Description of a Pelagic Juvenile of the Poorly Known Anglerfish *Sladenia zhui* (Lophiidae) from the East China Sea

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A single pelagic juvenile (23.1 mm standard length) of a lophiid fish, collected from 100–115 m in depth in the East China Sea, was identified as *Sladenia zhui* Ni, Wu, and Li, 2002, originally described from the East and South China Seas, on the basis of meristic counts [1-1-1-I, 10 dorsal-fin rays (2 post-cephalic spines); 7 anal-fin rays; and 19 pectoral-fin rays] and mitochondrial DNA sequences. Reported here for the first time, juveniles of *Sladenia* Regan, 1908 are uniquely characterized by inflated, balloon-like skin surrounding the head and body, and undeveloped head spines. The Japanese names “Daruma-ankou-zoku” and “Daruma-ankou” are proposed herein for the genus *Sladenia* and *S. zhui*, respectively.

**Key Words:** Lophiiformes, morphology, diagnosis, mitochondrial DNA, Japan.

### Introduction

The poorly known deep water lophiid genus *Sladenia* Regan, 1908 is characterized by a rounded, rather than depressed, head; and compressed, rather than depressed, tail; the nasal sacs which are not constricted at the base; very long pseudobranchia; humeral, subopercular, quadrate, pterygoid and articular spines absent; epiotic and interopercular spines which are low and rounded; vomerine teeth larger than palatine teeth; the illicial bone and 2nd dorsal-fin spine inserted very close together on the illicial pterygiophores; the 3rd or 3rd and 4th (post-cephalic) dorsal-fin spines lying under the skin; and a smooth ridge on the frontal bones anterior to the eye and lateral to the illicial pterygiophore (see Caruso and Bullis 1976; Caruso 1985). The genus comprises four nominal species, all being valid, viz., *Sladenia gardineri* Regan, 1908 (type species; distribution: Solomon Atoll, Chagos Archipelago, central Indian Ocean), *Sladenia remiger* Smith and Radcliffe in Radcliffe, 1912 [Sulawesi (Indonesia), Australia, New Caledonia, and the Hawaiian Islands], *Sladenia shaefersi* Caruso and Bullis, 1976 (Western Atlantic Ocean), and *Sladenia zhui* Ni, Wu, and Li, 2012 [South and East China Seas and Java (Indonesia)] (Caruso and Bullis 1976; Pietsch et al. 2013; Ho 2015; Ho et al. 2016). Although Pietsch et al. (2013) recently provided in-situ subsurface and ROV observations of *S. shaefersi*, the species of this poorly known genus are generally known only from a few specimens. Among them, *S. zhui* was originally described from four specimens from the South and East China Seas (Ni et al. 2012), the subsequent report by Ho et al. (2016) of two specimens collected off Java, Indonesia (as *S. cf. zhui*) being the most recently published record to date.

A single pelagic lophiiform juvenile (23.1 mm standard length; Fig. 1A), encased in an inflated transparent skin, collected by bottom trawl from the East China Sea in the vicinity of the type locality of *S. zhui*, was identified as that species. Because no pelagic juvenile of any *Sladenia* species have ever been reported, the present specimen is described in detail.

### Materials and Methods

Counts and measurements followed Caruso and Bullis (1976), Caruso (1981) and Ho et al. (2016). The terminology of head spines followed Caruso (1981: fig. 1). Osteological characters were observed from an X-ray photograph of the specimen, which was judged as being a pelagic juvenile due to its apparently full complement in number of fin rays and putative specializations for a pelagic lifestyle (inflated skin and elongate pelvic-fin rays), following Leis and Trnski (1989) and Okiyama (2014a).

Standard length is abbreviated as SL. Specimens examined were deposited in the fish collections of Kyoto University, Kyoto and Maizuru, Japan (FAKU), the Hokkaido University Museum, Hakodate, Japan (HUMZ), the Kagoshima University Museum, Kagoshima, Japan (KAUM), and Kindai University, Nara, Japan (KUN).

