

Verlag Dr. Friedrich Pfeil
ISSN 0936-9902

Ichthyological Exploration of Freshwaters

An international journal for field-orientated ichthyology

Volume 20
Number 3



Ichthyological Exploration of Freshwaters

An international journal for field-orientated ichthyology

Volume 20 • Number 3 • September 2009
pages 193-288, 60 figs., 16 tabs.

Managing Editor

Maurice Kottelat, Route de la Baroche 12, Case postale 57
CH-2952 Cornol, Switzerland
Tel. +41-32-4623175 / Fax +41-32-4622259 / E-mail mkottelat@dplanet.ch

Editorial board

Pier Giorgio Bianco,	Dipartimento di Zoologia, Università, Napoli, Italy
Ralf Britz,	Department of Zoology, The Natural History Museum, London, United Kingdom
Sven O. Kullander,	Naturhistoriska Riksmuseet, Stockholm, Sweden
Helen K. Larson,	Museum and Art Gallery of the Northern Territory, Darwin, Australia
Lukas Rüber,	Department of Zoology, The Natural History Museum, London, United Kingdom
Ivan Száma,	Museu de Zoologia, Unicamp, Campinas, Brazil
Paul H. Skelton,	South African Institute for Aquatic Biodiversity, Grahamstown, South Africa
Heok Hui Tan,	Raffles Museum of Biodiversity Research, National University of Singapore, Singapore

Ichthyological Exploration of Freshwaters is published quarterly

Subscriptions should be addressed to the Publisher:

Verlag Dr. Friedrich Pfeil, Wolfratshauser Str. 27, D-81379 München, Germany
PERSONAL SUBSCRIPTION : EURO 100 per Year/volume - 4 issues (includes surface mail shipping)
INSTITUTIONAL SUBSCRIPTION : EURO 180 per Year/volume - 4 issues (includes surface mail shipping)

Manuscripts should be addressed to the Managing Editor:

Maurice Kottelat, Route de la Baroche 12, Case postale 57, CH-2952 Cornol, Switzerland

CIP-Titelaufnahme der Deutschen Bibliothek

Ichthyological exploration of freshwaters : an international
journal for field-orientated ichthyology. – München : Pfeil.
Erscheint jährl. viermal. – Aufnahme nach Vol. 1, No. 1 (1990)
ISSN 0936-9902

Vol. 1, No. 1 (1990) –

Copyright © 2009 by Verlag Dr. Friedrich Pfeil, München, Germany

All rights reserved.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying or otherwise, without the prior permission of the copyright owner. Applications for such permission, with a statement of the purpose and extent of the reproduction, should be addressed to the Publisher, Verlag Dr. Friedrich Pfeil, Wolfratshauser Str. 27, D-81379 München, Germany.

Printed by Advantage Printpool, Gilching

ISSN 0936-9902

Printed in the European Union

Verlag Dr. Friedrich Pfeil, Wolfratshauser Str. 27, D-81379 München, Germany
Tel. +49-(0)89-7428270 – Fax +49-(0)89-7242772 – E-mail: info@pfeil-verlag.de – www.pfeil-verlag.de

***Danio quagga*, a new species of striped danio from western Myanmar (Teleostei: Cyprinidae)**

Sven O. Kullander*, Te Yu Liao* and Fang Fang*

Danio quagga, new species, is described from the Chindwin River drainage near Kalaymyo and Tamu, western Myanmar. It is similar to *D. kyathit* from the Ayeyarwaddy and upper Chindwin River, but differs in having four to five contrasting dark stripes along the side, instead of rows of spots along the side, and shorter barbels. *Danio quagga* is similar in colour pattern to the zebrafish, *D. rerio*, but differs in having four instead of three distinct dark bands above the pectoral fin, and in absence of dark bands on the caudal fin lobes.

Introduction

The cyprinid fish genus *Danio* includes 13 small species in South and South East Asia. In the most recent overview of the group Fang Kullander (2001) recognized nine species. Since then, we have found that *D. meghalayensis* is a valid species, and subsequent molecular and morphological analyses of danionin interrelationships have shown that *Microrasbora erythromicron* and *Celestichthys margaritatus* must also be referred to *Danio* (Conway et al., 2008; Fang et al., 2009). Sen (2007) described a small danionin species from Meghalaya, India, as *Brachydanio jaintianensis*, which upon revision probably will be confirmed as a species of *Danio*. *Brachydanio* is a junior synonym of *Danio* (Fang Kullander, 2001). Most of the species of *Danio* have a pigment pattern that consists of one or more dark horizontal stripes, which can be homologized between species and

the number and position of which serve as species diagnostic characters (Fang, 1998). One aberrant species, *Danio kyathit*, was described by Fang (1998) from northern Myanmar, differing in having the stripes broken up into rows of small brown spots. Specimens studied by Fang (1998) suggested that there would be variation in the colour pattern of *D. kyathit*. Two preserved specimens from Kamaing and the upper Chindwin basin respectively, appeared identical to other *D. kyathit* except for possessing a pattern of solid stripes or mixed stripes and spots, instead of spots.

