



Article

Description of *Stolephorus horizon* n. sp. from Fiji and Tonga, and redescription of *Stolephorus scitulus* (Fowler, 1911) (Teleostei: Clupeiformes: Engraulidae)[†]

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Abstract: The new anchovy *Stolephorus horizon* n. sp., described on the basis of 34 specimens collected from Fiji and Tonga, has been previously confused with *Stolephorus indicus* (van Hasselt, 1823) or *Stolephorus scitulus* (Fowler, 1911). However, the new species differs from both of the latter in having the pectoral fin without melanophores, and a unique range of gill rakers. A redescription of *S. scitulus* and an identification key of species previously identified as *S. indicus* are also provided.

Keywords: Actinopterygii; Clupeomorpha; *Stolephorus indicus*



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1. Introduction

Stolephorus Lacepède, 1803, an Indo-Pacific genus of marine and/or brackish water anchovies (Clupeiformes: Engraulidae), was reviewed by Whitehead et al. (1988) [1], who recognized 18 valid and 1 undescribed species (currently, the genus comprises at least 44 valid species [2]). In that review, species characterized by a short maxilla, posteriorly just reaching or extending slightly beyond the anterior margin of preopercle, the depressed pelvic fin posteriorly not reaching to vertical through the dorsal-fin origin, 6 or fewer pelvic scutes on the abdomen, and 28 or fewer gill rakers on lower limb of first arch (1LGR) had been treated as a single, widely-distributed Indo-Pacific species, *Stolephorus indicus* (van Hasselt, 1823) (Figure 1). Subsequently, Hata et al. (2021) [3] showed that the latter included five species [viz., *Stolephorus balinensis* (Bleeker, 1849), *Stolephorus belaerius* Hata, Lavoué and Motomura, 2021, *Stolephorus commersonnii* Lacepède, 1803, *S. indicus*, and *Stolephorus scitulus* (Fowler, 1911)]. In addition, Hata et al. (2023) [2] described a new species from the Red Sea, *Stolephorus meteorum* Hata, Lavoué, Bogorodsky, Alpermann, and Motomura 2023, which had also been previously confused with *S. indicus*. As the investigation of *Stolephorus* progressed, specimens from Fiji and Tonga, treated as *S. scitulus* by Hata et al. (2021) [3], were found to differ significantly from true *S. scitulus* (confirmed herein as restricted to Society Islands) in several characters, including pectoral fin without melanophores and lower gill-raker counts. In the present study, specimens previously identified as *S. indicus* or *S. scitulus* from Fiji and Tonga are described as a new species of *Stolephorus*, bringing the number of species represented by specimens identified as *S. indicus* by Whitehead et al. (1988) [1] to at least seven. An identification key to these seven species is provided.

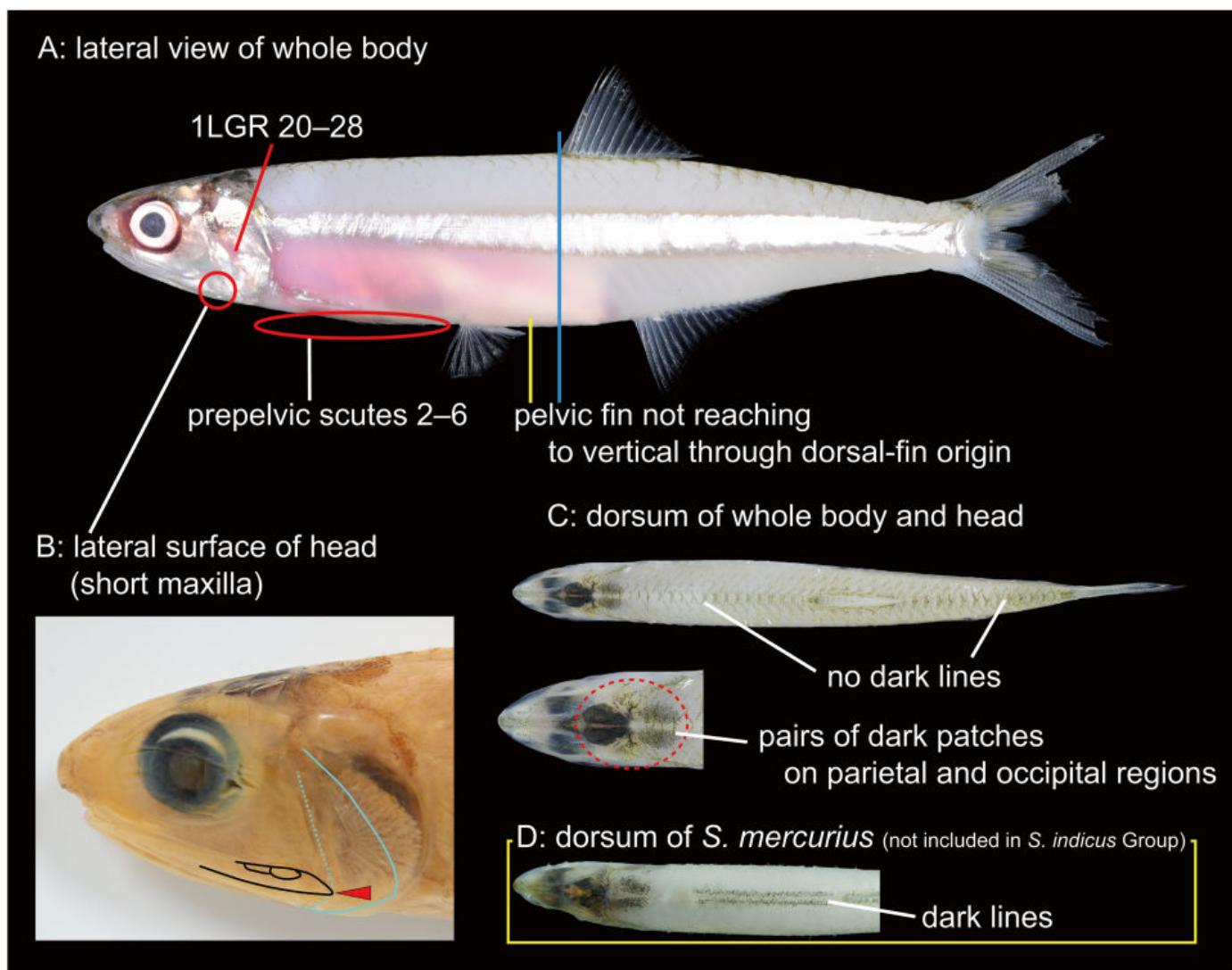


Figure 1. (A–D) Diagnostic characters of *Stolephorus indicus* Group. (A) Lateral view of whole body; (B) lateral surface of head (black line indicates posterior part of maxilla; red triangle indicates posterior tip of maxilla, just reaching anterior margin of preopercle; light green and broken lines indicate anterior and posterior margins of preopercle, respectively); (C) dorsal views of whole body and head; and (D), dorsal view of dorsum anterior to dorsal fin of *Stolephorus mercurius* (not included in *S. indicus* Group, double lines on dorsum). (A *Stolephorus balinensis*, KAUM-I. 110261, 114.0 mm SL, southwestern Taiwan; B USNM 26167, holotype of *Stolephorus horizon* n. sp., 97.8 mm SL, Viti Levu, Fiji; C *S. balinensis*, KAUM-I. 123286, 82.3 mm SL, Miyazaki Prefecture, Japan; and D holotype of *S. mercurius*, KAUM-I. 80755, 84.7 mm SL, Panay Island, Philippines).

2. Materials and Methods

Counts and proportional measurements followed Hata and Motomura (2017) [4]. All measurements were made to the nearest 0.01 mm using digital calipers. “Pelvic scute” refers to a scute joined to the pelvic girdle, and “prepelvic scute”, “postpelvic scute”, and “predorsal scute” to hard spine-like scutes anterior to the pelvic fin, posterior to the pelvic fin, and just anterior to the dorsal-fin origin, respectively. Abbreviations are as follows—SL: standard length; HL: head length; and UGR, LGR and TGR: rakers on upper limb, lower limb, and total gill rakers, respectively, with associated numbers indicating the specific gill arch. Institutional codes follow Sabaj (2020) [5]. Seven species identified as *S. indicus* by Whitehead et al. (1988) [1] (e.g., *S. balinensis*, *S. belaeirus*, *S. commersonnii*, *S. indicus*, *S. meteorum*, *S. scitulus*, and *S. horizon* n. sp.) are included as the *S. indicus* Group.

3. Results

Stolephorus scitulus (Fowler, 1911)

[English name: Southern Anchovy]

Figures 2 and 3A; Tables 1 and 2

Engraulis indicus (not of van Hasselt): Günther 1909 [6]: 377 (Tahiti).

Anchovia scitula Fowler, 1911 [7]: 211, fig. 2 [type locality: San Diego, CA, USA (in error; see Remarks)].

Stolephorus insularum Jordan and Seale, 1926 [8]: 381 (type locality: Tahiti)

Stolephorus indicus (not of van Hasselt): Wongratana 1987 [9]: 7 (in part: Tahiti); Whitehead et al., 1988 [1]: 412 (in part: Tahiti); Wongratana et al., 1999 [10]: 1735 (in part: Tahiti).

Stolephorus scitulus: Hata et al., 2021 [2]: 357, fig. 19 (in part: Society Islands).



Figure 2. (A) Lateral view of holotype of *Anchovia scitula*, ANSP 1576, 84.3 mm SL, locality unknown; see Remarks under *Stolephorus scitulus*); (B) lateral view of holotype of *Stolephorus insularum* (MCZ 17936, 69.3 mm SL, Tahiti, Society Islands); (C) lateral, (D) dorsal, and (E) ventral views of non-type specimen of *S. scitulus* (USNM 327725, 90.2 mm SL, Society Islands).



