RAFFLES BULLETIN OF ZOOLOGY **68**: 556–561
Date of publication: 25 June 2020
DOI: 10.26107/RBZ-2020-0071
http://zoobank.org/urn:lsid:zoobank.org:pub:93ECE504-C706-4300-A492-DBD4CDC677FD

Redescription of *Devario kysonensis* and first record from Laos (Teleostei: Cyprinidae)

Maurice Kottelat

Abstract. *Devario kysonensis*, originally described from Vietnam without essential details, is redescribed and reported for the first time from Laos. It is distinguished from all other species of the genus by its unique colour pattern in adults, made of two or three rows of black irregularly shaped spots on the flank.

Key words. Mekong, danio

INTRODUCTION

Cyprinid fishes of the genus *Devario* typically occur in moderate to swift-flowing water of small streams with clear and cool water. The genus is known throughout South and mainland Southeast Asia. The genus includes about 38 named species (Conway et al., 2009; Fang, 1997a, b, 2003; Fang & Kottelat, 1999; Kottelat, 2000, 2001, 2013; Fang & Kullander, 2009; Kullander & Fang, 2009; Ramananda & Vishwanath, 2014; Kullander & Norén, 2016; Kullander, 2017) and has the greatest diversity in Myanmar, northern Thailand, and Laos. Some are poorly known, such as *D. kysonensis*, originally described from Vietnam (Nguyen et al., 2010). The purpose of the present article is to redescribe it by providing essential additional information and to record its presence in Laos.

MATERIAL AND METHODS

Measurements and counts follow Kottelat (2001) and Kottelat & Freyhof (2007). The last 2 branched dorsal and anal-fin rays articulating on a single pterygiophore are noted as "1½". Lateral-line scale counts are given as scales on body + scales on caudal-fin base. In some species, the lateral line starts with a tubed scale followed by a canal running steeply in a few unperforated scales until behind pectoral-fin base, from where scales are pored again; the unpored scales are included in the count (scales are not regularly organised in the steep part, leading to possible inaccuracy of 1 or 2 scales). Frequency of meristic values is indicated in parentheses, if more than one value is observed; asterisks indicate the condition for the holotype. Stripes on body and interspaces are numbered following Fang (1997a) and Kullander (2015): P stripe is the dark stripe in the middle of the flank, stripes above are P+1, P+2, etc., stripes below are P-1, P-2, etc. Interspaces are similarly numbered I+1, I+2, I-1, etc. The infraorbital process is a truncate, laterally directed dorsal process on the posterior edge of infraorbital 1 (sometimes erroneously called 'preorbital spine') (Fang, 2003; 'processus dentiforme' in Kottelat, 1982). The danionine notch is an indentation on the median side of the dentary (Howes, 1979; Roberts, 1986; Fang, 2003).

Toponymy was obtained in the field and uses the spellings on the 1985 series of 1:100,000 topographic map issued by Service Géographique d'État, if present on the maps. Abbreviations used: CMK, collection of the author; ZRC, Zoological Reference Collection, Lee Kong Chian Natural History Museum, Singapore.

TAXONOMY

Devario kysonensis (Nguyen, Nguyen & Mua, 2010)
(Figs. 1, 2)

Danio kysonensis Nguyen, Nguyen & Mua, 2010: 62, fig. 1 (type locality: Vietnam: Nghe An Province: Ky Son District: Nam Can commune [19°10′20″N 104°15′48″E]: Nam Khien spring, Song Lam drainage).

Material examined. CMK 27892, 13 formalin-fixed, 2 ethanol-fixed, 25.9–67.5 mm SL; ZRC 61298, 2, 41.3–45.9 mm SL; Laos: Bolikhamsai Province: Nam Kading watershed: Houay Taen, small tributary of Nam Tuk, at ford about 3 km southeast of Ban Vangphieng on road to Viengthong; Nam Tuk is a tributary of Nam Chouan, which it enters at Ban Vanghieng; 18°47′34.4″N 104°29′44.5″E; 472 m asl; M. Kottelat et al., 25 March 2018. — CMK 27822, 1, 52.6 mm; Laos: Bolikhamsai Province: Nam Kading watershed:

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ISSN 2345-7600 (electronic) | ISSN 0217-2445 (print)