We collected recently in the Yu River drainage in western Myanmar, and obtained specimens of *Danio* with a colour pattern consisting of solid horizontal stripes only. The Yu River is a tributary of the Chindwin River, slightly upstream of the Myittha River. Careful comparison with type material of *D. kyathit* from the upper Chindwin and upper Ayeyarwaddy drainages, suggests that

* Department of Vertebrate Zoology, Swedish Museum of Natural History, PO Box 50007, SE-104 05 Stockholm, Sweden. E-mail: sven.kullander@nrm.se, teyu.liao@nrm.se, fang.kullander@nrm.se

the Yu specimens represent a species similar to *D. kyathit*, but slightly different in colour pattern and morphology, described below.

Material and methods

Specimens were fixed in formalin in the field, eventually transferred to 70 % ethanol, and are kept in the fish collection of the Swedish Museum of Natural History, Stockholm (NRM). Comparative material is also deposited in the Academy of Natural Sciences of Philadelphia, Philadelphia (ANSP). Measurements were taken with digital callipers to a precision of 0.1 mm. Counts and measurements were made according to Fang (1997), and colour pattern terminology follows Fang (1998). Horizontal stripes are identified by alphanumeric annotations: the P stripe is the dark stripe along the middle of the side, those above are numbered P+1, P+2, those below P-1, P-2, P-3; stripes on the anal fin are numbered with the middle one the A stripe, the proximal stripe A+1, and the distal stripe A-1. Fin-ray counts from median fins and vertebral counts were obtained from X-radiographs made with a Philips MG-105 low voltage X-ray unit and Kodax X-Omat V plates. Abdominal vertebrae counts include the Weberian apparatus (assumed to contain four centra). Statistics were calculated using SPSS v. 17 (SPSS, 2008). The type series of *Danio kyathit* (NRM 37291, 37292, 37244, and ANSP 93957), and specimens of *D. rerio* from the Brahmaputra (NRM 52658) and Ganga drainages (NRM 40446) were used as comparative material.

Danio quagga, new species (Fig. 1)

Holotype. NRM 58705, 22.2 mm SL; Myanmar: Sagaing Division: Kamphat River drainage (to Yu River): small river in Saw Bwa Ye Shan village, 46 km on road from Kalaymyo to Tamu, 23°37' 14"N 94°7'32"E; S. O. Kullander & T. Y. Liao, 28 Mar 2008.

Paratypes. NRM 58787, 2, 26.7-28.9 mm SL; NRM 58725, 2, 34.7-35.3 mm SL; Myanmar: Sagaing Division: Yu River drainage (to Chindwin River): market in Tamu; S. O. Kullander & T. Y. Liao, 29 Mar 2008.

Diagnosis. Different from all other species of *Danio* by having four distinct dark stripes (P+1, P, P-1, P-2) along the middle of the side, and also a short or long stripe abdominally (stripe P-3). *Danio kyathit* has a similar horizontal stripe pattern but the stripes are broken up into rows of spots. Rostral barbel short, reaching at most to posterior margin of orbit, vs. reaching to opercle in *D. kyathit*; maxillary barbel reaching to little beyond pectoral-fin base, vs. to middle of pectoral fin in *D. kyathit*. Head (22.8-24.8 % SL vs. 25.3-26.1), pectoral-fin (23.5-25.8 % SL vs. 26.8-29.8) and predorsal lengths (56.1-59.5 % SL vs. 60.6-63.6) shorter, and interorbital width narrower (9.0-10.8 % SL vs. 10.7-12.0) than in *D. kyathit*. Distinguished from *D. rerio*, with similar striped colour pattern, by having four distinct dark stripes above the pectoral fin, vs. three in *D. rerio*; horizontal dark stripes slightly ventrad slanting vs. horizontal; and absence of dark stripes across caudal fin lobes, vs. presence.