The present juvenile specimen and a single adult specimen (HUMZ 191110) of *S. cf. zhui* (sensu Ho et al. 2016) were subjected to genetic analysis. Total genomic DNA was extracted from either a fin clip or muscle tissue sample preserved in 99.5% ethanol, using the Wizard Genomic DNA Purification Kit (Promega), following the manufacturer’s
protocol. Partial sequences of three mitochondrial genes obtained from the juvenile specimen included the 5′ end of the Cytochrome c Oxidase subunit I (COI: 648 bp), 12S ribosomal RNA (12S: two separate regions of 181 bp and 403 bp), and 16S ribosomal RNA (16S: 566 bp). Only the 12S sequence was obtained for HUMZ 191110. Primers for each gene were: VF2_t1, FishF2_t1, FishR2_t1 and FR1d_t1 for COI (Ivanova et al. 2007); MiFish-U-F and MiFish-U-R for the 181 bp fragment of 12S (Miya et al. 2015); 12SA-L and 12SB-H for the 403 bp fragment of 12S (Palumbi et al. 2002); and 16Sr and 16Sbr for 16S (Palumbi 1996). PCR was conducted in an 8.0 µl reaction volume containing 4.0 µl of 2X KAPAq HS ReadyMix with dye (KAPA BIOSYSTEMS), 0.20 µM of each primer, and 1.0 µl (approximately 20 ng) of template DNA. PCR profiles followed those previously described (Palumbi 1996; Palumbi et al. 2002; Ivanova et al. 2007; Miya et al. 2015). PCR products were purified with ExoSAP-IT (Thermo Fisher Scientific), and DNA sequencing performed using the Big-Dye Terminator Cycle Sequencing Kit v3.1 (Thermo Fisher Scientific) on an Applied Biosystems 3500 Genetic Analyzer (Thermo Fisher Scientific). The resulting sequences were edited with BioEdit v7.0.5.3 (Hall 1999) and deposited in the International Nucleotide Sequence Database Collaboration under accession numbers LC499995 to LC500000.

The phylogenetic position of the present juvenile specimen within Lophiiformes was estimated by Bayesian inference (BI), based on the 12S, 16S and COI sequences. Sequences from the former were aligned with reference sequences of lophiiform species, comprising complete mitochondrial genome sequences of 39 species, representing 15 families and five suborders (Table 1). The latter, originally reported by several authors (Miya et al. 2003; Yamanoue et al. 2007; Miya et al. 2010), was analyzed by Miya et al. (2010), who inferred the phylogenetic history of the order. In addition, a sequence of Capros aper (Linnaeus, 1758) (Perciformes: Caproidae) was used as an outgroup, following Miya et al. (2010). Alignment was done separately for
each gene using Clustal W (Larkin et al. 2007) implemented in BioEdit. Poorly-aligned sites were removed using trimAl with the 'automated1' option (Capella-Gutiérrez et al. 2009). Optimal substitution models for a concatenated alignment of the 3 genes were inferred using Kakusan4 (Tanabe 2011), with the alignment partitioned by gene and codon positions. Following the Bayesian Information Criterion, the "Proportional_CodonProportional" model was selected for rate heterogeneity among partitions, which assumed that branch lengths were proportional among partitions. For the substitution model at each partition, GTR+Γ for 12S and the 3rd codon of COI, SYM+Γ for 16S and the 1st codon of COI, and F81+Γ for the 2nd codon of COI, were selected. Assuming these substitution models, BI was conducted using MrBayes v3.2.4 (Ronquist et al. 2012). Two independent runs of four Markov chain Monte Carlo (MCMC) chains of 1,000,000 generations were conducted, trees being sampled every 100 generations. Trees from the first 10% of MCMC chains were discarded as burn-in. Tracer v1.7 (Rambaut et al. 2018) was used to ensure that the chains had reached
convergence. Trees from the two MCMC runs were summarized by the ‘sumt’ option of MrBayes to construct a majority-rule consensus tree, which was then visualized with FigTree v1.4.3 (Rambaut 2016).

The relationship between the present juvenile and *S. cf. zhui* (*sensu* Ho et al. 2016) specimens was then inferred with respect to four other Lophioidei species, based on a reduced dataset comprising 12S sequences. BI was conducted (as outlined above) using *Centrophryne spinulosa* Regan and Trewavas, 1932 (Lophiiformes: Centrophrynidae) as an out-group (Miya et al. 2010).

**Genus Sladenia** Regan, 1908  
*New Japanese name: Daruma-ankou-zoku*

**Sladenia zhui** Ni, Wu, and Li, 2012  
*New standard Japanese name: Daruma-ankou*  
(Figs 1–3, 5; Table 2)

*Sladenia remiger* non Smith and Radcliffe in Radcliffe, 1912: Ni 1988: 317, fig. 250 (East China Sea; description).