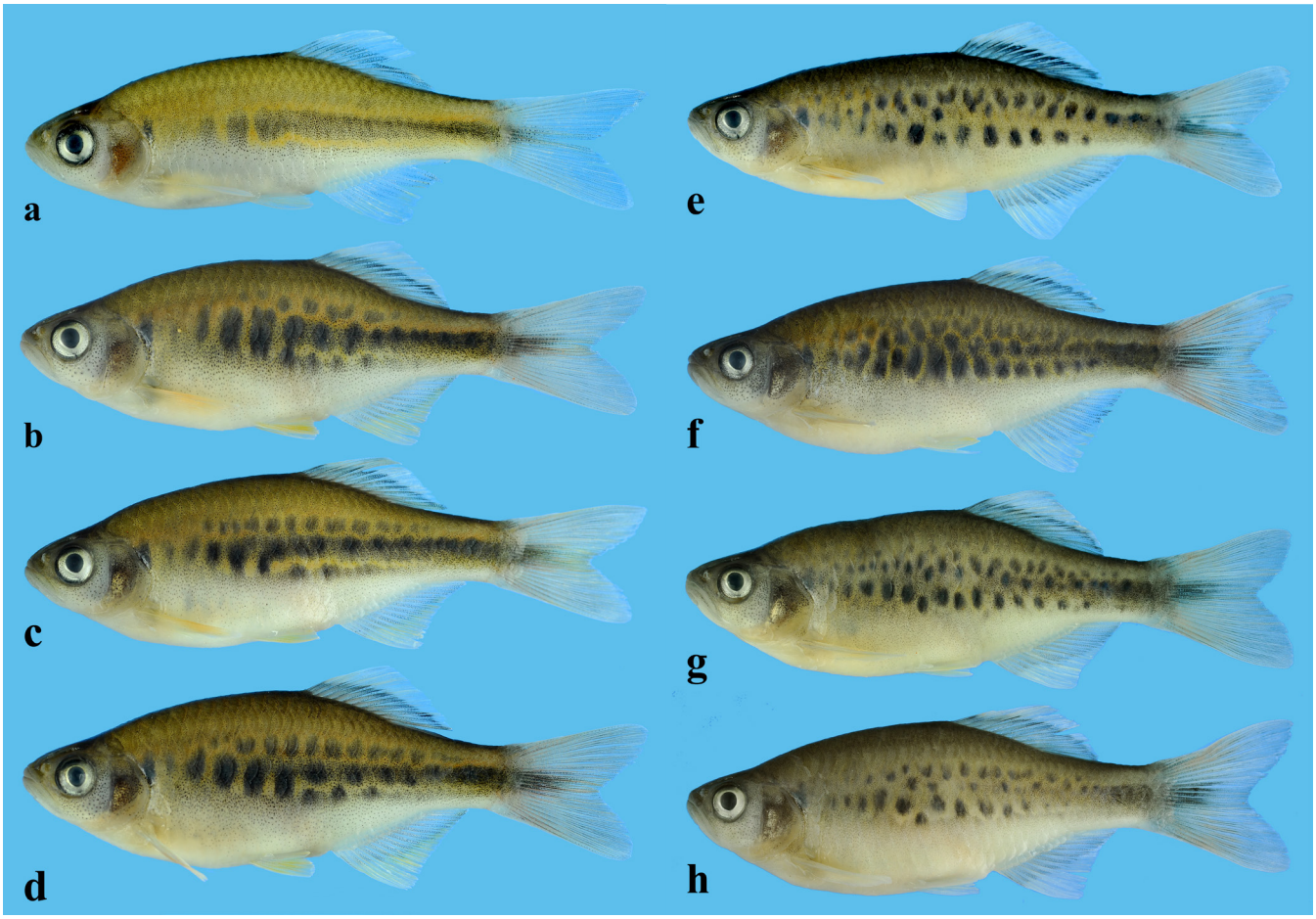

Fig. 1. *Devario kysonensis*; Laos: Nam Kading: Nam Chouan: **a**, CMK 27892, 31.3 mm SL; **b**, CMK 27892, 43.3 mm SL, right side, reversed; **c**, CMK 27892, 43.5 mm SL; **d**, CMK 27892, 45.3 mm SL, right side, reversed; **e**, CMK 27892, 53.1 mm SL, right side, reversed; **f**, CMK 27822, 52.6 mm SL; **g**, CMK 27892, 60.6 mm SL, right side, reversed; **h**, CMK 27892, 59.2 mm SL.

Houay Kapong, at mouth, a small stream entering Nam Ma about 800 m upstream of confluence of Nam Ma and Nam Sang, about 3 km northeast of Ban Vangphieng; 18°49′15.6″N 104°30′30.9″E; 439 m asl; M. Kottelat et al., 23 March 2018.