Description. Measurements and counts were taken from all five available specimens, 22.2-35.3 mm SL (Table 1). The holotype is well preserved but has lost scales and some rays are broken from the caudal and anal fins. The paratypes are in a relatively poor state of preservation, partly with eroded bellies, and scales absent from anterior sides. General body features and pigmentation are illustrated in Figure 1.

Body compressed, moderately elongate. Snout short, rounded, shorter than eye diameter. Mouth terminal, obliquely upwards directed. Small bony knob at dentary symphysis. Maxilla reaching to below anterior margin of orbit; premaxillary ascending processes not reaching to vertical from anterior margin of orbit. Lower jaw projecting beyond upper jaw, ending anteriorly above horizontal through middle of eye. Lower jaw with anterior fleshy lateral lobe beset with small conical tubercles; posterior and median to lateral lobe two close-set rows of small conical tubercles. Maxillary barbel more than double length of rostral barbels, ending distinctly posterior to pectoral-fin base. Rostral barbel reaching to $\frac{2}{3}$ of orbit or immediately beyond posterior margin of orbit. Head compressed, slightly deeper than wide.

Squamation incomplete in all specimens due to abrasion. Lateral line abbreviated, with at least one and up to five scales; 28-30 scales in lateral



Fig. 1. *Danio quagga*, NRM 58705, holotype, 22.2 mm SL; Myanmar: Sagaing Division: Chindwin River drainage: small stream in Saw Bwa Ye Shan village.

row, counting scale pockets and few remaining scales. Median predorsal scales 15(2), 16(3). Body lateral scale rows 5(5) above lateral line row, 1(5) below. Circumpeduncular scale rows 10(5). A row of scales along anal-fin base.

Dorsal-fin rays ii.7(5); anal-fin rays iii.12(4), iii.13(1); pectoral-fin rays i.11(2), i.12(2), i.13(1); pelvic-fin rays i.7(4); principal caudal-fin rays

10+9(5). Dorsal fin inserted at highest point of dorsum, at about $\frac{2}{3}$ distance from head to caudal-fin base, slightly anterior to vertical from anal-fin origin. Pectoral-fin insertion at about vertical through posterior margin of opercle. Pectoral-fin rays long, extending to slightly beyond pelvic-fin origin. Pectoral-fin axial lobe well developed. Pelvic-fin origin situated at about middle of body,

Table 1. Morphometry of *Danio quagga*. Measurements are in per cent of SL, except for SL and TL (in mm). SD, standard deviation. Ranges for *D. kyathit* (from Fang, 1998; N=6, except caudal peduncle length was re-measured in four specimens) for comparison. Differences in range of variation indicated in bold.

	<i>D. quagga</i>					<i>D. kyathit</i>
	N	min	max	mean	SD	
SL (mm)	5	22.2	35.3	29.6	5.53	26.9-34.5
TL (mm)	5	28.4	45.2	38.0	7.10	39.3-44.2
Body depth	5	25.2	26.6	25.8	0.57	24.5-29.4
Head length	5	22.8	24.8	23.5	0.85	25.3-26.1
Snout length	5	5.6	6.5	6.1	0.38	6.3-7.6
Head depth	5	15.0	18.3	16.0	1.34	15.8-17.1
Head width	5	11.5	14.0	12.4	0.94	13.4-14.9
Upper jaw length	5	8.4	9.9	9.2	0.65	9.3-10.0
Lower jaw length	5	10.7	12.2	11.4	0.63	11.9-13.3
Orbital diameter	5	6.9	9.0	8.0	0.88	6.5-7.3
Interorbital width	5	9.0	10.8	10.1	0.67	10.7-12.0
Caudal peduncle length	5	17.3	21.1	18.4	1.55	15.8-18.0
Caudal peduncle depth	5	10.8	13.2	12.4	0.99	10.4-14.2
Dorsal-fin base length	5	11.5	13.9	12.5	0.99	12.4-14.2
Anal-fin base length	5	19.8	24.0	21.3	1.69	22.0-23.8
Predorsal length	5	56.1	59.5	58.1	1.41	60.6-63.6
Preanal length	5	63.1	69.9	65.8	2.57	59.5-63.9
Prepelvic length	4	46.8	49.1	48.3	1.03	45.2-49.8
Pectoral-fin length	5	23.5	25.8	25.2	0.97	26.8-29.8
Pelvic-fin length	4	14.4	15.6	15.0	0.55	14.6-16.1
Rostral barbel length	4	9.0	11.2	10.0	0.93	12.0-14.7
Maxillary barbel length	4	21.0	24.8	22.7	1.61	24.2-37.4

