

Southernmost record of the starry pipefish *Halicampus punctatus* (Syngnathiformes: Syngnathidae)

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Abstract

The starry pipefish *Halicampus punctatus*, formerly known only from Japan and Korea, is reported herein in Taiwan for the first time; this represents the southernmost record of this species. The sole specimen was captured off Pengjia Islet, Northern Taiwan on 19 August 2021 and can be distinguished from local congeners by its blue spots on the dorsal side and upper lateral trunk, as well as its 14 upturned, U-shaped, black marks on the lower later trunk.

Introduction

The genus *Halicampus* Kaup 1856 (Syngnathiformes: Syngnathidae), a group of small pipefishes (standard length [SL]<200 mm), contains 12 valid species (Froese & Pauly, 2021) that are mostly restricted to shallow estuaries, tidal pools, seagrass beds, beaches, and coral reef environments in tropical and subtropical waters in the Indian and Pacific Oceans (Froese & Pauly, 2021); however, *H. punctatus* is commonly found in subtropical and sometimes temperate

waters (Takata & Sasaki, 2001). Five of the twelve species can be found in Taiwan (Chen, 2017; Shao, 2021): *H. brocki* Kaup 1856, *H. dunckeri* Chabanaud 1929, *H. grayi* Jordan & Seale 1906, *H. macrorhynchus* Bamber 1915, and *H. spinirostris* Dawson & Allen 1981). However, Taiwanese pipefishes are not well represented in museum collections, possibly due to their keen hiding abilities and excellent camouflage; indeed, they are rarely spotted in fish markets or while diving/snorkeling.

Halicampus spp. can be differentiated from other Syngnathidae genera by having a combination of the following morphological characteristics: rounded caudal fin; tail not prehensile; superior trunk and tail ridges discontinuous below base of dorsal fin; inferior and tail ridges discontinuous; trunk ridge on subdorsal rings arched dorsally; trunk rings between 13-18 (Chen, 2017). They also possess everted brood pouches, dermal “folds” extending ventromedially towards or even joining the midline of the tail (Herald, 1959; Wilson et al., 2001). Recently a male pipefish was captured off Pengjia Islet, Northern Taiwan by a trawling vessel and subsequently collected at Daxi Fish Market, Yilan, Northeastern Taiwan. Morphological characters of this specimen suggest that it is *H. punctatus* Kamohara 1952, which has never before been reported in Taiwan. The objective of this study was to describe this new Taiwanese record, which reflects the southernmost distribution of this species.

Materials and methods

Measurements, counts, and terminology mostly followed Dawson (1977). Length of the specimen was measured to the nearest 0.1 mm using digital calipers. Measurements of other morphological characters were expressed as relative to (i.e., % of) SL or head length (HL). After measurements and imaging, the specimen was immersed in 10%

formalin in seawater for 24 hr prior to preservation in 70% ethanol; it was then deposited in the collection of the Department of Environmental Biology and Fisheries Science, National Taiwan Ocean University, Keelung, Taiwan (EBFS 06022). Morphometric and meristic data from Takata and Sasaki (2001), Chen (2017) and Araki et al. (2019) were obtained for comparison (in some cases converting published data to % of SL to facilitate comparisons).

Results

Halicampus punctatus Kamohara 1952 (Figs. 1A-B & Table 1)

Material examined. EBFS 06022 (132.5 mm SL), male, off Pengjia Islet, Northern Taiwan, depth ca. 150 m, 19 August 2021.

Description. Rings 14+35=49, subdorsal rings 0.75+3=3.75; dorsal fin rays 20; pectoral fin rays 15; anal fin rays 4; caudal fin rays 9. Body very elongate and thin/tube-like; scales absent, body encased with highly modified skeleton; superior trunk ridge discontinuous with superior tail ridge below dorsal fin base (trunk ridge distinctly arched on subdorsal rings); lateral trunk ridge connects to inferior tail ridge after anal ring; lateral tail ridge present; margin of ridges smooth. Mouth small and without teeth; median dorsal snout ridge remarkably low, serrated, and continuously extending towards anterior margin of orbit; lateral snout ridge absent; interorbital narrow and hollow; dorsal