Diagnosis. *Devario kysonensis* is distinguished from all other species of the genus by its unique colour pattern in adults, made of 2 or 3 rows of black irregularly shaped spots on flank. Other characters useful for identification but not unique to the species are: lateral line complete, on 31–33 + 2–3 scales, 9½–11½ branched dorsal-fin rays and 11½–12½ branched anal-fin rays, infraorbital process present, and 2 pairs of barbels, one rostral and one maxillary.

Description. See Figs. 1, 2 for overall appearance, and Table 1 for morphometric data of 10 specimens. Body moderately deep, compressed. Dorsal profile straight to slightly convex on head, with a marked concavity at nape, and convex behind, body depth increasing until dorsal-fin origin, then decreasing regularly to posterior extremity of dorsal-fin base, then about straight horizontal. Ventral profile convex from chin to posterior extremity of anal-fin base, then about straight horizontal. Caudal peduncle 1.3–1.6 times longer than deep.

Infraorbital process present (Fig. 3). Danionine notch present. Mouth terminal to slightly superior. Knob at dentary

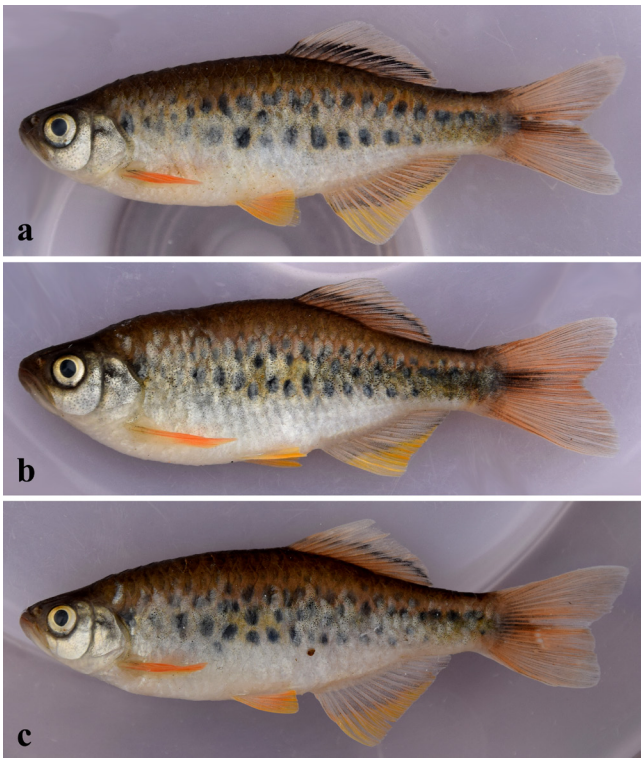

Fig. 2. *Devario kysonensis*, CMK 27892; Laos: Nam Kading: Nam Chouan; shortly after fixation; **a**, 53.1 mm SL; **b**, 60.6 mm SL; **c**, 65.1 mm SL. All right side, reversed.

Table 1. *Devario kysonensis*, morphometric data of 10 specimens.

	range	mean
Standard length (mm)	45.3–65.1	
Total length (mm)	59.5–88.4	
In percent of standard length		
Total length	129.2–136.3	133.0
Head length	26.1–28.9	27.6
Predorsal length	58.8–63.2	61.3
Prepelvic length	49.6–52.6	51.2
Preanal length	65.8–69.9	67.8
Head depth	19.4–22.6	21.0
Body depth (at anal-fin origin)	31.3–37.9	35.6
Depth of caudal peduncle	13.0–14.4	13.7
Length of caudal peduncle	18.1–21.0	19.4
Head width	13.6–16.1	15.3
Snout length	7.7–9.4	8.2
Eye diameter	7.1–8.8	8.0
Interorbital distance	10.7–12.1	11.4
Length of dorsal fin	16.6–22.3	19.6
Length of upper caudal-fin lobe	26.9–33.4	31.0
Length of median caudal-fin rays	18.5–22.8	21.3
Length of lower caudal-fin lobe	27.3–32.4	30.7
Length of anal fin	16.8–20.4	19.0
Length of pelvic fin	14.2–16.6	15.5
Length of pectoral fin	20.0–23.6	22.2
In percent of head length		
Head width	51–58	56
Snout length	27–32	30
Eye diameter	26–31	29
Interorbital distance	40–44	41

symphysis weakly developed, fitting in depression in upper jaw. Maxilla reaching to below anterior half of orbit. Lower jaw with only few and small conical tubercles, in a short line in 1 or 2 rows along outer edge of dentary and a few along the danionine notch. No visible tubercles on pectoral fin. Rostral barbel short, almost reaching base of maxillary barbel; maxillary barbel one third length of rostral barbel, reaching below middle of orbit.