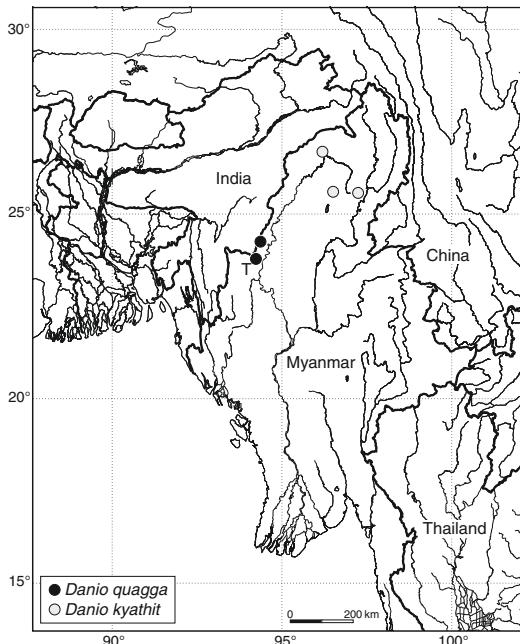


Fig. 2. Location of sampling localities of *Danio quagga* and *D. kyathit* in Myanmar. T, Type locality of *D. quagga*. Localities of *D. kyathit* from Fang (1998).

anterior to dorsal-fin origin; pelvic fin reaching to anal-fin origin. Pelvic axillary scale present. Caudal fin forked, lobes of about equal length.

Vertebrae 15+18(1, holotype), 16+17(4). Tubercles other than those on lower jaw absent in holotype and apparently also absent from paratypes, but latter not well preserved.

Colouration in preservative. White ground colour. Dorsal scales sparsely pigmented, brownish distally. Six horizontal dark brown stripes (P+2 through P-3) along side: P+2 stripe narrow and indistinct, from slightly behind head to about vertical from dorsal-fin origin; P+1 stripe distinct, from head, with sharp ventral margin, dorsal margin to some extent confluent with lighter brownish colour on caudal peduncle, extended onto dorsal lobe of caudal fin as dark streak; P stripe distinct, from head, with sharp margins, slightly widening caudally, continued much narrower on upper rays of lower lobe of caudal fin as dark streak; P-1 stripe from pectoral girdle, with sharp margins, slightly less densely pigmented caudally, slightly ventrad directed to run along lower margin of caudal peduncle, continued basally on middle rays of lower lobe of caudal

fin; P-2 stripe from pectoral girdle just above base of pectoral fin, with sharp margins, slightly ventrad directed, running along anal-fin base and merging with A+1 stripe on anal fin; P-3 stripe from pectoral axilla, with sharp margins in large specimens, but only scattered pigment in holotype and 26.7 mm specimen, ending at about vent. Interspaces between dark stripes slightly widening posteriorly due to slight radiating shift in course of stripes. Abdomen white. Head with sparse pigment. A short, narrow band of black pigment on chest just ventral to pectoral-fin base. Caudal fin hyaline, with narrow dark stripes continuing body stripes P+1, P, and P-1. Dorsal fin hyaline, with indistinct dark band across middle of rays, and less distinct band distally. Anal fin with three dark stripes across rays, one distally (stripe A-1), one along middle of fin (stripe A), and one basally (stripe A+1).

Geographical distribution and habitat. *Danio quagga* is known with certainty only from the Yu River drainage (Fig. 2). It seems plausible, however, that it has a wider distribution within the Chindwin River drainage which has been subject to very little collecting for fish. The type locality was a very small slow-flowing stream over sandy and stony bottom remaining in the bed of a much larger stream at the height of the low water period (Figure 3). The holotype was collected with a seine in a pool margined with vegetation. Despite extended efforts, only one specimen could be obtained. Four additional specimens were sampled in heaps of small fish offered at the local market in Tamu town, said to be from the nearby river, but we do not have precise information about where they were collected. Sampling in two streams near Tamu did not produce any specimens of *D. quagga*.

Other species obtained at the type locality included another small, abundant species of *Danio*, *Esomus altus*, *Garra* sp., *Puntius meingangbii*, *P. sophore*, *P. chola*, *Rasbora ornata* (Cyprinidae), *Badis ferrarisi* (Badidae), *Acanthocobitis botia*, *A. rubidipinnis* (Nemacheilidae), and *Lepidocephalichthys berdmorei* (Cobitidae).

Etymology. *Equus quagga* is one of the species of zebras, striped members of the family Equidae. *Quagga* is here used as a noun in apposition, and is given with reference to the similarity in colour pattern.



