremendous efforts to promote natural history research and species discovery during his tenure as Administrative Director of Academic Affairs.

Remarks and comparisons.—Sparks and Smith (2004; Fig. 4) presented a phylogenetic analysis of all nominal and many undescribed species of *Bedotia*, including distributional data for the major clades. This analysis included *B. alveyi*, which was recovered as a member of ''Clade D'' along with *B. masoala*, *B. longianalis*, and two undescribed forms from the Ivoloina basin. The Ivoloina basin populations of *Bedotia* and *B. longianalis* are isolated geographically (restricted to >17°S) from *B. alveyi* (distribution limited to <15°30'S), and they lack the diagnostic iridescent spangling and uniform golden to olive flank coloration characteristic of *B. alveyi*. *Bedotia alveyi* lacks the extensive lateral blotching of *B. masoala*, which occurs at similar latitudes on the Masoala Peninsula to the east of Makira. Sparks and Smith (2004) recovered *B. alveyi* as the sister taxon to the three other species comprising ''Clade D'' (Fig. 4). Uncorrected p distances from Sparks and Smith (2004) indicate that *B. masoala* is most similar to *B. alveyi* for seven of eight loci examined (*B.* sp. ''betampona'' was most similar for ND5). This is noteworthy because these two species' ranges are geographically adjacent (*B. masoala* endemic to the adjacent Masoala Peninsula), but their pigmentation pattern and coloration is markedly different. Despite both genetic similarity and geographic proximity, *B. masoala* possesses a blotchy and spotted pigmentation pattern more characteristic of members of Sparks and Smith's (2004) northern ''Clade C'' (see Stiassny, 2002, for commentary on the taxa involved; Fig. 4). This mosaic of geography, pigmentation pattern, phylogeny, and genetic distance indicates that significant work is still required to resolve the taxonomy of Malagasy rainbowfishes. This is particularly true given that nearly every newly explored east coast river basin yields new species of *Bedotia* (Sparks and Stiassny, 2003; Sparks and Smith, 2004; JSS, pers. obs.). In an effort to assist future researchers working on the phylogeny and taxonomy of Malagasy rainbowfishes, we have provided counts and measurements of the holotype or syntype(s) for all nominal species of *Bedotia* (Table 2), given that this material is spread across two continents and three countries (France, Switzerland, and the United States).

MATERIAL EXAMINED

Bedotia albomarginata: UMMZ 245388 (holotype); AMNH 235851 (paratypes, CS); AMNH 235852 (paratypes); AMNH 235853 (paratypes); AMNH 235854 (paratypes); AMNH 235855 (paratypes); UMMZ 240253 (paratypes); UMMZ 244515 (paratypes); UMMZ 244517 (paratypes).
Bedotia geayi: MNHN 1907-35 to 37 (syntypes); AMNH 11701; AMNH 12163; AMNH 28128; AMNH 229532 (CS); UMMZ 217630; UMMZ 218508 (CS); UMMZ 223575.
Bedotia leucopteron: AMNH 231263 (holotype); AMNH 231265 (paratypes).
Bedotia longianalis: MNHN 1914-6 (holotype); AMNH 28134; AMNH 228059; AMNH 229537 (CS); AMNH 229590; AMNH 229591.
Bedotia madagascariensis: MHNG 665.7 (holotype); AMNH 97061; AMNH 97070; AMNH 229594; AMNH 231373 (CS).
Bedotia marojejy: AMNH 224647 (holotype); AMNH 224648 (paratypes); AMNH 224648SW (paratype, CS); AMNH 231255; AMNH 231362.
Bedotia masoala: UMMZ 236581 (holotype); UMMZ 236578 (paratypes, CS); UMMZ 236579 (paratypes); UMMZ 236580 (paratypes); UMMZ 236582 (paratypes); UMMZ 236583 (paratypes); UMMZ 236584 (paratypes); UMMZ 236585 (paratype); AMNH 229523 (paratypes); AMNH 229524 (paratypes); AMNH 229528 (paratypes); FMNH 108361 (paratypes).
Bedotia tricolor: MNHN 1932-162 (syntypes).
Bedotia sp. ''betampona'': AMNH uncat.
Bedotia sp. ''ivoloina'': AMNH 231259; AMNH 231377.

