Limnichthys marisrubri, a new species of sand diver (Teleostei: Creediidae) from the Red Sea

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Abstract

Limnichthys marisrubri, a new species of the sand diver family Creediidae from the Gulf of Aqaba (Gulf of Eilat), Red Sea, is described on the basis of 22 specimens. The new species is very small (maximum standard length 22.1 mm), and is characterised by a combination of the following characters: origin of the anal fin preceding that of the dorsal fin, 22–24 dorsal-fin rays, 24–26 anal-fin rays, 13–15 pectoral-fin rays, a (moderately to) strongly developed lateral stripe, and 11–14 dorsal saddles, the posterior 2–4 of which reach the midlateral stripe. It is compared with related species. A checklist of and a key to species of the genus *Limnichthys* is presented.

Keywords: Fishes, Red Sea, *Limnichthys*, Creediidae, taxonomy, new species, checklist, key.

Zusammenfassung

Limnichthys marisrubri, eine neue Art der Familie Creediidae aus dem Golf von Aqaba (Golf von Eilat), Rotes Meer, wird aufgrund von 22 Exemplaren beschrieben. Die neue Art ist sehr klein (maximale Standardlänge 22.1 mm) und ist durch eine Kombination der folgenden Merkmale charakterisiert: Beginn der Afterflossenbasis liegt vor dem Beginn der Rückenflossenbasis, Rückenflossenstrahlen 22–24, Afterflossenstrahlen 24–26, Brustflossenstrahlen 13–15, laterales Band (mittel bis) stark entwickelt und 11–14 dorsale Sattelflecke, von denen die hinteren 2–4 das laterale Band erreichen. Die neue Art wird mit verwandten Arten verglichen. Weiterhin wird eine Checkliste und ein Bestimmungsschlüssel für die Gattung *Limnichthys* gegeben.

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1 Introduction

The sand diver (or sandburrower, sandlance) family Creediidae is a group of fishes living in marine waters of the Indo-West Pacific. They burrow in sand and gravel bottoms in coastal waters of the continental shelf. Most species are found in very shallow waters, while a few occur down to 100 m (Nelson 1978, 2001).

Creediids are identified as a family by their elongate and compressed body, a small body size of less than 8 cm, a fleshy snout that is projecting beyond the lower jaw, which is bordered by a row of cirri, and about 35–60 lateral line scales, most of which bearing a posterior extension (for details see Nelson 1985, 2001). Within the family, the genus *Limnichthys* is characterised by the combination of 5 soft pelvic-fin rays, the anal, pelvic and pectoral-fin rays unbranched, usually 11–14 pectoral-fin rays, the lowermost not thickened, 33 or less dorsal-fin rays, 34 or less anal-fin rays (Nelson 1978).

The family Creediidae was first revised by Nelson (1978), who recognised eight genera and 13 species as valid. Nelson (1979) examined the osteology of the two New Zealand species of *Limnichthys*, and commented on other creediids, removing *Squamicreedia obtusa* from the Creediidae and placing it in the Percophidae. Two additional species of *Creedia* from Australia were described by Nelson (1983). Nelson (1985) examined the interrelationships of the Creediidae at the generic level based on a detailed osteological examination; he postulated a close relationship of the Creediidae and the Percophidae and Trichonotidae, and recognised seven valid creediid genera comprising 16 valid species. Shimada & Yoshino (1987) described another species, *Creedia bilineatus*, from the Yaeyama Islands, Japan. In her PhD thesis, Lucena Rosa (1993) reviewed the taxonomy of the Creediidae; in the genus *Limnichthys*, she treated two subspecies, *Limnichthys nitidus nitidus* and *Limnichthys nitidus donaldsoni* (Lucena Rosa 1993: 43–46). Yoshino et al. (1999) described

another species from Japan, *Limnichthys orientalis*. Nelson (2001: 3314) mentioned Lucena Rosa's work and tentatively treated the species *Limnichthys nitidus* and *L. donaldsoni* as a species complex. Langston (2004) examined the gonad morphology and sex change of Hawaiian Islands creediids, including *Limnichthys donaldsoni*. Shibukawa (2010) described *Myopsaron nelsoni* from the Ogasawara Islands (Japan), bringing the total number of genera in the family to 8, and of species-group taxa to 19.