Figure 3. Pectoral-fin rays of preserved specimens of (A) *Stolephorus scitulus* (USNM 327725, 77.2 mm SL, Society Islands; melanophores scattered on 4 uppermost fin rays); and (B) *S. horizon* n. sp. (USNM 327834, 102.7 mm SL, Fiji Islands, Fiji; no melanophores on pectoral fin).

Holotype. ANSP 1576, 84.3 mm SL, San Diego, CA, USA (in error), W.N. Lockington.

Other materials examined. A total of 45 specimens (47.6–102.7 mm SL), all specimens collected from Society Islands: BPBM 11294, 4 specimens, 98.6–102.7 mm SL, Papetoai Bay, near Kellum's Rock, Moorea; BPBM 13337, 3 specimens, 70.5–72.0 mm SL, Taravao, Tahiti, 0–3.5 feet (approx. 0–1.06 m) depth; MCZ 17936, holotype of *Stolephorus insularum*, 69.3 mm SL, Tahiti; MCZ 31540, paratypes of *Stolephorus insularum*, 2 specimens, 62.2–76.1 mm SL, Tahiti; USNM 327722, 5 of 29 specimens, 67.2–74.3 mm SL, Port Phaeton, Tahiti. USNM 327725, 30 of 115 specimens, 47.6–85.9 mm SL, Society Islands.

Diagnosis. A species of *Stolephorus* with the following combination of characters: maxilla 14.9–17.0% of SL (mean 16.1%), 64.5–70.7% (68.6%) of HL, its posterior tip just reaching or extending slightly beyond anterior margin of preopercle; posterior margin of preopercle convex, rounded; no predorsal scutes; prepelvic scutes 2–5 (modally 4); pelvic scute without spine; dorsal fin with 3 unbranched and 12–14 (13) branched rays; anal fin with 3 unbranched and 15–18 (16) branched rays, its origin located just below base of 9th to 12th dorsal-fin ray; 1UGR 18–20 (19), 1LGR 25–28 (27), 1TGR 44–48 (45); 2UGR 12–14 (13), 2LGR 22–25 (24), 2TGR 35–39 (37); 3UGR 9–12 (11), 3LGR 13–16 (14), 3TGR 23–27 (25); 4UGR 7–10 (8), 4LGR 10–12 (11), 4TGR 18–22 (20); 4–7 (5) gill rakers on posterior face of third gill arch; transverse scales 8; pseudobranchial filaments 19–25 (23); total vertebrae 41–43 (42); scale rows in longitudinal series 38–40 (39); head 22.3–24.9% (23.5%) of SL; body depth 14.6–16.9% (mean 16.1%) of SL; pelvic fin 7.4–10.0% of SL (9.0%), 32.9–42.2% (38.3%) of HL, tip of depressed pelvic fin not reaching posteriorly to vertical through dorsal-fin origin;

anal-fin base 15.0–17.9% (16.0%) of SL; distance between insertions of pectoral and pelvic fins 18.8–22.0% (20.0%) of SL; distance between origins of dorsal and anal fins 17.2–19.0% (18.2%) of SL; postorbital distance 10.4–12.0% (11.3%) of SL, 45.2–51.4% (48.2%) of HL; lower jaw 14.8–16.7% (15.6%) of SL; pairs of dark patches on parietal and occipital regions; no dark lines on dorsum (Figure 2D); melanophores scattered on 1st to 6th pectoral-fin rays from uppermost ray (Figure 3A).

Table 1. Meristics of specimens of *Stolephorus scitulus* and *Stolephorus horizon* n. sp.

	<i>Stolephorus scitulus</i>			<i>Stolephorus horizon</i> n. sp.		
	Holotype of <i>Anchoviella</i> <i>scitula</i>	Holotype of <i>Stolephorus</i> <i>insularum</i>	Other Specimens	Holotype	Paratypes	
	ANSP 1576	MCZ 17936	n = 44	USNM 261617	n = 33	
Standard Length (mm)	84.3	69.3	47.6–102.7	Modes ± SD	97.8	62.3–108.1 Modes ± SD
Dorsal-fin rays (unbranched)	3	3	3	3 ± 0	3	3
Dorsal-fin rays (branched)	13	13	12–14	13 ± 0.5	12	12–14
Anal-fin rays (unbranched)	3	3	3	3 ± 0	3	3
Anal-fin rays (branched)	16	17	15–18	16 ± 0.6	17	15–18
Pectoral-fin rays (unbranched)	1	1	1	1 ± 0	1	1
Pectoral-fin rays (branched)	13	13	12–14	13 ± 0.7	13	12–14
Pelvic-fin rays (unbranched)	1	1	1	1 ± 0	1	1
Pelvic-fin rays (branched)	6	6	6	6 ± 0	6	6
Gill rakers on 1st gill arch (upper)	19	19	18–20	19 ± 0.7	17	17–19
Gill rakers on 1st gill arch (lower)	26	28	25–28	27 ± 0.8	26	24–27
Gill rakers on 1st gill arch (total)	45	47	44–48	45 ± 1.1	43	41–46
Gill rakers on 2nd gill arch (upper)	13	13	12–14	13 ± 0.4	12	11–13
Gill rakers on 2nd gill arch (lower)	22	23	23–25	24 ± 0.8	23	21–24
Gill rakers on 2nd gill arch (total)	35	36	35–39	37 ± 0.9	35	33–37
Gill rakers on 3rd gill arch (upper)	11	11	9–12	11 ± 0.6	10	9–12
Gill rakers on 3rd gill arch (lower)	14	14	13–16	14 ± 0.6	13	12–14
Gill rakers on 3rd gill arch (total)	25	25	23–27	25 ± 0.9	23	21–25
Gill rakers on 4th gill arch (upper)	8	9	7–10	8 ± 0.7	8	7–9
Gill rakers on 4th gill arch (lower)	12	11	10–12	11 ± 0.5	11	10–11

Table 1. Cont.

	<i>Stolephorus scitulus</i>			<i>Stolephorus horizon</i> n. sp.		
	Holotype of <i>Anchoviella</i> <i>scitula</i>	Holotype of <i>Stolephorus</i> <i>insularum</i>	Other Specimens	Holotype	Paratypes	
	ANSP 1576	MCZ 17936	n = 44	USNM 261617	n = 33	
Standard Length (mm)	84.3	69.3	47.6–102.7	Modes ± SD	97.8	62.3–108.1 Modes ± SD
Gill rakers on 4th gill arch (total)	20	20	18–22	20 ± 0.9	19	17–20
Gill rakers on posterior face of 3rd gill arch	4	5	4–7	5 ± 0.7	4	3–6
Prepelvic scutes	4	3	2–5	4	3	3–5
Scale rows in longitudinal series	39	damaged	38–40	39 ± 0.7	39	38–40
Transverse scales	8	8	8	8 ± 0	8	8 ± 0
Pseudobranchial filaments	23	broken	19–25	23 ± 1.4	23	20–26
Total vertebrae	42	42	41–43	42 ± 0.5	42	41–43
Pectoral-fin rays with melanophores	2	7	1–7	5 ± 1.4	0	0

Table 2. Morphometrics of specimens of *Stolephorus scitulus* and *Stolephorus horizon* n. sp. Abbreviations—D–P1: Distance from dorsal-fin origin to pectoral-fin insertion; D–P2: distance from dorsal-fin origin to pelvic-fin insertion; D–A: distance between origins of dorsal and anal fins; P1–P2: distance between insertions of pectoral and pelvic fins; and P2–A: distance from pelvic-fin insertion to anal-fin origin.

	<i>Stolephorus scitulus</i>			<i>Stolephorus horizon</i> n. sp.		
	Holotype of <i>Anchoviella</i> <i>scitula</i>	Holotype of <i>Stolephorus</i> <i>insularum</i>	Other Specimens	Holotype	Paratypes	
	ANSP 1576	MCZ 17936	n = 44	USNM 261617	n = 33	
Standard Length (mm; SL)	84.3	69.3	47.6–102.7	Means ± SD	97.8	62.3–108.1 Means ± SD
As % SL						
Head length (HL)	23.1	broken	22.3–24.9	23.5 ± 0.6	24.4	22.6–25.2
Body depth	15.8	15.1	14.6–16.9	16.1 ± 0.6	18.6	16.4–18.5
Pre-dorsal fin length	56.8	54.6	51.5–55.9	54.0 ± 1.1	56.6	52.9–56.4
Snout tip to pectoral-fin insertion	24.6	25.3	23.7–26.6	24.9 ± 0.6	25.3	24.3–26.7
Snout tip to pelvic-fin insertion	46.2	45.2	42.9–45.9	44.4 ± 0.8	44.8	43.1–46.2
Snout tip to anal-fin origin	65.1	65.6	60.1–63.9	62.5 ± 1.1	62.5	60.4–65.2
Dorsal-fin base length	13.1	13.6	12.8–14.7	13.8 ± 0.5	13.3	12.4–14.5
Anal-fin base length	15.5	16.9	15.0–17.9	16.5 ± 0.7	16.2	15.0–17.5
Caudal-peduncle length	22.3	21.4	19.7–23.4	21.9 ± 0.9	21.6	20.4–23.6
Caudal-peduncle depth	6.4	6.9	7.0–8.6	7.6 ± 0.4	7.9	6.8–9.0

Table 2. Cont.