Dorsal fin with 2 (9) or 3 (1) unbranched and 9½ (2), 10½ (7), or 11½ (1) branched rays; distal edge straight. Pectoral fin with 11 (1) or 12 (9) rays; posterior edge straight; not reaching pelvic-fin base; a small axillary lobe present. Pelvic fin with 7 (9) or 8 (1) rays; posterior edge straight; axillary scale present. Anal fin with 3 unbranched and 11½ (2) or 12½ (8) branched rays; distal edge slightly concave; origin below base of branched dorsal-fin rays 3–5; not reaching anal-fin origin. Caudal fin forked, with 10+9 principal rays, 9+8 branched (except for one specimen with damaged and regrown fin with 8+8 branched rays).

Lateral line complete, along 31+3 (1), 32+2 (2), 32+3 (3), 33+2 (3), or 33+3 (1) scales (3–5 unperforated scales in steep anterior part). 14 (3) or 15 (7) predorsal scales. ½6 (3) or ½7 (7) scale rows between dorsal-fin origin and lateral line; 2½ (1) or 3½ scale rows between lateral line and midventral line (counted about 2–3 scales in front of pelvic-fin base); 1½ scales between lateral line and pelvic-fin origin; ½3/1/1½ (9) or ½4/1/1½ (1) transverse rows of scales on caudal peduncle.

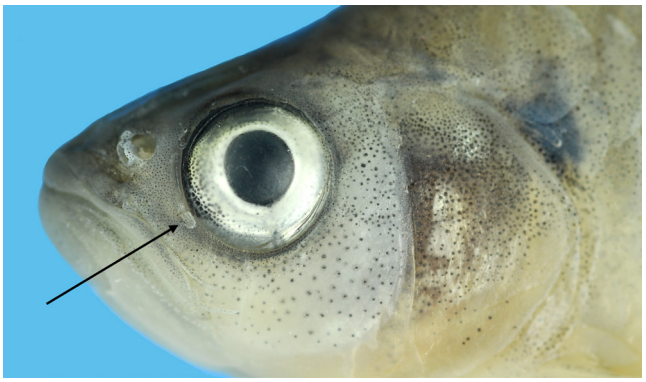

Fig. 3. *Devario kysonensis*, CMK 27892, 59.2 mm SL; head, showing infraorbital process (arrow).

Sexual dimorphism: none observed.

Colouration. In formalin, about 1 month after fixation. Body olive brown, darker brown on back, pale yellowish on belly. In largest specimens, 2 or 3 longitudinal rows of irregular black spots (smaller than eye) from gill opening to caudal peduncle (corresponding to stripes P, P+1 and P-1 in other *Devario* species). In smallest specimens (about 25–30 mm SL; Fig. 1a), a faint grey midlateral stripe (P) from about above pelvic-fin until base of caudal fin, continued anteriorly by 2 or 3 blotches immediately in front of stripe. Stripe margined above and below by a yellowish stripe (I+1, I-1); space between blotches and stripes same yellowish. A greyish stripe (P-1) from lower edge of blotches, parallel to midlateral stripe and ending on caudal peduncle. A faint greyish stripe (P+1) above upper yellow stripe.

In specimens 40–50 mm SL (Fig. 1b–d), midlateral stripe P becoming dark grey to black. Blotches becoming black and vertically elongated, reaching stripe P-1. Additional black blotches appearing overimposed on stripe P, more distinct anteriorly. A row of blackish spots appearing on stripe P+1, which disappears. Small spots on stripe P-1, connected or not with those on stripe P. With increasing size (Figs. 1e–h, 2), stripe P paler or indistinct except on caudal peduncle; stripe P-1 is fainter or missing. Spots on stripe P are smaller, more numerous, more contrasted, and extend until caudal-fin base. Spots on stripe P-1 are more numerous, and extend until above end of anal-fin base. Spots on stripe P+1 are more numerous, irregularly shaped, and extend until about midlength of caudal peduncle. With increasing size, spots are less regularly shaped and less regularly set; additional spots appear between the main rows.