During the examination of Red Sea creediid material which was previously misidentified as *Limnichthys nitidus*, it became clear that the species of *Limnichthys* in the Gulf of Aqaba (Gulf of Eilat) is distinct from other species of *Limnichthys*, including *Limnichthys nitidus*, and represents an undescribed species, which is described in the present paper.

Acknowledgments

We would like to thank A. Baranes and the staff of the Interuniversity Institute Eilat for logistic support of this study. We are grateful to the following individuals who gave permission to examine specimens under their care, or provided catalogue numbers: D. F. Hoese, J. Leis, M. McGrouther, J. Paxton (AMS); P. Pruvost (MNHN); C. D. Paulin, C. D. Roberts, A. L. Stewart (NMNZ); S. Smith, J. T. Williams (USNM). We thank S. Bogorodsky (Omsk, Russia) and H. Imamura (Laboratory of Marine Biology and Biodiversity, Systematic Ichthyology, Hokkaido University, Hakodate, Japan) for critically reviewing the manuscript, and for several useful suggestions and comments; S. Bogorodsky also provided colour photographs of *Limnichthys* spp.

2 Methods and Materials

Methods follow Nelson (1978: 351–352). The proportions are given as parts per thousand of the standard length (SL). Caudal-fin ray counting method follows Fricke (1983). In descriptive section, the data of the holotype is given first, followed by those of the paratypes, in parentheses. The midlateral stripe on the body is strongly expressed if it is dark brown all along the body; it is moderately expressed if parts are dark brown and parts are pale; it is weakly expressed if all of it is pale brown, disconnected, or absent. The genus and species classification follows Eschmeyer & Fricke (2011), unless otherwise noted. The museum abbreviations follow Fricke & Eschmeyer (2011). The key is based on Nelson (1978: 353), but was adapted and modified; subsequently described species are added.

Abbreviations of museum collections

AMS	The Australian Museum, Sydney, Australia
BMNH	The Natural History Museum, London, UK
HUJF	Hebrew University, Fish Collection, Jerusalem, Israel
MNHN	Muséum National d'Histoire Naturelle, Paris, France
NMNZ	Museum of New Zealand Te Papa Tongareva, Wellington, New Zealand
SMNS	Staatliches Museum für Naturkunde Stuttgart, Germany
USNM	National Museum of Natural History, Smithsonian Institution, Museum Support Center, Suitland, MD, USA

Comparative material

Limnichthys donaldsoni: SMNS 17824 (3), Cook Islands, Aitutaki Island; SMNS 22939 (1), New Caledonia, Loyalty Islands, Lifou Island; SMNS 22979 (1), New Caledonia, Loyalty Islands, Lifou Island.

Limnichthys fasciatus: SMNS 13865 (5), Australia, New South Wales, Treachery Point; SMNS 21414 (5), Australia, New South Wales, Wagonga Head; SMNS 24855 (2), Taiwan, south coast; SMNS 26543 (1), New Caledonia, Grande Terre, south coast, Goro.

Limnichthys nitidus: SMNS 16887 (1), Mauritius; SMNS 17046 (3), Réunion.

Limnichthys orientalis: AMS I.38816-001 (1 paratype), Japan, Yaeyama Islands, Ishigaki Island.

Limnichthys polyactis: SMNS 13984 (12), New Zealand, South Island, Jackson Bay.

Limnichthys rendahli: NMNZ 3967 (4), New Zealand, South Island, Foveaux Strait.

3 Species account

Limnichthys marisrubri **n. sp.**
(Figs. 1–3)

Creediidae indet.: Clark 1971: 4 (Eilat, Israel, Gulf of Aqaba).

?Limnichthys nitidus (non Smith, 1958): Nelson 1978: 360 (Egypt, Gulf of Aqaba; tentatively identified, may be a new species).

Limnichthys nitidus nitidus (non Smith, 1958): Lucena Rosa 1993: 43–48 (part).

Limnichthys nitidus (non Smith, 1958): Cozzi & Clark 1995: 327 (darting behaviour; Marsa Muqabelah, Egypt, Gulf of Aqaba).