	<i>Stolephorus scitulus</i>			<i>Stolephorus horizon</i> n. sp.		
	Holotype of <i>Anchoviella</i> <i>scitula</i>	Holotype of <i>Stolephorus</i> <i>insularum</i>	Other Specimens	Holotype	Paratypes	
	ANSP 1576	MCZ 17936	n = 44	USNM 261617	n = 33	
Standard Length (mm; SL)	84.3	69.3	47.6–102.7	Means ± SD	97.8	62.3–108.1
D-P1	34.2	34.1	31.0–35.4	33.4 ± 1.0	35.2	32.3–36.0
D-P2	17.2	17.8	16.9–20.7	18.9 ± 1.0	21.7	17.3–21.7
D-A	16.9	18.0	17.2–19.0	18.2 ± 0.5	20.1	18.4–19.8
P1–P2	20.8	21.9	18.8–22.0	20.0 ± 0.7	20.6	18.8–22.1
P2–A	18.6	19.8	16.4–19.8	18.3 ± 0.9	18.5	16.3–20.1
Pectoral-fin length	broken	broken	11.8–14.3	13.2 ± 0.6	broken	11.8–13.8
Pelvic-fin length	broken	broken	7.4–10.0	9.0 ± 0.6	8.3	8.0–9.9
Maxilla length	14.9	16.2	15.2–17.0	16.1 ± 0.5	16.9	14.7–17.2
Lower-jaw length	15.6	15.8	14.8–16.7	15.6 ± 0.4	15.8	14.6–16.7
Postorbital length	10.4	broken	10.7–12.0	11.3 ± 0.4	12.2	11.2–12.1
Supramaxilla end to maxilla end	1.4	2.0	1.7–2.5	2.1 ± 0.2	2.2	1.5–2.6
1st dorsal-fin ray length	1.7	1.1	1.1–2.2	1.6 ± 0.3	1.1	1.0–2.1
2nd dorsal-fin ray length	broken	broken	5.8–7.5	6.9 ± 0.4	6.0	5.9–7.8
3rd dorsal-fin ray length	broken	broken	12.9–15.5	14.6 ± 0.8	broken	13.0–15.0
1st anal-fin ray length	1.7	1.4	0.7–1.8	1.4 ± 0.3	0.9	0.7–1.9
2nd anal-fin ray length	broken	broken	4.0–5.2	4.7 ± 0.4	broken	3.9–5.5
3rd anal-fin ray length as % of HL	broken	broken	9.0–12.0	10.9 ± 0.9	broken	10.4–11.1
Maximum orbit diameter	35.6	—	31.2–37.0	33.9 ± 1.6	33.6	30.6–37.1
Eye diameter	25.6	—	25.1–30.8	27.7 ± 1.9	27.8	24.4–30.4
Snout length	18.1	—	16.0–20.4	17.6 ± 0.8	18.5	15.5–19.3
Interorbital width	21.1	—	19.7–24.0	21.7 ± 0.8	21.6	19.8–23.8
Maxilla length	64.5	—	66.5–70.7	68.6 ± 1.2	69.3	64.7–70.4
Pelvic-fin length	broken	—	32.9–42.2	38.3 ± 2.0	33.9	34.0–39.5
Postorbital length	45.2	—	45.5–51.4	48.2 ± 1.4	50.1	44.9–52.3

Description. Data for holotype of *Anchovia scitula* Fowler, 1911 presented first, followed by data for other specimens in parentheses (if different). Counts and measurements, expressed as percentages of SL or HL, given in Tables 1 and 2. Body cylindrical, elongated, deepest at dorsal-fin origin. Caudal peduncle laterally compressed. Dorsal profile of head and body slightly convex from snout tip to dorsal-fin origin, body depth thereafter gradually decreasing to uppermost point of caudal-fin base. Ventral profile of head and body slightly convex from tip of lower jaw to pelvic-fin insertion, thereafter slowly rising to lowermost point of caudal-fin base. Abdomen rounded, covered with four (two to five) midventral spine-like scutes. Pelvic scute without spine. Postpelvic and predorsal scutes absent. Anus just anterior to anal-fin origin. Snout profile pointed, with rounded tip; snout length less than eye diameter. Mouth large, inferior, ventral to body axis, mouth gape extending backward beyond posterior margin of eye. Maxilla short, its posterior tip pointed, just reaching (slightly beyond or just reaching) anterior margin of preopercle. Lower jaw elongated. Single row of conical teeth on both jaws, palatine, and medial side of

pterygoid. Several conical teeth on vomer. No teeth on upper edge of hyoid. Several rows of conical teeth on upper edges of basihyal and basibranchial. Eye round, covered with adipose eyelid, positioned laterally on head above horizontal through pectoral-fin insertion, visible in dorsal view. Pupil round. Orbit elliptical. Nostrils close to each other, anterior to orbit. Posterior margin of preopercle convex, rounded. Subopercle and opercle with smoothly rounded posterior margins. Gill membrane without serrations. Interorbital space flat, width less than eye diameter. Pseudobranchial filaments present, longest filament shorter than eye diameter. Gill rakers long, elongated, rough, visible from side of head when mouth opened. Fine serrations on inner margin of gill rakers. Isthmus muscle long, reaching anteriorly to posterior margin of gill membranes. Urohyal hidden by isthmus muscle, not visible without dissection. Gill membrane on each side joined distally, most of isthmus muscle exposed, not covered by gill membrane. Scales on lateral surface of body deciduous (completely lacking in holotype). Head scales absent. Fins scaleless, except for broad triangular sheath of scales on caudal fin. Dorsal-fin origin posterior to vertical through base of last pelvic-fin ray, slightly posterior to mid-point of body. Dorsal and anal fins with three anteriormost rays unbranched. First dorsal- and anal-fin rays minute. Anteriormost three rays of both dorsal and anal fins closely adpressed. Anal-fin origin below base of 10th (9th to 12th) dorsal-fin ray. Posterior tip of depressed anal fin not reaching caudal-fin base. Pectoral fin inserted below body axis, uppermost ray unbranched. Posterior tip of pectoral fin not reaching pelvic-fin insertion. Dorsal, ventral, and posterior margins of pectoral fin straight. Pelvic fin shorter than pectoral fin, its insertion anterior to vertical through dorsal-fin origin. Tip of depressed pelvic fin not reaching to vertical through dorsal-fin origin. Caudal fin forked, tips of both lobes pointed.

Coloration of preserved specimens. Body uniformly pale tan, light ivory longitudinal band running just behind upper opercular margin to caudal-fin base (completely lost in some specimens). Melanophores scattered on snout, maxilla, and lower-jaw tip. Pairs of dark patches on parietal and occipital regions. No dark lines on dorsum before and after dorsal fin. Melanophores scattered along posterior margin of dorsal scale pockets. Fin rays transparent, colorless. Melanophores scattered along bases of dorsal and anal fins, along fin rays of dorsal and caudal fins, and anteriorly on anal fin. Scattered melanophores on 2nd (1st to 6th) pectoral-fin rays from uppermost ray (Figure 3A).

Distribution. *Stolephorus scitulus* is currently known only from Society Islands (Figure 4).

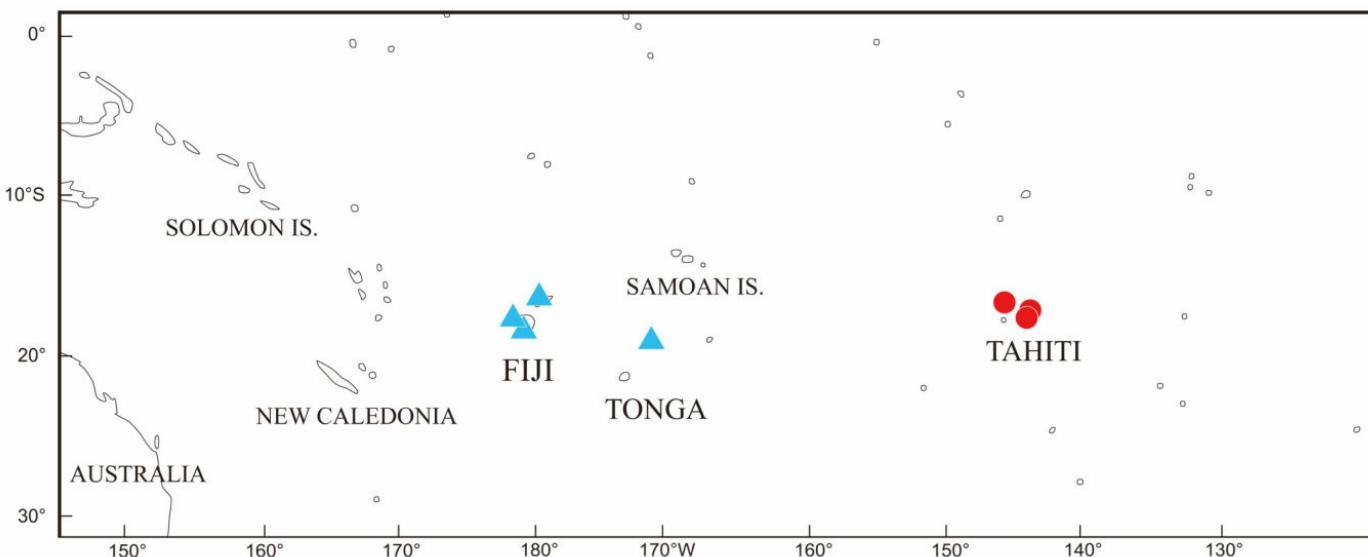


Figure 4. Distributional records of *Stolephorus scitulus* (red circles), and *S. horizon* n. sp. (blue triangles), based on specimens examined in this study.