*Sladenia gardineri* non Regan, 1908: Su 2002: 351, fig. 163 (South and East China Seas; description).

*Sladenia zhui* Ni, Wu, and Li, 2012: 211, figs 1–3 (type locality: East China Sea, 28°09′N, 126°58′E–28°14′N, 127°01′E).

*Sladenia cf. zhui*: Ho et al. 2016: 78, fig. 1 (off Java, Indonesia; description).

**Specimen examined.** KAUM–I. 70329, 23.1 mm SL, East China Sea, 28°45′39″N, 125°4′53″E–28°41′08″N, 125°45′07″E, 100–115 m depth, bottom trawl, 13 December 2014.

**Description.** Morphometrics and selected meristics shown in Table 2. Pelvic fin with 1 spine (embedded under skin) and 5 soft rays. Vertebrae 12+7=19. Body rounded, moderately compressed anteriorly, more compressed posteriorly. Head and body encased in inflated (balloon-like) smooth transparent skin (Figs 1, 2). Gill opening small, below pectoral-fin base, not extending in front of base. Dorsal edge of orbit rim slightly expanded dorsolaterally with blunt tip; head surface smooth without other spines or ridges. Mouth relatively large, its width 28.4% of SL; lower jaw slightly extended beyond upper jaw anteriorly; posterior margin of maxilla anterior to vertical through anterior margin of eye. Papilliform nasal sacs above upper jaw. Teeth conical, enlarged and well pointed; premaxilla with single row of 4 teeth; teeth on maxilla slightly smaller, in a single row; teeth on lower jaw forming ca. 2 irregular rows, inner row teeth slightly larger than outer teeth; vomer with 2 dis-

| Table 2. Meristic and morphometric data from specimens of *Sladenia zhui* (expressed as percentages of SL). |
|-------------------------------------------------|-----------------|-----------------|-----------------|
| **Localities**                                  | **KAUM–I. 70329** | **HUMZ 191110** | **HUMZ 191516** |
| **Dorsal-fin spines**                          | 4               | 4               | 4               |
| **Dorsal-fin soft rays**                       | 10              | 9               | 9               |
| **Anal-fin soft rays**                         | 7               | 6               | 6               |
| **Pectoral-fin rays**                          | 19              | 18              | 18              |
| **Pelvic-fin rays**                            | 1, 5            | 1, 5            | 1, 5            |
| **Caudal-fin rays**                            | 8               | 9               | 9               |
| **SL (mm)**                                     | 23.1            | 271.5           | 278.2           |
| **Head length (% SL)**                         | —               | 33.6            | 32.5            |
| **Head width**                                  | —               | —               | 132.5           |
| **Head depth**                                  | —               | 31.4            | 34.4            |
| **Pre-dorsal fin length**                      | —               | 62.7            | 56.1            |
| **Illicial length**                             | 86.5*           | 36.0            | 38.3            |
| **2nd dorsal-fin spine length**                 | —               | 20.2            | 16.6            |
| **Pre-preopercle length**                      | —               | 31.5            | 29.1            |
| **Snout length**                                | 12.5            | 18.3            | 19.1            |
| **Snout width**                                 | —               | 8.8             | 8.6             |
| **Eye diameter**                                | 7.5             | 5.9             | 5.3             |
| **Upper jaw length**                            | 21.1            | 29.2            | 28.0            |
| **Inter-palatine width**                        | —               | 12.8            | 13.8            |
| **Inter-frontal width**                        | —               | 10.2            | 10.0            |
| **Inter-sphenotic width**                       | —               | 16.3            | 17.8            |
| **Inter-pterotic width**                        | —               | 24.1            | 25.4            |
| **Inter-opercular width**                      | —               | 32.4            | 31.6            |
| **Length between pterotic and sphenotic spines**| —               | 8.6             | 8.6             |
| **Length between upper palatine and quadrates** | —               | 25.6            | 26.3            |
| **Caudal peduncle depth**                      | —               | 13.2            | 13.6            |
| **Tail length**                                 | —               | 27.1            | 31.5            |
| **Caudal fin length**                          | 71.3*           | 30.5            | 32.9            |

*slightly damaged.
crete, elongate teeth patches laterally; palatine without teeth; tongue without teeth, covered with numerous papillae. Eye moderately large, directed laterally and slightly dorsally. Interorbital space narrow.