Material

Holotype: HUJF 19903 (22.05 mm SL), Eilat, north beach, Gulf of Aqaba (Gulf of Eilat), northern Red Sea, Israel, 29° 32′ 41″ N 34° 58′ 22″ E, 0–1.2 m depth, D. Golani, 9 Mar. 2010.

Paratypes: All from Eilat, north beach, Gulf of Aqaba (Gulf of Eilat), northern Red Sea, Israel, 29° 32′ 41″ N 34° 58′ 22″ E, 0–1.2 m depth (total 21 specimens): BMNH 2011.6.26.1 (1 specimen, 21.4 mm SL), D. Golani, 30 Mar. 2011; HUJF 18609 (1 specimen, 22.05 mm SL), D. Golani, 9 Mar. 2010; HUJF 20066 (5 specimens, 19.2–22.1 mm SL), D. Golani, 29 Mar. 2011; HUJF 20060 (12 specimens, 15.2–21.2 mm SL), D. Golani, 30 Mar. 2011; MNHN 2011-0210 (1 specimen, 21.8 mm SL), D. Golani, 30 Mar. 2011; USNM 400922 (1 specimen, 22.0 mm SL), D. Golani, 30 Mar. 2011.

Diagnosis

A very small *Limnichthys* (maximum body size 22.1 mm SL) with origin of anal fin preceding that of dorsal fin, 22–24 dorsal-fin rays, 24–26 anal-fin rays, 13–15 pectoral-fin rays, a strongly developed lateral stripe, and 11–14 dorsal saddles, the posterior 2–4 of which reach the midlateral stripe.

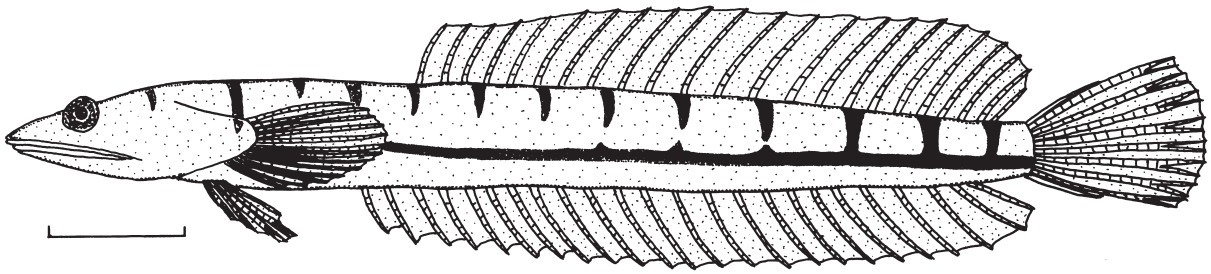


Fig. 1. *Limnichthys marisrubri* n. sp., holotype, lateral view. – Scale: 3 mm.

Description

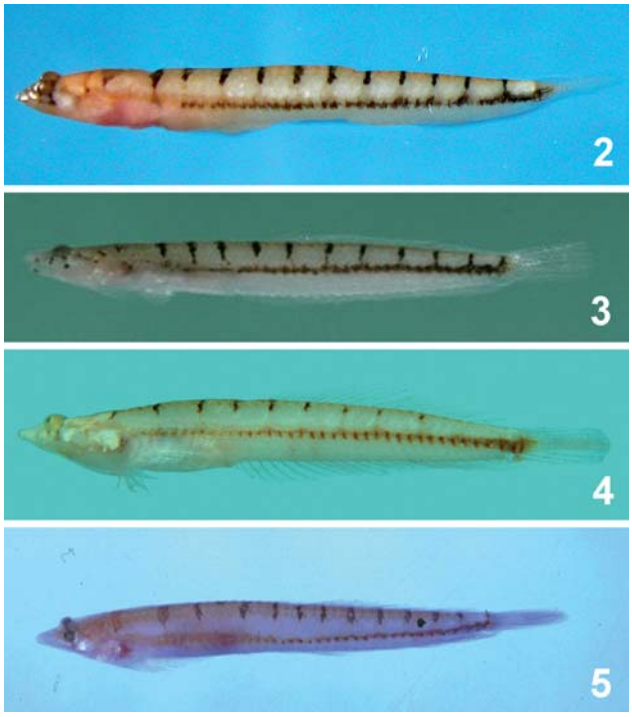
The measurements of the holotype are given in Tab. 1. Body moderately compressed, fusiform. Body depth 111 (97–143) mm. Mouth large; tip of maxilla (concealed by suborbital flap) extending past posterior margin of eye, rounded. Lower jaw considerably shorter and narrower than upper jaw. Cirri along the sides of the lower jaw well developed, in a single row. Eyes dorsal, usually slightly protruding. Interorbit narrow. Anterior nostrils with distinct tubes; posterior nostrils adjacent to anterior margin of eye, pore-like. Sensory pores on head minute. Teeth few, minute, villiform, in a narrow band on upper and lower jaws, and present on prevomer. Lateral line arising at upper edge of gill opening, gradually decreasing near end of pectoral fin 3 rows above anal fin base, reaching posteriorly to caudal-fin base. Body size very small, maximum observed SL 22.1 mm.