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Table 2. Morphometric and Meristic Data for Holotypes or Syntype(s) of All Described Species of *Bedotia*. Note that the count of first dorsal-fin rays in *Bedotia leucopteron* differ from those in original description (listed as 4 in Loiselle and Rodriguez [2007]).

Character	*Bedotia albomarginata* Holotype UMMZ 245388	*Bedotia alveyi* Holotype AMNH 249487	*Bedotia geayi* Syntype 1 MNHN 1907-35	*Bedotia leucopteron* Holotype AMNH 231263	*Bedotia longianalis* Holotype MNHN 1914-6	*Bedotia madagascariensis* Holotype MHNG 665.7	*Bedotia marojejy* Holotype AMNH 224647	*Bedotia masoala* Holotype UMMZ 236581	*Bedotia tricolor* Syntype 1 MNHN 1932-0001	*Bedotia tricolor* Syntype 2 MNHN 1932-0002
Measurements (in mm)										
Standard length	59.2	84.9	73.3	62.8	75.1	73.6	46.6	87.1	60.1	65.6
Head length	17.4	23.0	23.4	18.6	20.6	20.1	14.2	24.6	16.7	18.4
Head width	8.7	12.4	11.8	10.3	10.4	9.8	7.3	13.3	8.5	9.3
Body depth	12.5	20.1	18.1	15.2	19.3	18.6	10.9	22.4	14.4	16.9
Snout to first dorsal-fin origin length	32.0	45.9	40.3	35.1	38.8	39.6	25.4	46.3	31.8	35.0
Snout to second dorsal-fin origin length	39.0	56.0	49.8	42.5	48.4	48.8	30.4	56.3	38.5	42.2
Snout to anal-fin origin length	32.7	49.2	44.4	37.1	44.9	40.7	25.3	47.5	34.4	39.6
Caudal-peduncle length	9.6	13.3	9.6	10.4	10.8	9.8	7.7	13.2	8.9	9.0
Caudal-peduncle depth	5.5	8.4	7.2	7.2	7.8	8.3	4.8	9.4	6.2	6.8
Pectoral-fin length	10.2	15.3	12.4	12.9	11.7	10.2	7.6	14.6	8.4	7.3
Pelvic-fin length	8.3	14.8	12.9	11.0	10.8	11.6	9.0	13.3	9.1	9.2
Second dorsal-fin base length	12.8	17.4	14.3	12.0	16.2	15.6	10.2	19.6	12.8	14.5
Anal-fin base length	17.0	25.1	20.0	18.0	22.6	23.5	13.2	28.4	18.1	20.6
Snout length	5.8	9.0	7.8	5.1	7.1	6.8	4.7	9.4	5.9	6.6
Lower-jaw length	9.2	12.6	13.0	10.5	12.1	10.7	7.2	14.4	9.6	11.2
Orbit diameter	5.9	6.0	6.8	5.6	6.1	6.3	3.9	7.1	5.5	6.1
Meristics										
Scales in lateral series	37	37	36	37	38	37	33	38	38	38
Gill rakers (lower limb)	9	12	13	11	11	13	11	13	12	N/A
Precaudal vertebrae	19	19	17	18	19	18	17	19	19	18
Caudal vertebrae	16	17	16	17	17	17	16	17	16	17
First dorsal-fin rays	5	5	4	5	5	5	6	5	6	5
Second dorsal-fin rays	13	12	10	12	14	12	12	13	14	13
Anal-fin rays	18	18	15	17	21	19	17	18	19	19

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