Base of illicial bone (tip broken) in interorbital space between anterior margins of eyes. Second dorsal-fin spine thin, very long, its length 86.5% of SL (tip broken); spine base at mid-orbit level, close to illicial base (Fig. 3A). Two post-cephalic dorsal-fin spines embedded under skin (determined from X-ray photograph); well separated from each other and dorsal-fin soft-rayed portion. Dorsal-fin soft-rayed portion relatively large, with semi-truncate profile; all rays unbranched. Anal fin without spines, semi-truncate; all soft rays unbranched; fin base shorter than that of dorsal-fin soft-rayed portion. Caudal fin very long, its length 71.3% of SL (slightly broken); all rays unbranched. Pectoral fin relatively small, fan-shaped, set laterally; all rays unbranched. Pelvic fin relatively small, with elongate filamentous soft rays [3rd ray of right fin only retained (tip broken; other rays broken near base)], its length 55.9% of SL; Fig. 3B].

**Coloration.** Transparent skin encasing body when fresh (Fig. 1A), becoming semi-transparent after preservation (Figs 1B–D, 2), entirely covered with numerous minute brown melanophores. Inner surface of head and body brownish, entirely covered with numerousstellate brown melanophores. Eye dark blue. Illicial and 2nd dorsal-fin spine semi-transparent, with scattered minute brown melanophores. Dorsal-fin soft-rayed portion and anal fin semi-transparent, with dense melanophores on membranes. Pectoral fin base with scattered minute brown melanophores; rays with few scattered melanophores, membranes semi-transparent without melanophores. Pelvic fin semi-transparent, with minute brown melanophores scattered on membranes along rays; filamentous portion of pelvic-fin ray partially brownish. Caudal fin semi-transparent covered with minute brown melanophores on basal portion; minute melanophores densely covered with membranes along rays.

**Distribution.** The species has been collected from the central East China Sea, northern South China Sea (east of Hainan Island) and Indonesia (off Java) (Ni et al. 2012; Ho et al. 2016; this study) (Fig. 4). Two Indonesian specimens, reported by Ho et al. (2016) as *S. cf. zhui*, were identified herein as *S. zhui* (see below). Adults of the species were collected in depths of 655–979 m (Ni et al. 2012; Ho et al. 2016), whereas the present juvenile specimen was collected on the continental shelf (100–115 m depth), suggesting that the pelagic juvenile of the species have a shallower bathymetric distribution before settlement.

**Identification.** The present juvenile specimen was assigned to Lophiidae, differing from currently known larvae and juveniles of other lophiform families by having 4 dorsal-fin spines (3 in Antennariidae), smooth body skin (covered with spinules in Chaunacidae and Ogcocephalidae), and developed pelvic fins [absent in ceratioid families, except for *Caulophryne* Goode and Bean, 1896 (Caulophrynidae)] (see Pietsch 1984; Bertelsen 1984; Pietsch 2009; Okiyama 2014b).

Among lophiid genera, the specimen conformed to *Sladenia* in both meristic counts, and having a rounded head and body, and undeveloped head spines (Table 3), compared with larvae and juveniles of other lophioid genera, including
Lophius Linnaeus, 1758, Lophiodes Goode and Bean, 1896 and Lophiomus Gill, 1883, generally characterized as having a moderately depressed head with relatively well developed spines, and laterally compressed body (Caruso 1983; Everly and Caruso 2003; Okiyama 2014c; Okiyama and Minami 2014a, b; this study: Fig. 5). The genetic analysis also supported the generic identification of the present specimen (see below).

The specimen was further identified as S. zhui, due to having 4 dorsal-fin spines (2 post-cephalic spines), compared with 3 dorsal-fin spines (1 post-cephalic spine) in S. remiger and S. shaefersi (Table 4). Although similar to S. gardineri in meristic counts, Ni et al. (2012) distinguished S. zhui from the former due to the wider snout, sturdy blunt head spines, and uniformly brown body without vermiculations or other contrasting markings in the latter. Although such distinguishing characters were absent in the juvenile specimen, the genetic similarity between it and a published sequence of S. gardineri (see Genetic analysis), and the disjunct distribution of the two species (S. gardineri, central Indian Ocean; Table 4), pointed to the former being S. zhui.