Dorsal-fin rays 23 (22–24, usually 23). Origin of anal fin 2–3 rays in advance of dorsal-fin origin. Anal-fin rays 24 (24–26, usually 24). Combined dorsal and anal-fin rays 47 (46–50, usually 46–48). Pectoral-fin rays 14 (13–15, usually 14). Pelvic-fin rays I, 5 (I, 5). Caudal-fin rays ii, 8, ii (ii–iii, 8, ii–iii). Lateral-line scales 37 (37–41). Scales above/below the lateral line 3/3 (3/3).

Colour in live (Figs. 2, 3): Dorsal parts of head and body light brown; remainder creamy white, belly pinkish. Eye dark brownish grey. Eye dark brownish grey. Cheek below the eye with two triangular dark grey spots. Sides of body with a (moderately to) strongly developed lateral stripe which is orange with dark brownish grey pigment. Back with a series of 13 (11–14) dark brownish grey sad-

Tab. 1. Measurements of the holotype of *Limnichthys marisrubri* n. sp. (HUJF 19903).

	Measurement (mm)
Standard length	22.05
Caudal-fin length	3.70
Total length	25.75
Head length	6.45
Orbital diameter	1.25
Bony interorbital width	0.70
Maxillary length	3.90
Maximum body depth	2.45
Caudal-peduncle length	0.40
Caudal-peduncle depth	0.90
Predorsal length	10.90
Preanal length	10.45
Prepectoral length	5.40
Pectoral-fin length	3.25
Prepelvic length	5.80
Pelvic-fin length	2.10



Figs. 2–5. *Limnichthys marisrubri* n. sp. (2, 3), *L. nitidus* (4, 5), live colouration. –**2**. Israel, Eilat, holotype. **3**. Israel, Eilat, non-type specimen. **4**. Comores. **5**. South Africa. – Photographs: Daniel Golani (2), Sergey Bogorodsky (3–5).

dles (some – especially the anterior two – may be inconspicuous, or fused, in young paratypes). Posterior 3 (2–4) saddles reaching the lateral band (all saddles reaching lateral band by thin branches in one paratype).

Colour in preservative: Head and body whitish, eye dark grey. Fins translucent. Sides of body with a strongly developed lateral dark grey stripe (may be moderately developed and light grey in small paratypes). Dorsal parts of head and back with a series of 13 (11–14) dark grey saddles; some – especially the anterior two – may be inconspicuous, or fused, in young paratypes. Posterior 3 (2–4) saddles reaching the lateral band (all saddles reaching lateral band by thin branches in one paratype).

Etymology

The new species is named *marisrubri*, a Latin expression that refers to its occurrence in the Red Sea.

Distribution

Northern Red Sea (Gulf of Aqaba: Israel, Egypt).