Comparisons. *Stolephorus scitulus* is distinguished from all other congeners, except for species included in *Stolephorus indicus* Group by having a short maxilla just reaching or

extending slightly beyond the anterior margin of preopercle, a short pelvic fin not reaching to vertical through the dorsal-fin origin, and 1LGR < 29 [1–23]. Among them, *S. scitulus* differs from *S. balinensis*, *S. belaeirus*, *S. indicus*, and *S. meteorum* in having 44 or more 1TGR (vs. 43 or fewer; see table 3 in Hata et al. (2023) [2] for gill raker numbers in *S. balinensis*, *S. belaeirus*, *S. commersonnii*, *S. indicus*, and *S. meteorum*). *Stolephorus scitulus* further differs from *S. balinensis* in having a greater mean distance between the pectoral and pelvic fin insertions (18.8–22.0% in *S. scitulus* vs. 15.1–20.8% in *S. balinensis*; Figure 5), and from *S. belaeirus* in having a shorter pelvic fin (7.4–10.0% of SL in *S. scitulus* vs. 7.9–10.3% in *S. belaeirus*), anal-fin base (15.0–17.9% of SL vs. 15.2–18.5%), and distance between the dorsal and anal fin origins (16.8–19.0% of SL vs. 19.0–20.7%), a narrower body (14.6–16.9% of SL vs. 17.8–19.8%) (Figure 6), and fewer branched anal-fin rays (modally 16 vs. 17) and vertebrae (modally 42 vs. 43) (Figure 7). Moreover, head length [22.3–24.9% (mean 23.5%) of SL in *S. scitulus* vs. 23.0–26.7% (25.0%) in *S. indicus* and 23.7–26.0% (24.9%) in *S. meteorum*], body depth [14.6–16.9% (16.1%) of SL vs. 16.0–20.1% (18.3%) and (18.2%) vs. 18.1–20.8% (19.5%) and 18.6–20.5% (19.5%)] of *S. scitulus* all tend to be less than in *S. indicus* and *S. meteorum*, whereas the distance between the pectoral and pelvic fin insertions [18.8–22.0% (20.0%) of SL vs. 16.0–21.2% (18.7%) and 16.0–20.6% (18.5%)] is greater (Figure 8). Vertebral counts also distinguish *S. scitulus* [41–43 (modally 42)] from *S. indicus* [40–41 (41)] and *S. meteorum* [41–42 (41); see table 4 in Hata et al. (2023) [22] for vertebral numbers in *S. balinensis*, *S. belaeirus*, *S. commersonnii*, *S. indicus*, and *S. meteorum*. In addition, lengths of the postorbital length (10.4–12.0% of SL in *S. scitulus* vs. 12.0–13.1% in *S. meteorum*), maxilla [14.9–17.0% (mean 16.1%) of SL vs. 15.9–18.2%], and lower jaw [14.8–16.7% (mean 15.6%) of SL vs. 15.4–17.6% (16.3%)] of *S. scitulus* tend to be shorter than those of *S. meteorum* (Figure 9). *Stolephorus scitulus* is distinguished from *S. commersonnii*, by having a shorter pelvic fin [32.9–42.2% (mean 38.3%) of HL in *S. scitulus* vs. 37.9–40.0% (39.0%) in *S. commersonnii*] and maxilla [64.5–70.7% (mean 68.6%) of HL vs. 70.2–73.4% (71.7%)] (Figure 10). Detailed comparisons of *S. scitulus* with *S. horizon* n. sp. are given under “Comparisons” following the latter.

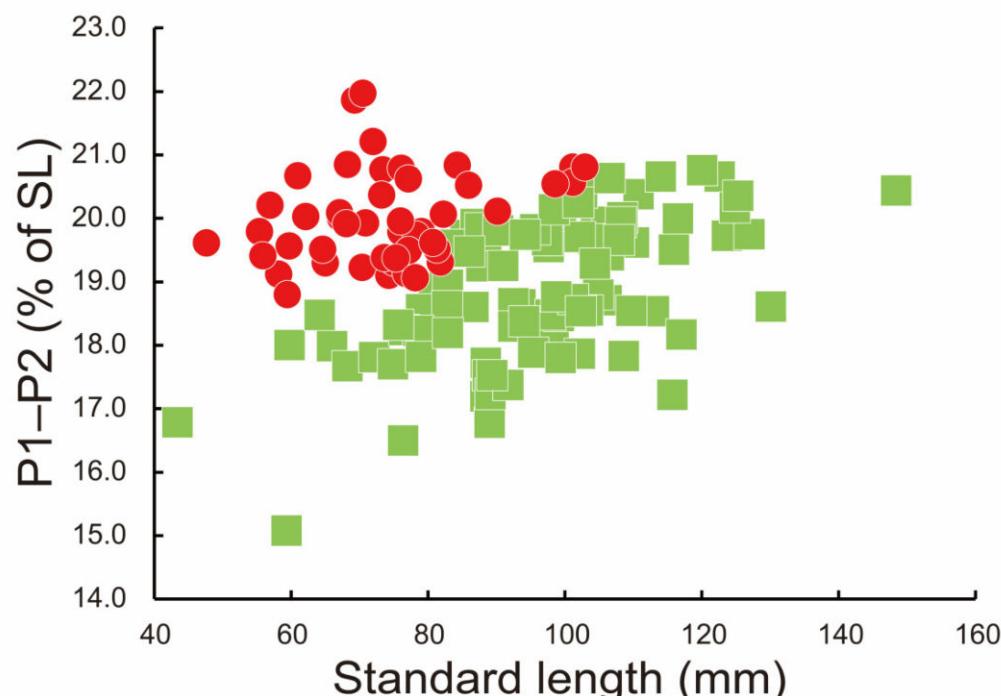


Figure 5. Distance between pectoral and pelvic fin insertions (P1–P2; as % of standard length; SL) relative to SL in *Stolephorus scitulus* (red circles) and *S. balinensis* (green squares).

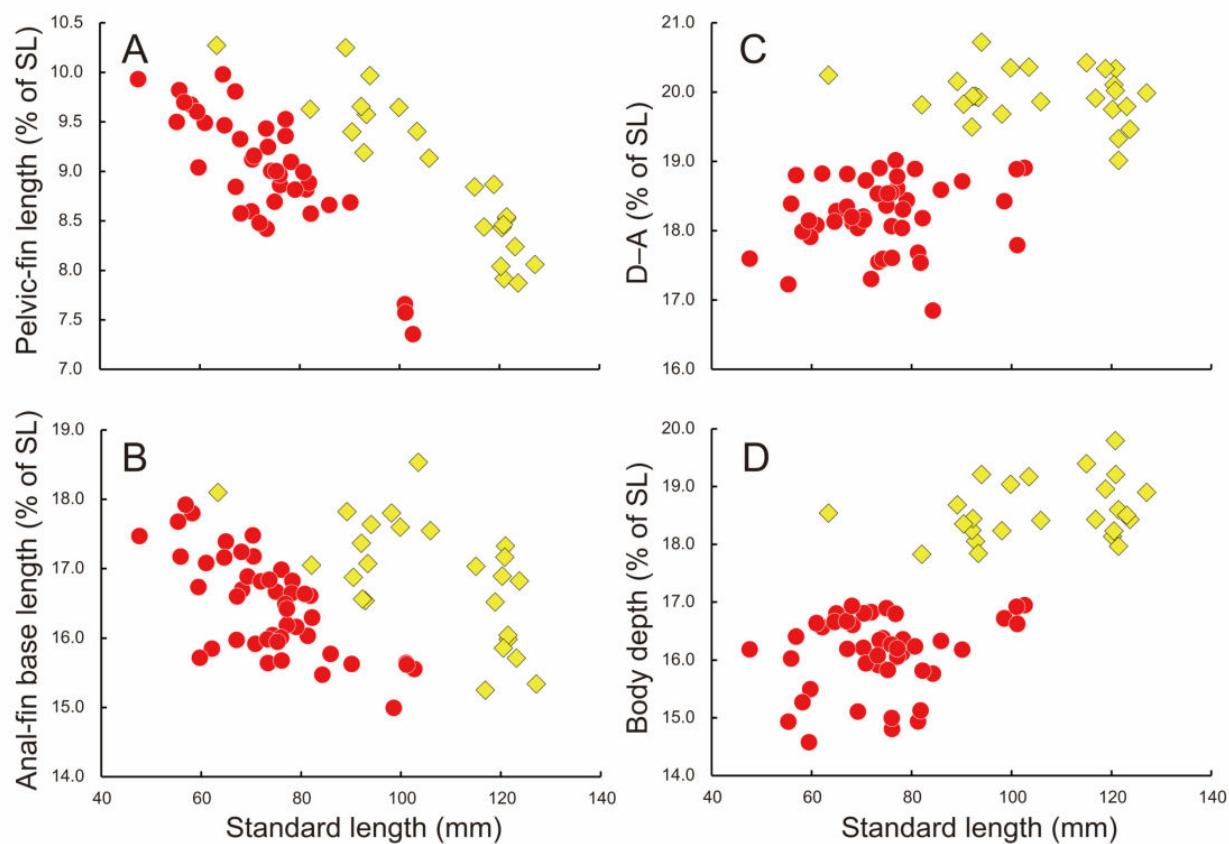


Figure 6. Pelvic-fin length (A), anal-fin base length (B), distance between dorsal and anal fin origins (D–A) (C), and body depth (D) (all as % of standard length; SL) relative to SL in *Stolephorus scitulus* (red circles) and *S. belaeirus* (yellow diamonds).

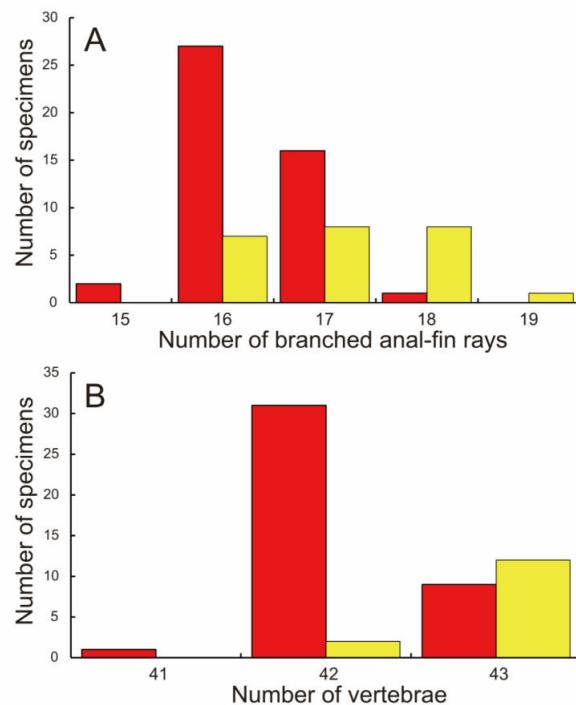


Figure 7. Frequency distributions of numbers of (A) branched anal-fin rays and (B) vertebrae in *Stolephorus scitulus* (red bars) and *S. belaeirus* (yellow bars).