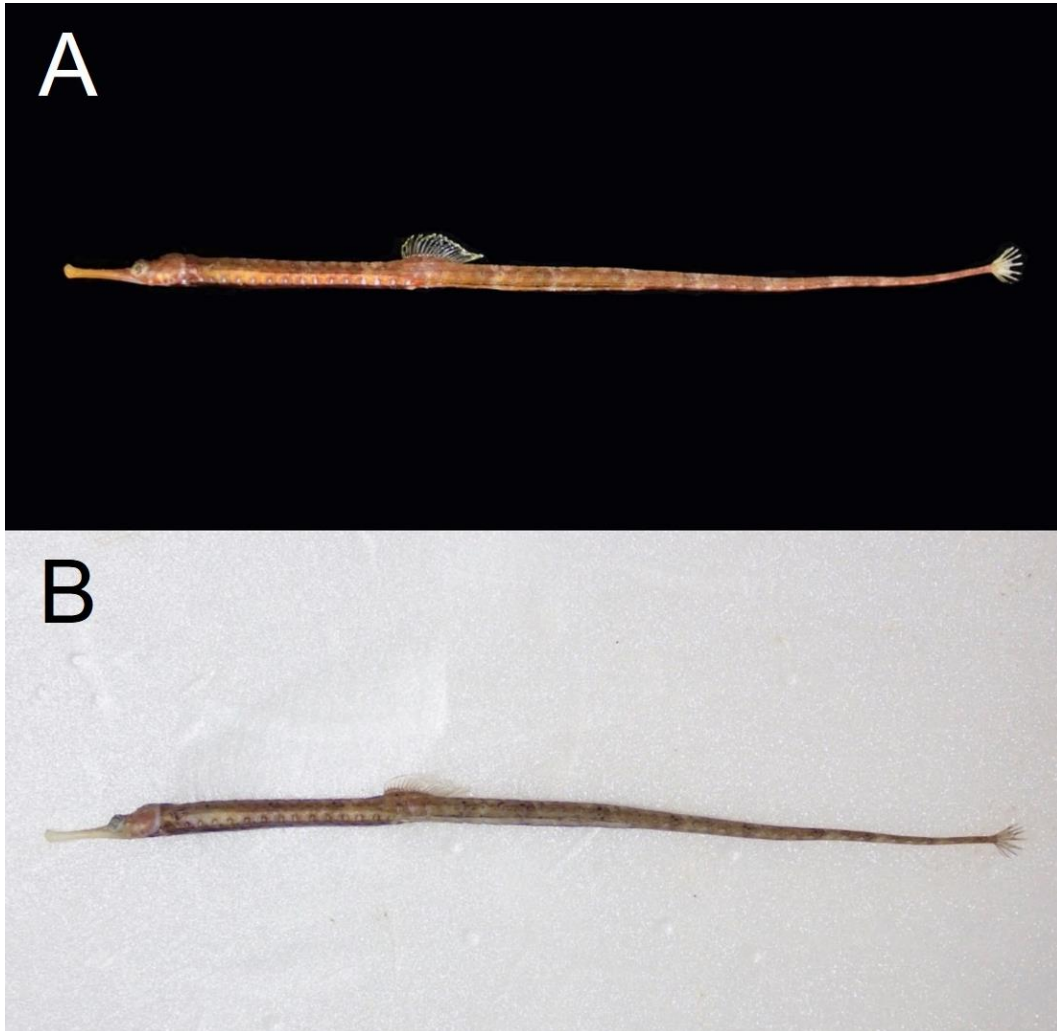


Fig. 1. Coloration of *Halicampus punctatus* (EBFS06022, 132.5 mm SL) from Northern Taiwan. **A.** fresh, **B.** preserved.

profile of orbit weakly ascending; supraorbital and frontal ridge rudimentary; opercular and supraopercular ridges low; pectoral fin base convex with two ridges (the dorsal ridge barely discernable & the ventral ridge distinct); dermal flaps very short and sparsely distributed along head and body; brood pouch occupying 1st to 13th tail rings; no pouch plates; dermal

pouch folds developing ventromedially but not reaching the ventral midline; eggs absent.

Coloration. When fresh (Fig. 1A), body generally pale yellow, with 13 dark brown bars (4 on trunk) about 3-4 rings wide; snout mostly dark yellow, dorsal side lighter, posteroventral part gradually white, dorsoposterior part with three pairs of

Table 1. Morphometric and meristic data of *H. punctatus* from the present study and other publications. SL and HL=standard and head length, respectively. “-”=no data.

Reference	<i>H. punctatus</i>		<i>H. gravi</i> Chen (2017)	<i>H. macrohynchus</i> Chen (2017)	<i>H. mataiafae</i> Chen (2017)	<i>H. spinirostris</i> Chen (2017)		
	This study	Araki et al. (2019)					Takata & Sasaki (2001)	Chen (2017)
catalog number	EBFS06022	KAUM-I-115442	KAUM-I-124297	BSKU 1776 (holotype)	Non-types (n=16)	ASIZP0055353, ASIZP0055562, ASIZP0064374, ASIZP0070457, NTMP0853, NTUM04219	ASIZP0055212	ASIZP0062025
Location	Taiwan	Japan	Japan	Japan	Japan	Taiwan	Taiwan	Taiwan
SL	132.5	90.4	40.6	160.9	115-150	Taiwan 100-211	100.6	107.4
HL	17.6	12.1	6	19.4	-	11-15	2	2.5
Counts								
Trunk rings	14	14	15	14	14	16	14	13
Tail rings	35	35	35	35	33-35	35-36	34	35
Subdorsal rings	0.75+3	0.75+2.75	1.75+2.25	0.25+3.5	0.75-1.25 +2.25-3	-	-	-
Pectoral fin rays	15	14	15	14	14-15	15-18	15	13
Dorsal fin rays	20	20	20	20	20-21	17-30	20	19
Anal fin rays	4	4	4	4	3-4	2-5	-	4
Caudal fin rays	9	9	9	9	9	8-10	8	11
Measurements (% of SL)								
Trunk length	23.2	25.9	26.4	-	-	-	-	-
Trunk depth	2.7	2.9	3.1	-	-	3.1-3.9	3.6	4.1
Trunk width	3.2	3.4	3.3	-	-	-	-	-
Tail length	62.3	61.4	57.8	-	-	57.7-62	64.5	63.9
Anal ring depth	3.1	2.5	2.1	-	-	-	-	-
Pectoral fin length	1.5	3.0	2.2	-	-	-	-	-
Pectoral fin base length	1.2	1.5	1.4	-	-	-	-	-
Dorsal fin height	2.1	3.5	2.9	-	-	-	-	-
Dorsal fin base length	6.3	5.9	6.0	-	-	5.4-8.4	8.3	10.1
Caudal fin length	3.0	3.7	3.9	-	-	1.7-2.6	1.1	1.6
Measurements (% of HL)								
Head width	23.6	24.6	19.0	-	-	-	-	-
Snout length	53.1	51.5	45.6	55.7	-	27.1-35.5	26.6	25.4
Snout depth	9.6	6.7	8.8	7.2	-	6.6-16.1	17.3	15.1
Orbit diameter	13.4	17.9	16.3	-	-	21.5-27	15.6	19.4
Interorbital width	6.0	8.2	-	-	-	8.3-13	7.1	22.1