Comparison

The species of *Limnichthys* are compared in Tab. 2. The new species is most similar to *Limnichthys fasciatus* in having fewer dorsal-fin and anal-fin rays and a strongly or moderately expressed midlateral stripe, but differs from the latter species in having 11–14 dorsal saddles [7–9 in *Limnichthys fasciatus*], 46–50 (usually 46–48) combined dorsal-fin and anal-fin rays [50–55, usually 52–55], 22–24 dorsal-fin rays [24–27], 24–26 anal-fin rays [26–29], 13–15 pectoral-fin rays [usually 12], and 11–14 dorsal saddles [7–9]. The new species is distinguished from *Limnichthys donaldsoni*, *L. nitidus* and *L. orientalis* by the presence of a strongly or moderately developed midlateral stripe, 13–15 pectoral-fin rays [usually 10–12 in those species], and 11–14 dorsal saddles [6–12]. It differs from *Limnichthys polyactis* and *L. rendahli* in 22–24 dorsal-fin rays [28–33 in *L. polyactis* and *L. rendahli*], 24–26 anal-fin rays [30–34], 46–50 combined dorsal-fin and anal-fin rays [59–66], and 11–14 dorsal saddles [6–9].

Remarks

This new northern Red Sea creediid was first observed in Eilat (Israel) by Clark (1971: 4), who already considered the possibility that it was an undescribed species. Nelson (1978: 360), who examined only two small specimens, tentatively identified it as *Limnichthys nitidus* (non Smith, 1958). In the present study, a larger number of specimens is examined, and trenchant differences to other species of *Limnichthys* including *Limnichthys nitidus* are found; the northern Red Sea populations, described as *Limnichthys marisrubri* n. sp., are more similar to *Limnichthys fasciatus*.

A checklist to the species of the genus *Limnichthys* is presented below. *Limnichthys nitidus* was first described by Smith (1958: 247) from the western Indian Ocean. Schultz in Schultz et al. (1960: 278) described a closely related species, *Limnichthys donaldsoni*, from the western Pacific Ocean. Nelson (1978: 360) distinguished the two as valid species, mainly based on the number of lateral-line scales, the combined number of dorsal-fin and anal-fin rays, and the number of pectoral-fin rays. Lucena Rosa (1993: 43–48) recognised differences between western Indian Ocean and western Pacific Ocean populations, but due to a similarity of the two in a PCA analysis she treated the two as subspecies *Limnichthys nitidus nitidus* (Indian Ocean) and *Limnichthys nitidus donaldsoni* (western Pacific Ocean). Subsequent authors (including Randall 2005, 2007; Fricke et al. 2011) usually treated *L. donaldsoni* as a junior synonym of *L. nitidus*. However, Yoshino et al. (1999), who followed Lucena Rosa (1993) and placed *L. donaldsoni* in the synonymy of *L. nitidus*, described a further new species in the *L. nitidus* complex, *Limnichthys orientalis*, from the Ryukyu Islands. Indian Ocean (*L. nitidus*) and western Pacific Ocean populations (*L. donaldsoni*) as well as Ryukyu Islands populations (*L. orientalis*) are clearly distinguishable based on counts (especially pectoral-fin ray numbers) and colouration (presence or absence of a midlateral stripe on body, number of dorsal saddles, number of saddles joining midlateral stripe), same standards of species distinction should be applied for *L. orientalis* as well as other

Tab. 2. Comparison of the species of *Limnichthys*. – Midlateral stripe: + = strongly or moderately developed; – = weakly developed (pale or disconnected) or absent.

	L. marisrubri n. sp.	*L. donaldsoni*	*L. fasciatus*	*L. nitidus*	*L. orientalis*	*L. polyactis*	*L. rendahli*
Dorsal-fin rays	22–24	21–24	24–27	22–25	21(–23)	28–32	29–33
Anal-fin rays	24–26	25–27	26–29	26–28	24–25	31–34	30–32
Combined dorsal + anal-fin rays	46–48(–50)	46–50	(50–)52–56	48–53	45–48	59–66	59–66
Pectoral-fin rays	13–15	(10–)11(–12)	(11–)12(–14)	12–13	10–11	12–13	(13–)14(–16)
Midlateral stripe	+	–	+	–	–	+	(+)
Dorsal saddles (number)	11–14	9–11	7–9	8–12(–13)	6–11	7–9	6–8
Dorsal saddles joining midlateral stripe (number)	2–4	–	5–9	–	–	3–5	3–6

taxa in the species-group, and subspecies are generally no longer used, but are either treated as separate species or synonymised, following FRICKE et al. (2007: 6). Therefore, the three taxa are here recognised as separate species.