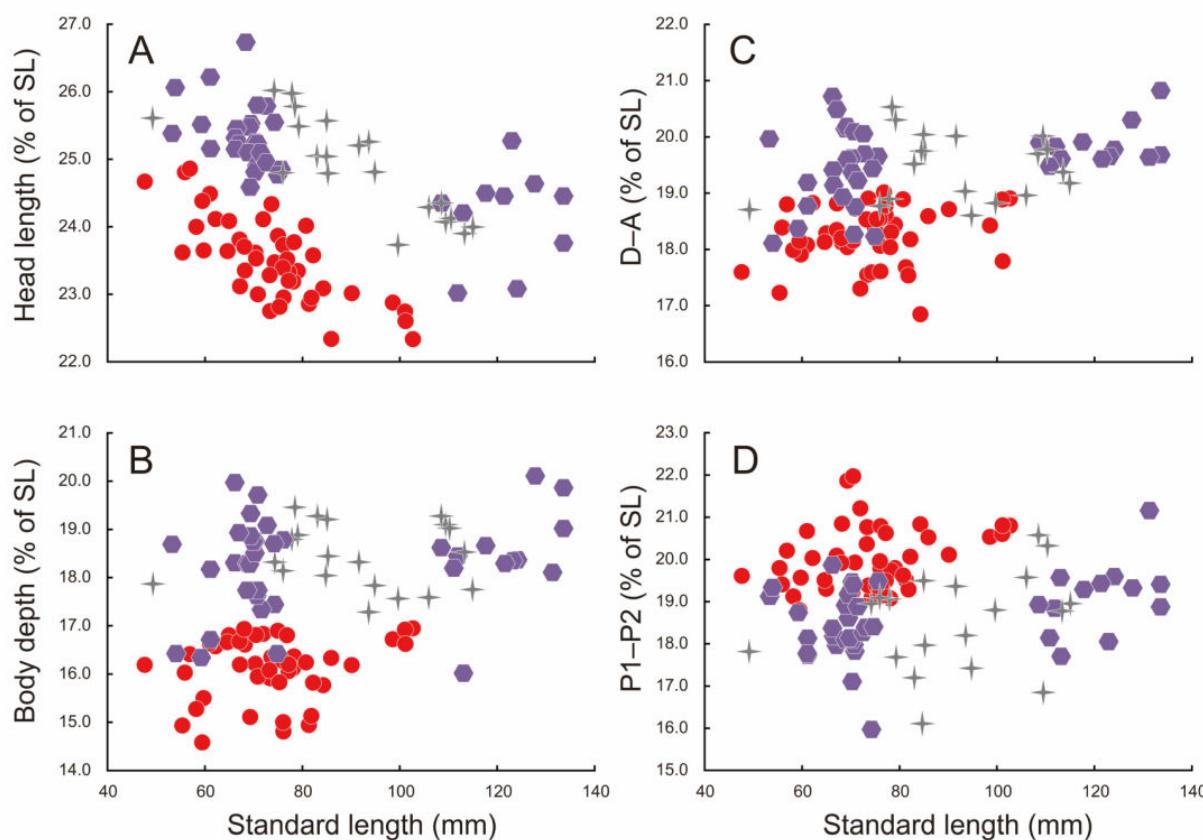


Figure 8. Head length (A), body depth (B), distance between dorsal and anal fin origins (D–A) (C), and distance between pectoral and pelvic fin insertions (P1–P2) (D) (all as % of standard length; SL) relative to SL in *Stolephorus scitulus* (red circles), *S. indicus* (purple hexagons), and *S. meteorum* (grey stars).

Remarks. Although *S. scitulus*, originally described as *Anchovia scitula* by Fowler (1911) [7], had long been regarded as a junior synonym of *S. indicus* (e.g., Whitehead et al., 1988 [1]; Wongratana et al., 1999 [10]), the former was recognized as a valid species by Hata et al. (2021) [3]. However, among the specimens purported by the latter to be *S. scitulus*, several collected from Fiji and Tonga are described herein as the new species *S. horizon*. In the original description of *A. scitula*, the type locality was shown as San Diego, CA, USA, located on the eastern Pacific coast. Since the genus *Stolephorus* is not distributed in that region, the so-called type locality is considered to be in error (Nelson 1983 [11]; Whitehead et al., 1988 [1]; Fricke et al., 2023 [12]; this study). Additionally, *Stolephorus insularum* (Jordan and Seale, 1926) (type locality Tahiti), is regarded herein as a junior synonym of *S. scitulus*, as indicated by Hata et al. (2021) [3].

Stolephorus horizon n. sp.
[New English name: Horizon Anchovy]
Figures 1A, 3B and 11; Tables 1 and 2

Stolephorus indicus (not of van Hasselt): Lee 1973 [13]: 28 (Fiji); Ellway and Kearney 1981 [14]: 18 (Fiji); Whitehead et al., 1988 [1] (in part): 413 (Fiji); Rawlinson 1993 [15]: 10 (Fiji); Blaber et al., 1993 [16]: 106, table 1 (Vanua Balavu Island, Fiji); Randall et al., 2003 [17]: 7 (Tonga); Seeto and Baldwin 2010 [18]: 6 (Fiji).

Stolephorus scitulus (not of Fowler): Hata et al., 2021 [3] (in part): 357 (Fiji and Tonga).

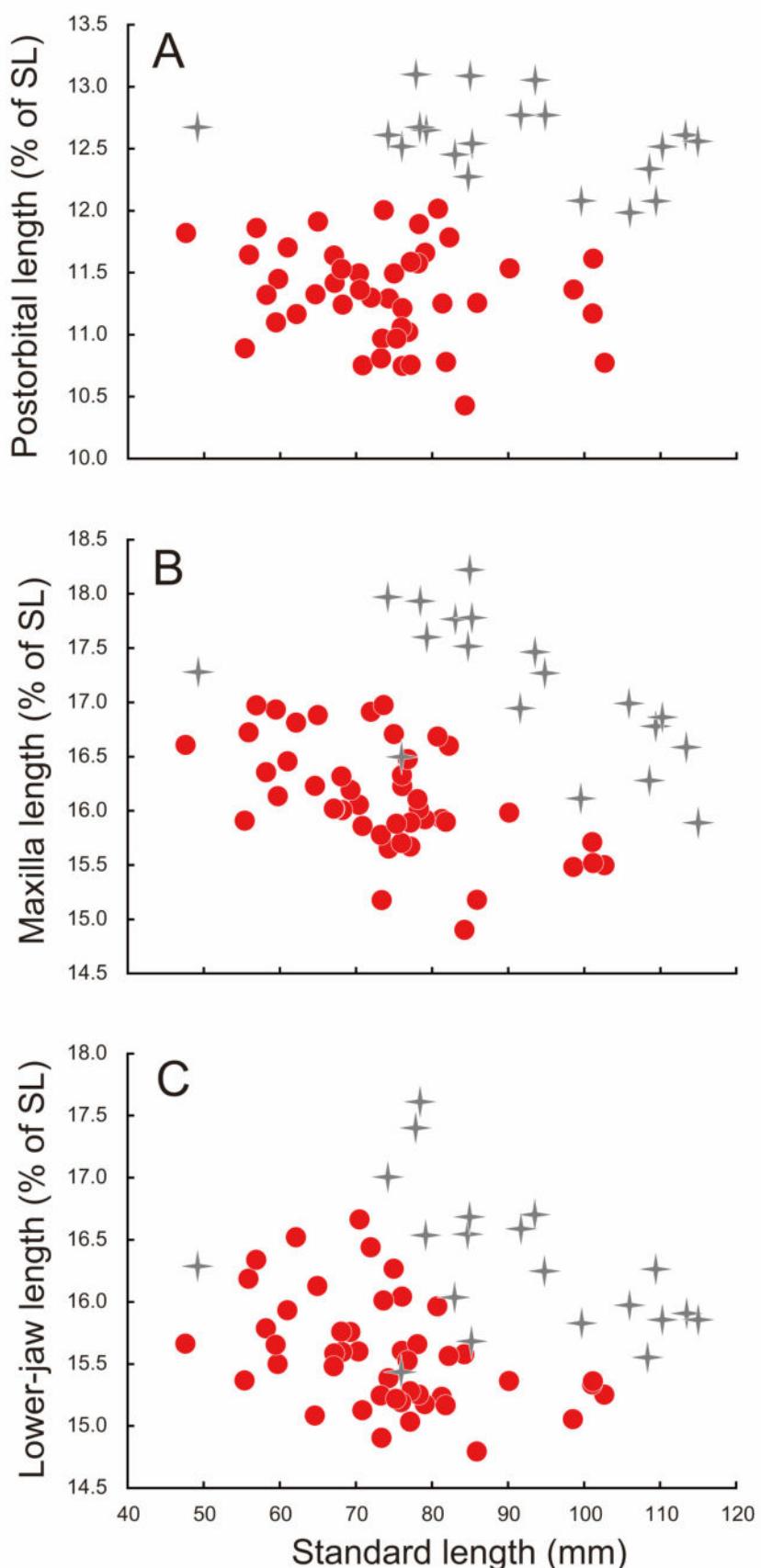


Figure 9. Postorbital length (A), maxilla length (B), and lower-jaw length (C) (all as % of standard length; SL) relative to SL in *Stolephorus scitulus* (red circles) and *S. meteorum* (grey stars).