Genetic analysis. A Bayesian phylogenetic tree based on a concatenated alignment of 12S, 16S and COI sequences (626, 564 and 648 bp, respectively, including gaps) is shown in Fig. 6A. Among the 39 lophiiform species subjected to the analysis, S. gardineri was most closely related to the present specimen, supporting its generic identification. On the other hand, the overall tree topology was largely consistent with that of Miya et al. (2010), who analyzed the complete mitogenome sequences (ca. 16,000 bp) of the same 39 species (each of five suborders being recovered as monophyletic). Such consistency implied that the present analysis had successfully resolved the phylogenetic relationships among lophiiform species to some extent, despite the limited lengths of the sequences analyzed.

A second Bayesian phylogenetic tree based on a reduced dataset [a 598 bp (including gaps) alignment of 12S sequences from six lophioid specimens, including both the present juvenile specimen and HUMZ 191110 (S. cf. zhui sensu Ho et al. 2016)], is shown in Fig. 6B. Notably, the latter two specimens possessed identical sequences, being clearly separated from other tree branches. On this basis, together with their similarity in meristic counts, the present juvenile and S. cf. zhui (sensu Ho et al. 2016) specimens can be safely considered as conspecific.

Remarks. Sladenia zhui was originally described by Ni et al. (2012) on the basis of four specimens collected from the northern South China and central East China Seas, the species having previously been reported as S. remiger or S. gardineri by Ni (1988) and Su (2002) (see synonym list). Ho et al. (2016) subsequently reported two specimens collected off Java, Indonesia as C. cf. zhui (Fig. 7C, D), commenting that they differed slightly from the original description of the species, having a narrower snout (mostly due to a different measurement method). Meristic and morphometric data of the Indonesian specimens are given in Table 2. However, since all congeners are known from only a few specimens of each, intraspecific variations and interspecific differences between them are poorly known (Caruso and Bullis 1976; Ho 2015).

Larval or juvenile Sladenia specimens have not previous-
Pelagic juvenile of \textit{Sladenia zhui} has never been reported (Richards 1990; Everly and Caruso 2003). In his comprehensive work, entitled "An atlas of early stage fishes in Japan," Okiyama (2014b) provided keys to larval stages of the lophiiform suborders, and stated that Ceratioidei differed from the other suborders by having an inflated, balloon-like skin surrounding the body, and the pelvic fin absent. The juvenile \textit{Sladenia} specimen also had the former feature. In addition, the latter also possessed the following external adult \textit{Sladenia} features (Fig. 7C, D): rounded head and body [depressed in adults of other lophiid genera (Fig. 7A, B)], and absence of distinct humeral, articular, quadrate and subopercular spines (present) (see Caruso 1985).

The fin rays of the present juvenile are considered to reach the full complement in number (Table 2). A difference of the number of caudal-fin rays between the juvenile specimen (8) and adults (9) is regarded here as an intraspecific variation. A series of larvae and juvenile examples are necessary to reveal the development of the numbers of fin rays in the species.

\textit{In-situ} observations of \textit{Sladenia} from seamounts around the Ogasawara Islands, Japan, archived in the Japan Agency for Marine-Earth Science and Technology data base [JAMSTEC E-library of Deep-sea Images (J-EDI)], showed several \textit{Sladenia} individuals characterized by vermiculate markings on the body (e.g., J-EDI: HPD0747HDTV0088). Similarly, a \textit{Sladenia} individual reported by Senou (2012) as “Chaunacidae gen. et sp. 2” from the Mokuyo Seamount (Ogasawara Islands) also had a vermiculate pattern. Such body markings have been regarded as a diagnostic feature of \textit{Sladenia} species (Caruso and Bullis 1976; Ni et al. 2012; Table 4). \textit{In-situ} images of \textit{S. shaefersi} in the Gulf of Mexico showed obvious widespread vermiculations on the body (Pietsch et al. 2013), and the drawing of the 500 mm TL-holotype of \textit{S. gardineri} also showed maze-like vermiculations on the body (Regan 1908: pl. 32). In contrast, adults of \textit{S. zhui} have a uniformly brownish body without vermiculations (Ni et al. 2012: fig. 1; Ho et al. 2016: fig. 1; Fig. 7C, D), suggesting that the \textit{in-situ} images and footage of \textit{Sladenia} from the Ogasawara Islands were not consistent with \textit{S. zhui}. Although Caruso and Bullis (1976) stated that \textit{S. remiger} lacked vermiculations or other contrasting markings, as originally described by Smith and Radcliffe in Radcliffe (1912), an underwater photograph of \textit{S. remiger}, reported by Chave and Mundy (1994) from the Hawaiian Islands, showed dark vermiculations on a whitish body. Ho (2015) reported an underwater photograph of \textit{S. cf. remiger} from the Kermadec Ridge, with similar vermiculations, suggesting that the specimen may have represented an undescribed species.