4 Checklist of the species of the genus *Limnichthys*

Limnichthys donaldsoni Schultz in Schultz, Chapman, Lachner & Woods, 1960: SCHULTZ in SCHULTZ et al. 1960: 278, fig. 107. – Distribution: Western Pacific Ocean: Ryukyu Islands and Ogasawara Islands (Japan), Taiwan, Marshall Islands, Queensland (Australia), Loyalty Islands (New Caledonia), Cook Islands, Henderson Island (Pitcairn Group), Hawaiian Islands. – Hawaiian Islands populations have a different colouration and may represent a different species; see photograph of RANDALL (2005: 468).

Limnichthys fasciatus Waite, 1904: WAITE 1904: 178, pl. 23, fig. 4. – Synonym: *Limnichthys fasciatus major* Whitley 1945: WHITLEY 1945: 31. – Distribution: Eastern Indian Ocean: Western Australia; Western Pacific Ocean: Queensland and New South Wales (Australia), Lord Howe Island, New Caledonia, Kermadec Islands (New Zealand), Solomon Islands, Fiji, Gilbert Islands (Kiribati), Philippines, Taiwan, southern Japan.

Limnichthys marisrubri n. sp. (present paper). – Distribution: Gulf of Aqaba (Egypt, Israel), northern Red Sea.

Limnichthys nitidus Smith, 1958 (Fig. 4): SMITH 1958: 247, fig. 1. – Distribution: Indian Ocean: KwaZulu-Natal (South Africa), Mozambique, Comores, Réunion, Mauritius, Seychelles, Cocos-Keeling Islands. – South African populations have a slightly different colouration and may represent a different species (Fig. 5).

Limnichthys orientalis Yoshino, Kon & Okabe, 1999: YOSHINO et al. 1999: 82, figs. 2c, 4c, 5c, 6c, 7c. – Distribution: Ryukyu Islands (Japan).

Limnichthys polyactis Nelson, 1978: NELSON 1978: 353, fig. 1A. – Distribution: New Zealand.

Limnichthys rendahli Parrott, 1958: PARROTT 1958: 116. – Distribution: New Zealand.

5 Key to species of the genus *Limnichthys*

1 Dorsal-fin rays 28 or more; anal-fin rays 30 or more; interorbital pores paired, with a distinct interspace. **2**
– Dorsal-fin rays 27 or fewer; anal-fin rays 30 (rarely) or fewer; interorbital pore(s) single or paired, with little or no interspace. **3**
2 Origin of anal fin preceding that of origin of dorsal fin; snout length usually less than half maximum body depth; cirri along either side of lower jaw usually fewer than 20, of near uniform length; pectoral-fin rays usually 12 or 13. ..... ***L. polyactis***
– Origin of anal fin beneath or behind that of dorsal fin; snout length usually greater than half maximum body depth; cirri along either side of lower jaw usually more than 20, of alternating size posteriorly; pectoral-fin rays usually 14 (range 13–16). ..... ***L. rendahli***
3 Lateral band strongly or moderately developed; at least some dorsal saddles reaching lateral band. **4**
– Lateral band weakly developed or absent; dorsal saddles not reaching lateral band (if present at all). **5**
4 Dorsal saddles 7–9; combined number of dorsal-fin and anal-fin rays 50–55 (usually 52 or more). ..... ***L. fasciatus***
– Dorsal saddles 11–14; combined number of dorsal-fin and anal-fin rays 46–50 (usually 46–48)..... ***L. marisrubri* n. sp.**
5 Lateral line scales 41–43; combined number of dorsal-fin and anal-fin rays 45–48; pectoral fin rays 10–11..... ***L. orientalis***
– Lateral line scales 36–41; combined number of dorsal-fin and anal-fin rays 46–53; pectoral fin rays 11–13. ..... **6**
6 Lateral line scales 39–41; combined number of dorsal-fin and anal-fin rays 48–53; pectoral-fin rays 12 or 13..... ***L. nitidus***
– Lateral line sc ales 36–38; combined number of dorsal-fin and anal-fin rays 46–50; pectoral-fin rays usually 11 (rarely 10 or 12). ..... ***L. donaldsoni***

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Manuscript received: 14.VI.2011, accepted: 7.X.2011.