Fig. 3. Type locality of *Danio quagga*: small pool-like widening in small stream in Saw Bwa Ye Shan village, 28 Mar 2008.

Discussion

Danio quagga is similar to *D. rerio* in the conspicuous contrasted pattern of alternating dark and light horizontal stripes (Fig. 4). *Danio rerio* is a widely distributed species in the Ganga, Brahmaputra and Indus basins, and known from a few other localities more south on the Indian peninsula. *Danio quagga* differs from *D. rerio* in details of the colour pattern. In *D. rerio* the horizontal stripes run horizontally and in parallel, whereas in *D. quagga* stripes P-1, P-2 and P-3 are distinctly slanting, and more separated caudally. In *D. quagga* the P+2 stripe does not show distinctly close to the head, whereas in *D. rerio* it is narrow but with a clear origin on the head above the opercle. In *D. quagga* stripes P+1, P, P-1, and P-2 are narrow close to the head, and widening caudally; stripe P+1 becomes constricted again posteriorly on the caudal peduncle. In *D. rerio*, stripes P+1 and P are of similar width along the length. In *D. quagga* stripe P-1 ends on the lower

margin of the caudal peduncle, whereas in *D. rerio* it has a lateral course all the way. Stripe P-3 is not found in *D. rerio*, and stripe P-2 in that species extends only a short distance anterior to the pelvic-fin base, whereas in *D. quagga* it continues craniad all the way to the pectoral girdle. In *D. rerio*, the two major stripes (P+1, P) originate immediately behind the gill cover, and stripe P-1 at the pectoral axillary flap; by contrast in *D. quagga* stripes P+1, P and P-1 originate in the positions of stripes P+1 and P in *D. rerio*, and stripe P-2 in the position of P-1 in *D. rerio*. *Danio rerio* also has only one dark stripe in the dorsal fin, in a distal position, whereas in *D. quagga* there is an indistinct marking across the middle of the fin rays, and a less distinct dark field distally. In *D. rerio* the caudal fin is strongly patterned with distinct dark stripes extending bars P+1, P, and P-1, and also an additional dark stripe more distally on each caudal-fin lobe which is absent in *D. quagga*.

The horizontal markings of *D. quagga* agree



Fig. 4. *Danio rerio*, NRM 52658, 22.6 mm SL. India, Assam: Brahmaputra River drainage: near Kaupati.



Fig. 5. *Danio kyathit*, paratype 37244, 31.0 mm SL. Myanmar: Kachin State: Ayeyarwaddy River drainage: Hpa Lap stream near Myitkyina.

better with *D. kyathit* than with *D. rerio*, except that in *D. kyathit* the stripes are disrupted into rows of dark spots (Fig. 5). In *D. kyathit* the P stripe may be further subdivided into two parallel rows of spots converging on the caudal peduncle. Otherwise, as in *D. quagga*, the P+1, P, P-1, and P-2 stripes (or rows of spots) originate behind the opercle, and stripe P-2 in the pectoral-fin axilla. Stripe P-1 runs ventral, but still more lateral in *D. kyathit*, and *D. kyathit* also possesses a short row of spots representing stripe P-3. *Danio kyathit* also shares with *D. quagga* an indistinct dark stripe at the base of the pectoral fin, and a dark stripe across the middle of the dorsal fin rays. In both *D. quagga* and *D. kyathit* stripes P+1 and P continue on the caudal fin, and there may also be some pigmentation on the lower lobe posterior to stripe P-1.

The only definite difference in colour pattern between *D. kyathit* and *D. quagga* is that the former is spotted and the latter striped. The only obvious other external difference that we have discovered is in the caudad extension of the barbels. In

D. quagga the rostral barbel, when laid back, reaches at most barely beyond the posterior margin of the eye, whereas in *D. kyathit* it reaches to the opercle. This is also reflected in proportional measurements (Table 1), with *D. kyathit* having proportionally longer barbels.

Several proportional measurements of *D. quagga* lie outside of the range reported by Fang for *D. kyathit*, and notably the head, pectoral, and predorsal lengths are shorter, and the interorbital width somewhat narrower (Table 1). We re-measured some of the paratypes of *D. kyathit* to check for differences in methods of measuring, and the differences hold, except that caudal-peduncle length measurements in Fang (1998) are conspicuously smaller (13.1–14.2 % SL), so we re-measured four specimens of *D. kyathit*, from which we obtained caudal peduncle lengths of 15.8, 16.1, 17.1, and 18.0 % of SL, which tends to be shorter than in *D. quagga*, but still overlapping with *D. quagga*. *Danio quagga* has 12 or 13 branched anal-fin rays, averaging lower than *D. kyathit* with 13–14 rays (counts of 16 and 17 in Fang, 1998

should be reduced with three). The vertebral count is the same in the two species, but 16+17 is modal in *D. quagga*, and *D. kyathit* has exclusively 15+18.