A small vertically elongated black spot behind upper extremity of gill opening, visible at all sizes, although less contrasted in largest individuals.

Dorsal fin: a black band made of pigments on membranes in median position; distal part hyaline, proximal part greyish. Anal fin: a black band made of pigments on membranes in median position; distal part yellowish, proximal part pale grey. Caudal pale yellowish; proximal half of median rays black, continuing stripe P. Pectoral and pelvic fins yellowish.

In fresh specimens, about 10 hours after fixation (heavy rain did not allow to examine material at day light earlier; Fig. 2): body pale brown with greenish to orangish hue, blotches black with greenish hue, back brown, belly silvery. Dorsal fin: median stripe dark brown, distal part whitish to pale yellowish, proximal part pale brown. Anal fin: median band pale brown, distal part yellow to orange, proximal part greyish to orange. Caudal fin pale orange. Pectoral and pelvic fins orange.

Geographical distribution. *Devario kysonensis* was originally described from the Song Lam drainage in Nam Can commune (Ky Son district, Nghe An Province, Vietnam; Nguyen et al., 2010). No additional records have appeared in available Vietnamese literature as far as could be ascertained. Nam Can is located at 19°10′20″N 104°15′48″E, along the border with Laos, which corresponds to the water divide between the Song Lam and Mekong drainages. The Song Lam drains eastwards and enters the Gulf of Tonkin.

In Laos, the species has been observed only in the Nam Chouan. The Nam Chouan originates along the divide between the Mekong drainage and the Song Lam. It is formed by the confluence of two small streams, Nam Xang and Nam San, at 18°49′20″N 104°30′10″E. After about 40 km, at 18°51′39″N 104°14′42″E the Nam Chouan meets the Nam Sang and becomes the Nam Mouan, which after about 100 km enters the Nam Kading at 18°23′00″N 104°18′41″E. Headwaters of the Nam Sang originate on the Mekong–Song Lam divide, where it makes the limits of Nam Can commune. The species is expected to be more widespread in headwaters on both sides of the water divide.

Field observations. In the Nam Chouan, *D. kysonensis* was obtained in small streams, 1–3 m wide, 20–100 cm deep, with riffles, along shores in sheltered areas. The water was cool and clear. Other species present in syntopy included *Neolissochilus blanci*, *Scaphiodonichthys acanthopterus*, *Balitora* cf. *annamitica*, *Schistura corruscans*, *S.* cf. *crassa*, *S. dorsizona*, *S. ephelis*, *S. obeini*, *S. sombooni*, *Oreoglanis delacouri*, and *Channa limbata*.

In March 2018, temperatures in the upper Nam Chouan watershed were very low, air temperature about 10–15° at night and it had reportedly been lower in December–January. Water was cold (estimated 10–15°C) and fish were at low density. Most collected specimens of all species were relatively large. It is noteworthy that, of most species, there were very few or no juveniles, especially of the small-sized species that usually would have spawned around December–February (end of rainy season or beginning of dry season). This suggests a cold spell in the preceding months (at spawning time or early in life-cycle), which villagers indicated; however, there are no available meteorological data to confirm or refute this hypothesis. For most small-sized species (e.g., *Schistura* spp.), the presence of adults (estimated 2 years old) in numbers equivalent to those usually observed in the previous days in other areas (e.g., Nam Ngiep watershed) under similar sampling conditions but warmer water, suggests that the cold temperature could be responsible for the low number of fry and juveniles. Massive overfishing, for example with electricity or ichthyocides, seems excluded because this would have resulted in the absence of large individuals and the numerical dominance of juveniles of the year (pers. obs.).

The upper Nam Chouan is included in the Nam Chouan–Nam Xang Biodiversity Offset Site for the Nam Ngiep 1 hydropower scheme. Human activity is presently limited in this area, there is no known mining and there is a very limited number of 'roads' and the resulting accumulation of sediments in the river bed. Because of its small known range and two documented populations, with the present knowledge the species would probably have to be rated as Data Deficient or Vulnerable using IUCN Red List criteria (IUCN, 2001).