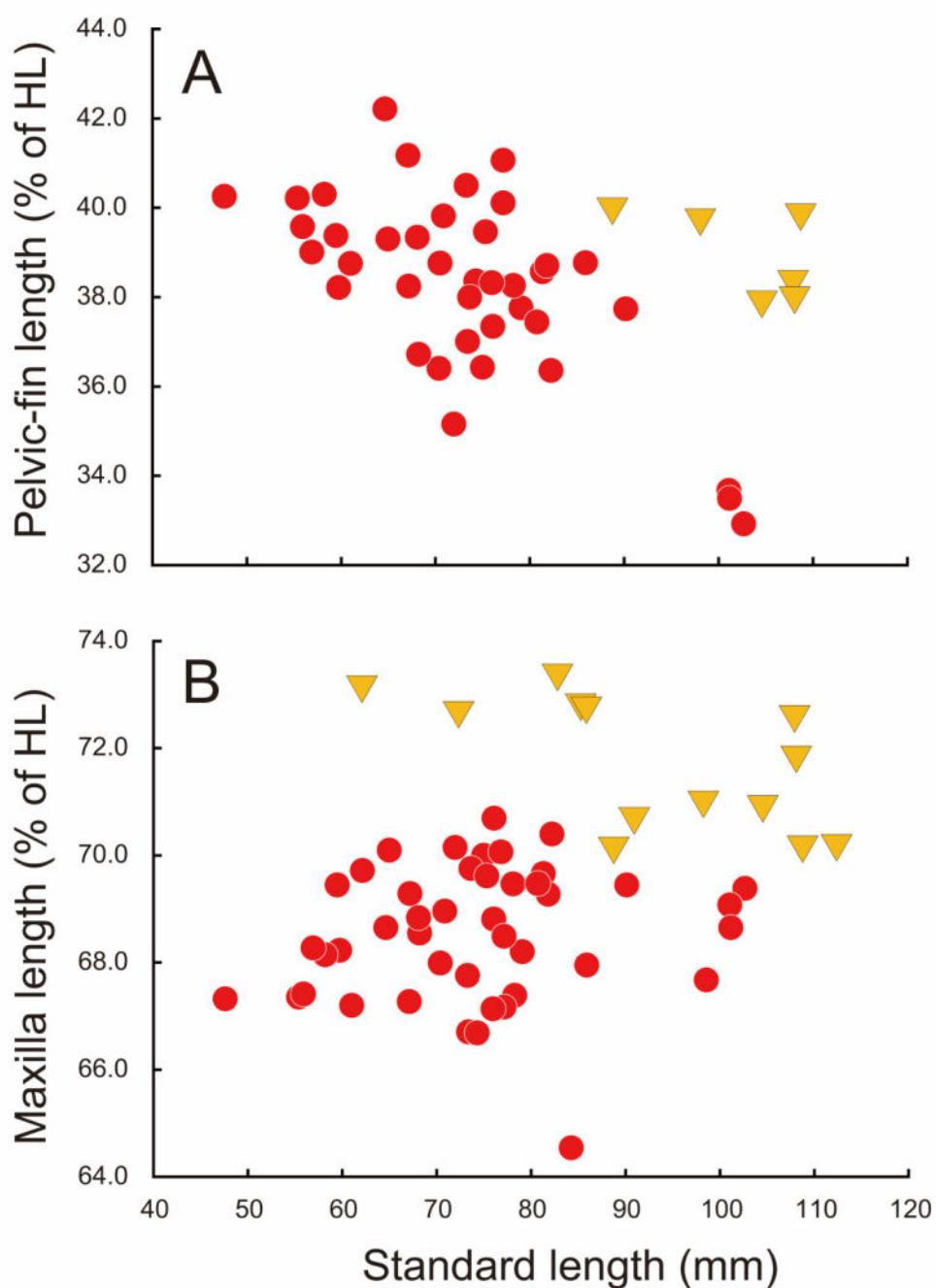


Figure 10. Pelvic-fin length (A) and maxilla length (B) (both as % of head length; HL) relative to standard length in *Stolephorus scitulus* (red circles) and *S. commersonnii* (inverted orange triangles).

Holotype. USNM 466251, 97.8 mm SL, Serua, Viti Levu, Fiji Islands.

Paratypes. 33 specimens, 62.3–108.1 mm SL. FIJI: USNM 261617, 88.9 mm SL, Serua, Viti Levu, Fiji Islands; USNM 327730, 10 specimens, 78.5–106.5 mm SL, Vanua Levu, Fiji Islands ($16^{\circ}14'53.9''$ S $179^{\circ}29'13.2''$ E); USNM 327834, 8 specimens, 92.6–104.4 mm SL, KAUM-I. 180820, 87.4 mm SL, KAUM-I. 180821, 87.9 mm SL, Nadi Bay, Viti Levu, Fiji Islands ($17^{\circ}43'36.1''$ S $177^{\circ}23'34.8''$ E), 0–15 m depth; USNM 330905, 3 specimens, 62.3–66.0 mm SL, Fiji; USNM 330909, 2 specimens, 101.4–108.1 mm SL, Fiji Islands; USNM 466143, 92.3 mm SL, Fiji Islands; USNM 330927, 2 specimens, 93.7–105.3 mm SL, Fiji Islands. TONGA: URM-P 33476, 103.7 mm SL, URM-P 33479, 93.9 mm SL, URM-P 33480, 82.0 mm SL, URM-P 33481, 80.6 mm SL, Vava'u.



Figure 11. Lateral (A), dorsal (B), and ventral (C) views of holotype (USNM 261617, 97.8 mm SL, Viti Levu, Fiji), and lateral view (D) of paratype (USNM 327834, 102.7 mm SL, Fiji Islands, Fiji) of *Stolephorus horizon* n. sp.

Diagnosis. A species of *Stolephorus* with the following combination of characters: maxilla 14.7–17.2% of SL (mean 16.1%), 64.7–70.4% (67.9%) of HL, its posterior tip just reaching or extending slightly beyond anterior margin of preopercle; posterior margin of preopercle convex, rounded; no predorsal scutes; prepelvic scutes 3–5 (modally 4); pelvic scute without spine; dorsal fin with 3 unbranched and 12–14 (13) branched rays; anal fin with 3 unbranched and 15–18 (16) branched rays, its origin located just below base of 9th to 12th dorsal-fin ray; 1UGR 17–19 (18), 1LGR 24–27 (26), 1TGR 41–46 (44); 2UGR 11–13 (12), 2LGR 21–24 (23), 2TGR 33–37 (34); 3UGR 9–12 (10), 3LGR 12–14 (13), 3TGR 21–25 (23); 4UGR 7–9 (8), 4LGR 10 or 11 (11), 4TGR 17–20 (19); 3–6 (5) gill rakers on posterior face of 3rd gill arch; transverse scales 8; pseudobranchial filaments 20–26 (23); total vertebrae 41–43 (42); scale rows in longitudinal series 38–40 (39); head 22.6–25.2% (23.8%) of SL; body depth 16.4–18.6% (mean 17.7%) of SL; pelvic fin 8.0–9.9% of SL (8.7%), 33.9–39.5% (36.6%) of HL, tip of depressed pelvic fin not reaching posteriorly to vertical through dorsal-fin origin; distance between origins of dorsal and anal fins 18.4–20.1% (19.3%) of SL; distance between insertions of pectoral and pelvic fins 18.8–22.1% (20.7%) of SL; distance from snout to pelvic-fin insertion 43.1–46.2% (45.0%) of SL; postorbital length 11.2–12.2% (11.7%) of SL, 44.9–52.3% (49.2%) of HL; lower jaw 14.6–16.7% (15.7%) of SL; pairs of dark patches

on parietal and occipital regions; no dark lines on dorsum (Figure 11B); no melanophores scattered on pectoral-fin rays (Figure 3B).

Description. Data for holotype presented first, followed by data for paratypes in parentheses (if different). Counts and measurements, expressed as percentages of SL or HL, given in Tables 1 and 2. Body cylindrical, elongated, deepest at dorsal-fin origin. Caudal peduncle laterally compressed. Dorsal profile of head and body slightly convex from snout tip to dorsal-fin origin, body depth thereafter gradually decreasing to uppermost point of caudal-fin base. Ventral profile of head and body slightly convex from tip of lower jaw to pelvic-fin insertion, thereafter slowly rising to lowermost point of caudal-fin base. Abdomen rounded, covered with three (three to five) midventral spine-like scutes. Pelvic scute without spine. Postpelvic and predorsal scutes absent. Anus just anterior to anal-fin origin. Snout profile pointed, with rounded tip; snout length less than eye diameter. Mouth large, inferior, ventral to body axis, mouth gape extending backward beyond posterior margin of eye. Maxilla short, its posterior tip pointed, just reaching (slightly beyond or just reaching) anterior margin of preopercle. Lower jaw elongated. Single row of conical teeth on both jaws, palatine, and medial side of pterygoid. Several conical teeth on vomer. No teeth on upper edge of hyoid. Several rows of conical teeth on upper edges of basihyal and basibranchial. Eye round, covered with adipose eyelid, positioned laterally on head above horizontal through pectoral-fin insertion, visible in dorsal view. Pupil round. Orbit elliptical. Nostrils close to each other, anterior to orbit. Posterior margin of preopercle convex, rounded. Subopercle and opercle with smooth rounded posterior margins. Gill membrane without serrations. Interorbital space flat, width less than eye diameter. Pseudobranchial filaments present, longest filament shorter than eye diameter. Gill rakers long, elongated, rough, visible from side of head when mouth opened. Fine serrations on inner margin of gill rakers. Isthmus muscle long, reaching anteriorly to posterior margin of gill membranes. Urohyal hidden by isthmus muscle, not visible without dissection. Gill membrane on each side joined distally, most of isthmus muscle exposed, not covered by gill membrane. Scales on lateral surface of body deciduous (completely lacking in holotype). Head scales absent. Fins scaleless, except for broad triangular sheath of scales on caudal fin. Dorsal-fin origin posterior to vertical through base of last pelvic-fin ray, slightly posterior to mid-point of body. Dorsal and anal fins with three anteriormost rays unbranched. First dorsal- and anal-fin rays minute. Anteriormost three rays of both dorsal and anal fins closely adpressed. Anal-fin origin below base of tenth (ninth to twelfth) dorsal-fin ray. Posterior tip of depressed anal fin not reaching caudal-fin base. Pectoral fin inserted below body axis, uppermost ray unbranched. Posterior tip of pectoral fin not reaching pelvic-fin insertion. Dorsal, ventral, and posterior margins of pectoral fin straight. Pelvic fin shorter than pectoral fin, its insertion anterior to vertical through dorsal-fin origin. Tip of depressed pelvic fin not reaching to vertical through dorsal-fin origin. Caudal fin forked, tips of both lobes pointed.