The colour pattern of *D. quagga* resembles that of the specimen from Kamaing (in the Ayeyarwaddy drainage, slightly west of Myitkyina) illustrated by Prashad & Mukerji (1929: pl. VII) as *D. rorio*, and referred to *D. kyathit* by Fang (1998). That specimen is shown with very long rostral and maxillary barbels, similar to *D. kyathit*, but unlike *D. quagga*. In spotted *D. kyathit* it can be difficult to trace the orientation of the rows of spots. Generally they run in parallel as in the striped specimen illustrated by Prashad & Mukerji (1929), or the lower stripes make slight curves abdominally. The rows of spots may also be irregular in *D. kyathit*, e.g., when the P stripe is represented by two parallel rows of spots anteriorly (Fig. 5), or when the spots in the P stripe are vertically extended as in the holotype (Fang, 1998: fig. 2). The paratype of *D. kyathit* from the upper Chindwin drainage (ANSP 93957) is faded and the fins are damaged, but there are sufficient remains of the dark pigmentation to see that the P+1, P, and P-1 stripes run in parallel along the side. The P stripe is divided into an upper striped section and a lower spotted section, and the P-1 stripe consists of spots anteriorly. The P-2 and P-3 stripes are slanting as in *D. quagga*.

Acknowledgments

We are indebted to our guide Thein Win for considerable effort in getting the fish out of the water, and to Tin Win, Hein Aquarium Co., Yangon, for information and logistic support. Permission to collect and export specimens was granted by the Fisheries Department,

Yangon. We thank Maurice Kottelat for kindly commenting on an early draft, and Scott A. Schaefer and William G. Saul (ANSP) for the loan of specimens.

References

- Conway, K. W., W.-J. Chen & R. L. Mayden. 2008. The "Celestial Pearl danio" is a miniature *Danio* (s.s.) (Ostariophysi: Cyprinidae): evidence from morphology and molecules. *Zootaxa*, 1686: 1-28.
- Fang, F. 1997. Redescription of *Danio kakhienensis*, a poorly known cyprinid fish from the Irrawaddy basin. *Ichthyological Exploration of Freshwaters*, 7: 289-298.
- 1998. *Danio kyathit*, a new species of cyprinid fish from Myitkyina, northern Myanmar. *Ichthyological Exploration of Freshwaters*, 8: 273-280.
- Fang, F., M. Norén, T. Y. Liao, M. Källersjö & S. O. Kullander. 2009. Molecular phylogenetic interrelationships of the south Asian cyprinid genera *Danio*, *Devario* and *Microrasbora* (Teleostei, Cyprinidae, Danioninae). *Zoologica Scripta*, 38: 237-256.
- Fang Kullander, F. 2001. Phylogeny and species diversity of the South and Southeast Asian cyprinid genus *Danio* Hamilton (Teleostei, Cyprinidae). PhD dissertation, Stockholm University, Stockholm, 26 pp.
- Prashad, B. & D. D. Mukerji. 1929. The fish of the Indawgyi Lake and the streams of the Myitkyina District (Upper Burma). *Records of the Indian Museum*, 31: 161-223.
- Sen, N. 2007. Description of a new species of *Brachydanio* Weber and de Beaufort, 1916 (Pisces: Cypriniformes: Cyprinidae) from Meghalaya, North East India, with a note on comparative studies of other known species. *Records of the Zoological Survey of India*, 107: 27-31.
- SPSS. 2008. SPSS Statistics 17.0. SPSS Inc., Chicago.

Received 17 April 2009

Revised 16 July 2009

Accepted 16 July 2009

Ichthyological Exploration of Freshwaters

An international journal for field-orientated ichthyology

INSTRUCTIONS TO CONTRIBUTORS

Warning

Prospective authors should read carefully the following instructions and follow them when submitting a manuscript. Doing so significantly hasten publication and save money and efforts. Manuscript which do not satisfy the instructions below may be rejected at the Editor's discretion and will not be returned.

Types of papers

- 1) Major Articles and Notes. These manuscripts are submitted to two referees for evaluation.
- 2) Rapid communications. These articles will be reports on exciting new results or discoveries within the scope of the journal. They are evaluated by the Editor and the Editorial Board and are either accepted or rejected.