The new Japanese names “Daruma-ankou-zoku” and

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**Table 4. Distribution and selected diagnostic characters of \textit{Sladenia} species.**

<table>
<thead>
<tr>
<th></th>
<th>\textit{S. zhui}</th>
<th>\textit{S. gardineri}</th>
<th>\textit{S. remiger}</th>
<th>\textit{S. shaefersi}</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distribution</strong></td>
<td>East and South China Seas and Indonesia</td>
<td>Chagos Archipelago (central Indian Ocean)</td>
<td>Western and Central Pacific</td>
<td>Western Atlantic</td>
</tr>
<tr>
<td><strong>Size (mm SL)</strong></td>
<td>23.1–525 ((n=4))</td>
<td>351</td>
<td>92.3</td>
<td>146.2–397 ((n=4))</td>
</tr>
<tr>
<td><strong>Dorsal-fin spines</strong></td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Post-cephalic dorsal-fin spines</strong></td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Dorsal-fin soft rays</strong></td>
<td>9 or 10</td>
<td>9</td>
<td>9</td>
<td>8 or 9</td>
</tr>
<tr>
<td><strong>Anal-fin rays</strong></td>
<td>6 or 7</td>
<td>6</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td><strong>Pectoral-fin rays</strong></td>
<td>18 or 19</td>
<td>18</td>
<td>19</td>
<td>17 or 18</td>
</tr>
<tr>
<td>** Vermiculate body pattern**</td>
<td>absent</td>
<td>present</td>
<td>absent?</td>
<td>present</td>
</tr>
</tbody>
</table>

1, this study; 2, Ni et al. (2012); 3, Ho et al. (2016); 4, Caruso and Bullis (1976); 5, Ho (2015); 6, Prokofiev and Kukuev (2009); 7, Sepúlveda et al. (2013).
“Daruma-ankou” are proposed herein for the genus Sladenia and S. zhui, respectively, such names being derived from a combination of the overall rounded body of the species (=daruma), plus the Japanese name for lophiid fishes (=ankou); “zoku” refers to “genus”.

Comparative material examined

Lophius litulon (Jordan, 1902): FAKU 109453, 3 specimens, 19.0–26.6 mm SL, Japan (further locality unknown), 1960’s; FAKU 137621, 32.4 mm SL, off Miyazu, Kyoto Prefecture, Japan, 8 May 2015; KUN-P 50268, 196.4 mm SL, off Saikazaki, Wakayama Prefecture, Japan, 27 February 2019. Sladenia zhui: HUMZ 191110, 271.5 mm SL, off Java, Indonesia, 08°40.3’S, 111°15.5’E–08°45.5’S, 111°14.2’E, 680–706 m depth, 10 September 2004; HUMZ 191516, 278.2 mm SL, off Java, Indonesia, 08°20.1’S, 109°54.2’E–08°19.3’S, 109°53.3’E, 850–916 m depth, 12 September 2004.

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Fig. 6. Bayesian phylogenetic trees of (A) Lophiiformes, based on 1838 bp of concatenated sequences of 12S rRNA, 16S rRNA and Cytochrome c Oxidase subunit I genes; and (B) Lophioidae, based on 598 bp of 12S rRNA gene sequences. Numbers beside nodes represent Bayesian posterior probabilities.

Fig. 7. Preserved adult specimens of Lophius litulon (A, B) and Sladenia zhui (C, D) in dorsal (A, C) and lateral (B, D) views. (A, B) KUN-P 50268, 196.4 mm SL, Wakayama Prefecture, Japan; (C, D) HUMZ 191516, 278.2 mm SL, off Java, Indonesia.
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