Coloration of preserved specimens. Body uniformly pale tan, light ivory longitudinal band running just behind upper opercular margin to caudal-fin base (completely lost in some specimens). A few melanophores scattered on snout, maxilla, and lower-jaw tip. Pairs of dark patches on parietal and occipital regions. No dark lines on dorsum before and after dorsal fin. Melanophores scattered along posterior margin of dorsal scale pockets. Fin rays transparent, colorless. Melanophores scattered along bases of dorsal and anal fins, along fin rays of dorsal and caudal fins, and anteriorly on anal fin. No scattered melanophores on pectoral-fin rays (Figure 3B).

Distribution. *Stolephorus horizon* n. sp. is currently known only from around Fiji and Tonga (Figure 4).

Etymology. The specific name “*horizon*” is given in reference to the horizontal white line along the lateral body surface in the new species.

Comparisons. The new species is assignable to the genus *Stolephorus*, as defined by Whitehead et al. (1988) [1] and Wongratana et al. (1999) [10], having a long isthmus muscle reaching anteriorly to the posterior margin of the gill membrane, a hidden urohyal, and

prepelvic and postpelvic scutes absent. The new species is included in *Stolephorus indicus* Group by a short maxilla just reaching or extending slightly beyond the anterior margin of preopercle, a short pelvic fin not reaching to vertical through the dorsal-fin origin, and 1LGR < 30.

However, the new species can be distinguished from all species of *Stolephorus indicus* Group by having the pectoral fin without melanophores (melanophores scattered on several pectoral-fin rays in the former; Figure 3B). The new species is further distinguishable from *Stolephorus balinensis* (Bleeker, 1849) in having more gill rakers [1TGR 42–44 (rarely 41 or 46; modally 44) in *S. horizon* vs. 35–42 (modally 40) in *S. balinensis*; see table 3 in Hata et al. (2023) [2] for gill raker numbers in *S. balinensis*, *S. belaerius*, *S. commersonii*, *S. indicus*, and *S. meteorum*], a longer pelvic fin (8.0–9.9% of SL vs. 5.6–9.2%), and greater distances between the pectoral and pelvic fin insertions (18.8–21.1% of SL vs. 15.1–20.8%), and snout to pelvic-fin insertion (43.1–46.2% of SL vs. 39.7–46.5%) (Figure 12). In addition, *S. horizon* differs from *S. belaerius* in having higher gill raker numbers (1TGR 38–42 in *S. belaerius*), fewer vertebrae [41 or 42 (rarely 43) in *S. horizon* vs. 43 (rarely 42) in *S. belaerius*; see table 4 in Hata et al. (2023) [2] for vertebral numbers in *balinensis*, *S. belaerius*, *S. commersonii*, *S. indicus*, and *S. meteorum*], a shorter pelvic fin (8.0–9.9% of SL vs. 7.9–10.3%) and narrower body (16.4–18.6% of SL vs. 17.8–19.8%) (Figure 13). The former differs from *S. commersonii* in having fewer gill rakers (1TGR 44–47 in *S. commersonii*), a shorter pelvic fin (8.0–9.9% of SL in *S. horizon* vs. 8.6–9.5% in *S. commersonii*), greater postorbital length (11.2–12.2% of SL vs. 10.5–11.7%) and a longer maxilla (64.7–70.4% of HL vs. 70.2–73.4%) (Figure 14), and from *S. indicus* in having greater numbers of gill rakers (1TGR 36–41 in *S. indicus*), vertebrae [42 (rarely 41 or 43) vs. 40 or 41], and longitudinal series scales [38–40 (modally 39) vs. 37–39 (38)] (Figure 15), and greater postorbital length (11.2–12.2% of SL vs. 11.8–13.7%) (Figure 16). The new species differs from *S. meteorum* in having slightly higher gill raker numbers (1TGR 40–43 in *S. meteorum*), and a shorter postorbital (11.2–12.2% of SL in *S. horizon* vs. 12.0–13.1% in *S. meteorum*), maxilla (14.7–17.2% of SL vs. 15.9–18.2%), and lower jaw (14.6–16.7% of SL vs. 15.4–17.6%) (Figure 17), and from *S. scitulus*, Hata et al. (2021), with which it had been confused, by lower gill raker numbers on each gill arch (Table 1; Figure 18), a longer head [22.6–25.2% (mean 23.8%) of SL in *S. horizon* vs. 22.3–24.9% (23.5%) in *S. scitulus*] and deeper body (16.4–18.6% of SL vs. 14.6–16.9%), and a greater distance between the dorsal and anal fin origins [18.4–20.1% (mean 19.3%) of SL vs. 16.8–19.0% (18.2%)] (Figure 19).

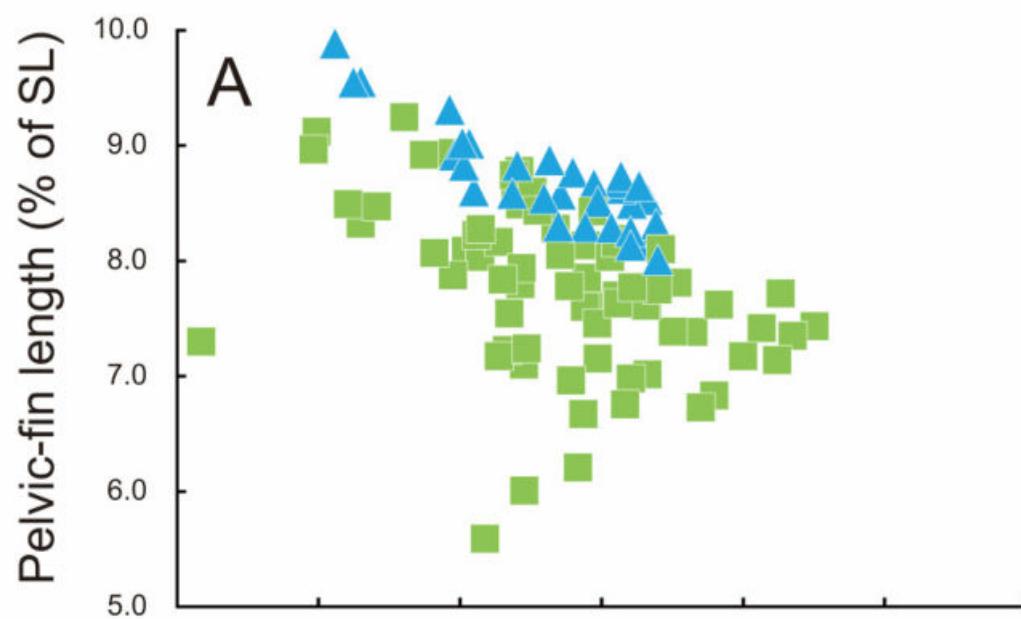


Figure 12. Cont.