Submission of manuscripts

The original manuscript and two copies should be sent to the Editor, Maurice Kottelat, Route de la Barache 12, Case postale 57, CH-2952 Cornol, Switzerland. Do not send a disk or original of figures at this stage. A letter of transmittal is requested, giving:

- 1) the name, postal and email addresses and telephone of the corresponding author;
- 2) the names, postal and email addresses of up to four persons outside the authors' institutions who are qualified to review the paper;
- 3) a statement that the material has not been published and is not considered for publication elsewhere and that it will not be submitted elsewhere unless it is rejected or withdrawn. In submitting a manuscript, the author(s) accept transfer of the copyright to the Publisher.

Co-authors, corresponding author

Authors are those who have played a *significant* role in designing and conducting the research and in writing the manuscript. Individuals who have only collected data, provided material or financial support, or reviewed the manuscript should be listed in acknowledgments. Honorary authorship is not accepted.

Co-authors should designate a single corresponding author to whom correspondence and proofs will be sent. All correspondence regarding the paper should go through the corresponding author. Correspondence will not be sent to other co-authors and correspondence from other co-authors regarding the manuscript will neither be answered nor taken into consideration.

Format

Text. All manuscripts are subject to editorial revision before final acceptance for publication. The manuscript should be printed, double spaced and with at least 2.5 cm right, left and bottom margins. Pages must be numbered. Nothing in the manuscript should be underlined. Titles with numerical series designations are not permitted. Titles should be brief, fewer than 20 words and should indicate clearly the field of study and the group of fishes investigated. All abbreviations should be explained in the Method section (or figure caption when appropriate) or a reference to published explanations should be provided; exceptions are very common abbreviations, such as mm, km, kg, sec, min, yr, vs, SL. Footnotes are not permitted. Do not end a line of text with a hyphen. All measurements must be in metric units. The first page should include: title of the paper, author(s), addresses and abstract, all left justified. The text should be followed by Material Examined (if appropriate), Acknowledgments (if any), Appendix (if any) and Literature Cited, in that order. Keys are desirable in taxonomic papers. They should be dichotomous and not serially indented.

Nomenclature. Names of living organisms should follow the appropriate and current International Codes of Nomenclature. Formal names of genera and species should be written in italics. Names of authors and publication dates of scientific names should appear only when nomenclatural problems are involved.

Language. Manuscripts should be written in English, French or German, but English is strongly encouraged. All papers must have a concise but informative abstract in English. Manuscripts in French or German must have an extensive summary in English. In taxonomic papers, the abstract must include at least clear diagnosis of the new taxa. A second abstract, provided by the author(s), in the language of the country or area concerned by the text is acceptable. A maximum of two abstracts is permitted.

Acknowledgments. Identify individuals by name(s) and surname. Do not list titles, position or institution. Acknowledge individuals, not positions. Idiosyncrasy and private jokes are not permitted.

Literature Cited. Format for Literature Cited is that of the most recent issue. Abbreviate names of well known journals, but provide in full the names of lesser known journals. For books, give full name of publishing company or institution, city and country. Manuscripts in preparation or submitted, abstracts, in-house reports and other literature not obtainable through normal library channels cannot be cited.

Tables. Each table should be on a separate sheet, numbered sequentially with Arabic numerals; they should have concise but self-explanatory headings. Do not insert frames, vertical rules, dotted lines or footnotes. The location of first citation of each table should be clearly indicated.

Figures. Do not submit originals for the review; send originals with the revised manuscript. All maps, graphs, charts, drawings and photographs are regarded as figures and are to be numbered consecutively and in the sequence of their first citation in the text. When several charts or photographs are grouped as one figure, they must be trimmed and spaced as intended for final reproduction. Each part of such a group figure should be lettered with a lower case block letter in the lower left corner. Scale should be indicated on the figure by a scale bar. Figures should never be mounted on hard cardboard. Do not mark or write on the back of the figures.

All illustrations should be designed to fit a width of 68 or 140 mm and a depth no greater than 200 mm. Prints should be of high contrast and glossy. Lettering should be large enough to be easily seen when reduced onto a journal column (68 mm). Legends for figures must be typewritten on a separate sheet. Identify each illustration with the author's name, figure number and direction of top margin.

Colour illustrations should preferably be slides. Slides should be framed and properly labelled. For the review, they should be submitted as three sets of prints, pasted on sheets of paper, or as a series of color photocopies. Prints to be used for publications should never be mounted and never labelled on the back.