small, light blue, closely packed spots; anterior part of orbit with one brownish-gold bar extending downwards towards the suborbital area; dorsal part of head posterior to orbit, with a pair of light blue spots; lower half of operculum with three distinct, brownish-gold bars; gular region with a distinct, large, circular, black spot; lateral side of trunk below lateral ridge darker, with an upturned, U-shaped black mark on each ring (each mark encircling a white spot), ending before the anal ring; several rows of blue spots present randomly on dorsal and lateral sides of trunk and tail; ventral side of trunk uniformly dark brown, contrastingly pale from anal ring to the posterior end of the brood pouch (pale yellow after end of brood pouch); brood pouch light yellow; all fins mostly colorless, though caudal fin with inconspicuous black membrane. When preserved (Fig. 1B), body generally pale grey; ventral side of trunk black; all formerly blue spots black.

Distribution. Formerly known only from Japan and Korea (Kim et al., 2006), mostly along the Southern coast of Japan (Takata & Sasaki, 2001; Araki et al., 2019) but also in the Sea of Japan (off Yamagata Prefecture; Honma, 1959). The distribution of this species now extends south into Northern Taiwan.

Discussion

With the addition of our new record,

half of all *Halicampus* species can be found in Taiwan. Morphological characters of our specimen are mostly consistent with others (Table 1). *Halicampus punctatus* can be readily distinguished from the five Taiwanese congeners by its body coloration (blue spots on dorsal & upper lateral trunk with 14 upturned, U-shaped black marks on lower lateral trunk). It also differs from other Taiwanese congeners (except *H. macrorhynchus*) in having a remarkably longer snout (45.6-55.7% vs 25.4-35.5% HL), a shallower trunk (2.7-3.1% vs 3.1-4.1% SL), and a longer caudal fin (3-3.9% vs 1.6-2.6% SL). *Halicampus punctatus* can be distinguished from *H. macrorhynchus* by having much shorter dermal flaps (vs. long & leaf-like dermal flaps), more tail rings (33-35 vs. 25), fewer pectoral fin rays (14-15 vs. 18), more dorsal fin rays (20-21 vs. 18), a shallower trunk (2.7-3.1% vs. 5.1% SL), a much longer tail (57.8-62.3% vs. 50.6% SL), a much longer caudal fin (3-3.9% vs. 1.1% SL), and a wider interorbital area (6-8.2% vs. 3.6% HL).

Chen (2017) examined one specimen of *H. dunckeri* and counted 21 trunk rings and 47 tail rings; these values are not within the range of *Halicampus* (13-18 trunk rings & 25-42 tail rings). Although it cannot be known from the photograph of the specimen of Chen (2017), it is more likely to be *Trachyrhamphus* sp. given its relatively longer snout (in addition to the

higher number of trunk & tail rings). As such, we did not include this specimen in Table 1. Chen et al. (2010) made a confirmed record (photograph) of *H. dunckeri* in Southern Taiwan, yet no voucher specimen is available.

Halicampus punctatus is the only species in the genus that has never been found in tropical waters; Takata and Sasaki (2001) examined a specimen from Okinawa's Haneji River (Japan), yet the actual locality of that specimen is questionable as they mentioned. *H. punctatus* is also the deepest-dwelling species in the genus: 100-150 m (Takata & Sasaki, 2001; Froese & Pauly, 2021). This depth is consistent with the depth-at-capture of our specimen. That said, shallow-water records exist (e.g., Araki et al., 2019). Whether this species proves to be more commonly observed in Taiwanese waters in the future and has to date been over-looked due to its camouflage and cryptic nature, or, alternatively, if our record reflects an individual that has become displaced remains to be determined (Chou & Tang, 2021).

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