DISCUSSION

Devario as recognised by Fang (2003) included two species groups: (1) striped species distinguished by having, among others, a colour pattern made of several stripes, rostral and maxillary barbels, a complete lateral line, 8½–15½ branched dorsal-fin rays, 9½–17½ branched anal-fin rays, and an infraorbital process; and (2) barred species distinguished by having, among others, a colour pattern made of short bars, or a single stripe and several small bars on anterior part of body, no rostral barbels, rudimentary or no maxillary barbels, an incomplete or no lateral line, 6½–18½ branched dorsal-fin rays, 10½–13½ branched anal-fin rays, and no infraorbital process. Some of the barred species have been placed in *Inlecypris* by Kottelat (2013), a point on which some disagree (e.g., Kullander, 2017).

The presence of stripes in the juveniles, of barbels, infraorbital process, complete lateral line, 9½–11½ branched dorsal-fin rays and 11½–12½ branched anal-fin rays, clearly place *D. kysonensis* in the group of striped species.

Besides *D. kysonensis*, seven named species of striped *Devario* are known to occur in the Mekong drainage. *Devario kysonensis* is distinguished from all by the unique colour pattern in adults, made of 2 or 3 rows of black irregularly shaped spots on the flank (vs. striped). Besides striped adult colour pattern, these seven species are distinguished from *D. kysonensis* by some additional characters:

— *D. acrostomus*, from the Nam Ngum, Nam Ngiep, and Nam Xan watersheds, has 34–36 + 2 lateral line scales, 9½–10½ branched dorsal-fin rays, and 9½–10½ branched anal-fin rays (Fang & Kottelat, 1999);

— *D. chrysotaeniatus*, from the Nam Ma and Nam Youan watersheds, has 32–36 + 2 lateral line scales, 8½–9½ branched

Fig. 4. *Devario fangfangae*, CMK 27773, 57.1 mm; Laos: Nam Kading watershed: Nam Gnouang.

dorsal-fin rays, 12½–13½ branched anal-fin rays, and a more slender body (Fang & Kottelat, 1999; pers. obs.);
— *D. fangfangae*, from the Nam Kading watershed, has 33–36 + 2–3 lateral line scales, 9½–10½ branched dorsal-fin rays, and 12½–14½ branched anal-fin rays (Fig. 4) (Kottelat, 2000);
— *D. gibber*, from the Xe Don and Xe Kong watersheds, has 34–36 + 2–3 lateral line scales, 9½–10½ branched dorsal-fin rays, and 12½–14½ branched anal-fin rays (Kottelat, 2000);
— *D. laoensis*, from the Nam Mang to Nam Ma watersheds, has 34–36 + 2 lateral line scales, 8½–9½ branched dorsal-fin rays, and 12½–14 ½ branched anal-fin rays;
— *D. leptos*, from Nam Ngum to Nam Tha watersheds, has 32–34 + 2 lateral line scales, 7½–8½ branched dorsal-fin rays, and 11½–12½ branched anal-fin rays; in adults: anteriorly on the side, the stripes become reorganised into irregular bars, with the edges darker than the inner part, and separated by thin, sinuous, pale interspaces (Fang & Kottelat, 1999);
— *D.* cf. *quangbinhensis*, from the Xe Bangfai watershed, has 35–36 + 2–3 lateral line scales, 10½ branched dorsal-fin rays, 13½–14½ branched anal-fin rays, and the anterior part of the stripes becoming vermiculated in large adults (pers. obs.).

A single other species of *Devario* is known from the Nam Kading watershed, *D. fangfangae* (Fig. 4). It has been observed in the Nam Theun and Nam Gnouang branches (which join to form the Nam Kading proper; Kottelat, 1998, 2016), but was not observed in the Nam Mouan branch, which enters the Nam Kading only in the lowland shortly upstream of its confluence with the Mekong. The topography of the intermediate area makes it difficult to survey, and if it had possibly been surveyed in the context of some hydropower project, the results have not been made public.

ACKNOWLEDGEMENTS

The examined material was obtained during work for Nam Ngiep 1 Power Company, Vientiane (NNP1). Permission to sample was granted by the Biodiversity Offset Management Unit (BOMU) of the Nam Chouane–Nam Xang Biodiversity Offset Management Plan of the Nam Ngiep 1 Hydropower Project in Bolikhamxay Province; the support of Saming Sengphachanh, head of the unit, was much appreciated. I thank Thavone Phommavong (Living Aquatic Resources Research Center, Vientiane) and Natkritta Wongyai (NNP1) for their help in all aspects of logistics, communication, and sampling; without them, the work would not have been possible. I thank Troy Hansel for organising the survey and logistics and staff of NNP1 and BOMU for their help in the field. Comments by Sven Kullander (NRM) and two anonymous reviewers contributed to improve the manuscript.

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