The decision to print in colour or in black and white any figure originally submitted in colour remains with the editor and publisher. This decision will be based on scientific justification, quality of the original, layout and other editorial, financial and production constraints. By submitting colour originals, the authors know and accept that they may be published in black and white.

Even if photographs or line drawings are processed with graphics programs, original slides, negatives or drawings must always be submitted. Software texts. The whole text should be left justified. Do not right-justify. Do not underline. Never use "L" or "l" for the numeral 1 or "O" or "o" for "0". Do not hyphenate any word. Do not format the text. Text should be on 3.5" disks, readable on IBM-compatibles with MS-DOS. Do not send a disk, when submitting the manuscript. Revised manuscript must be accompanied by a disk satisfying above criteria, or will not be accepted.

Review

Each manuscript will be sent to two reviewers for confidential evaluation. When justified, the reviewer's comments will be forwarded to the author. When submitting a revised manuscript, authors should *briefly* indicate which comments have been incorporated and the reasons for disregarding any suggestion regarded as unacceptable. Remember that if a reviewer had questions or did not understand you, other readers may make the same experience and the answers should be in the manuscript and not in a letter to the editor. *Changes in style, format and layout requested by the Editor are non-negotiable and non-observance will usually result in rejection of the manuscript.*

Revised manuscripts received more than 6 months after the reviewers' comments had been sent will not be considered or will be treated as new submissions.

Proofs, Reprints and Page Charges

One set of proofs will be sent to the corresponding author; they should be checked and returned to the Editor within one week. Proofs not received within this delay may be corrected by the Editor, at the author's risks. Authors may be charged for any changes other than printer's error. Reprint orders must be forwarded with the corrected proofs on the form supplied by the editor. The corresponding author is responsible for contacting the co-authors and forwarding their reprint orders.

The authors will obtain 20 reprints free of charge, additional reprints may be ordered at cost. There will be no page charges and no charges for justified colour illustrations.

Ichthyological Exploration of Freshwaters

An international journal for field-orientated ichthyology

Volume 20 • Number 3 • September 2009

C O N T E N T S

Kullander, Sven O., Te Yu Liao and Fang Fang: <i>Danio quagga</i> , a new species of striped danio from western Myanmar (Teleostei: Cyprinidae)	193
Schäfer, Frank: <i>Oreichthys crenuchoides</i> , a new cyprinid fish from West Bengal, India	201
Vreven, Emmanuel J. and Melanie L. J. Stiassny: <i>Mastacembelus simbi</i> , a new dwarf spiny eel (Synbranchiformes: Mastacembelidae) from the lower Congo River	213
Kullander, Sven O. and Fang Fang: <i>Danio tinwini</i> , a new species of spotted danio from northern Myanmar (Teleostei: Cyprinidae)	223
Schöter, Christian, Müfit Özuluğ and Jörg Freyhof: <i>Capoeta caelestis</i> , a new species from Göksu River, Turkey (Teleostei: Cyprinidae)	229
Wildekamp, Rudolf H., Konstantin M. Shidlovskiy and Brian R. Watters: Systematics of the <i>Nothobranchius melanospilus</i> species group (Cyprinodontiformes: Nothobranchiidae) with description of two new species from Tanzania and Mozambique	237
Xin, Qiang, E Zhang and Wen-Xuan Cao: <i>Onychostoma virgulatum</i> , a new species of cyprinid fish (Pisces: Teleostei) from southern Anhui Province, South China	255
Morioka, Shinsuke and Kohsuke Sano: Growth and maturation of the bumble-bee goby <i>Brachygobius mekongensis</i> (Perciformes: Gobiidae) occurring in the Mekong basin, in Vientiane Province, Central Laos	267
Ng, Heok Hee: Two new species of <i>Pseudolaguvia</i> , sisorid catfishes (Teleostei: Siluriformes) from northeastern India	277

Cover photograph:

Danio tinwini (photograph by Sven O. Kullander)

Sven O. Kullander and Fang Fang
(this volume pp. 223-228)

Articles appearing in this journal are indexed in:

AQUATIC SCIENCES and FISHERIES ABSTRACTS
BIOLIS - BIOLOGISCHE LITERATUR INFORMATION SENCKENBERG
CAMBRIDGE SCIENTIFIC ABSTRACTS
CURRENT CONTENTS/AGRICULTURE, BIOLOGY & ENVIRONMENTAL SCIENCES and SCIE
FISHLIT
ZOOLOGICAL RECORD