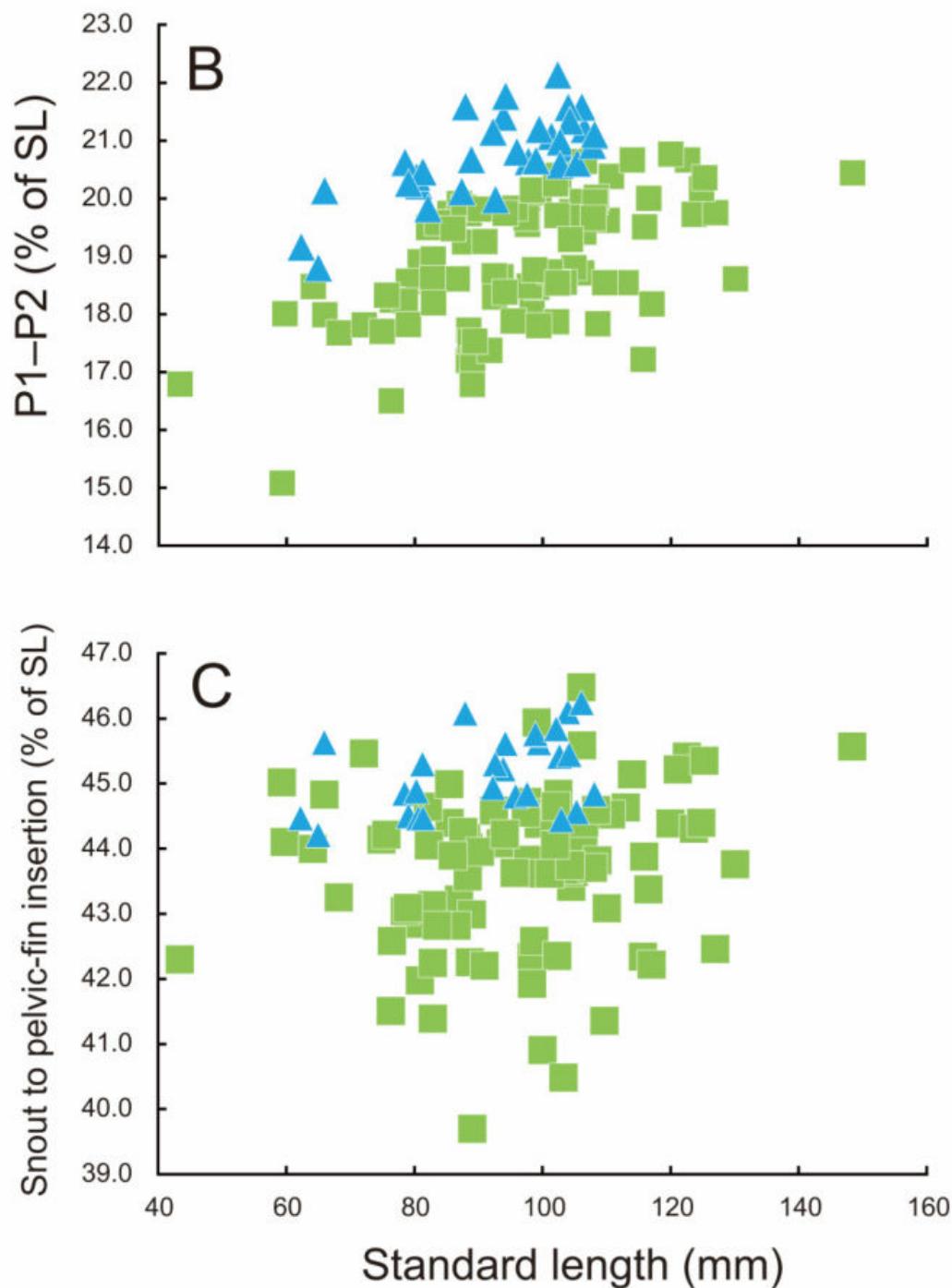


Figure 12. Pelvic-fin length (A), distance between pectoral and pelvic fin insertions (P1–P2) (B), and snout to pelvic-fin insertion (C) (all as % of standard length; SL) relative to SL in *Stolephorus horizon* (blue triangles) and *S. balinensis* (green squares).

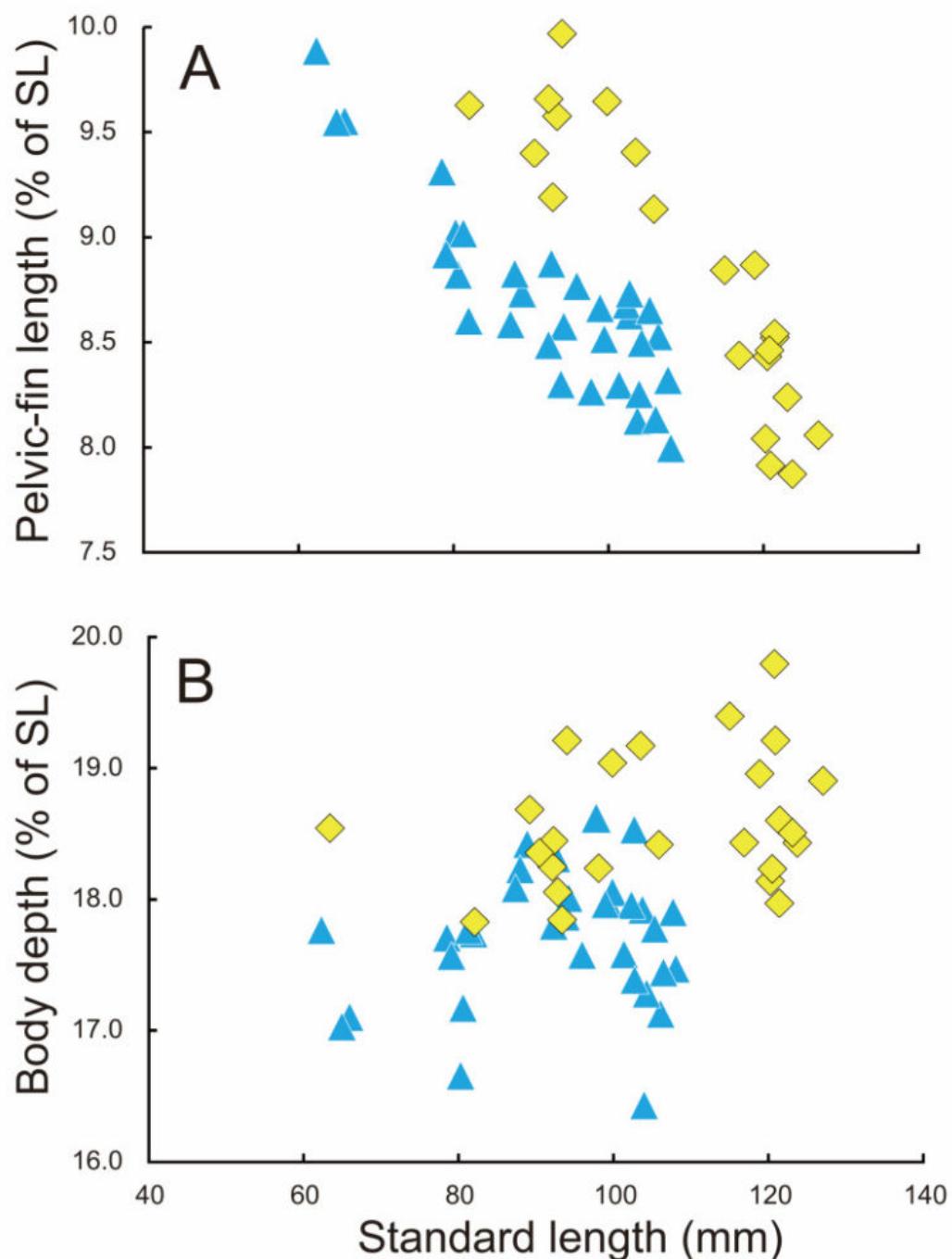


Figure 13. Pelvic-fin length (A) and body depth (B) (both as % of standard length; SL) relative to SL in *Stolephorus horizon* (blue triangles) and *S. belaeirus* (yellow diamonds).

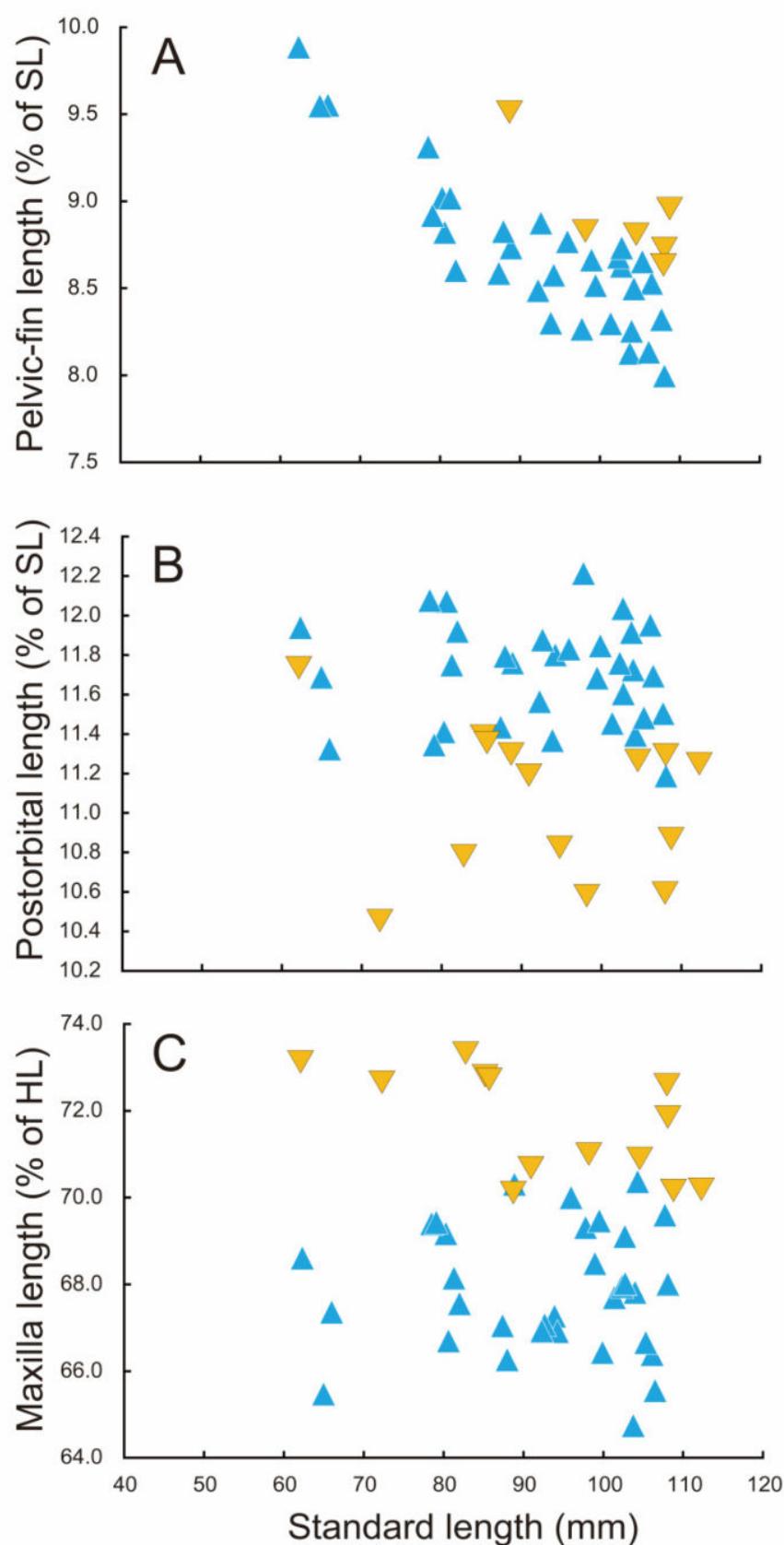


Figure 14. Pelvic-fin length (A), postorbital length (B) (both as % of standard length; SL), and maxilla length (C) (as % of head length; HL) relative to SL in *Stolephorus horizon* (blue triangles) and *S. commersonnii* (inverted orange triangles).

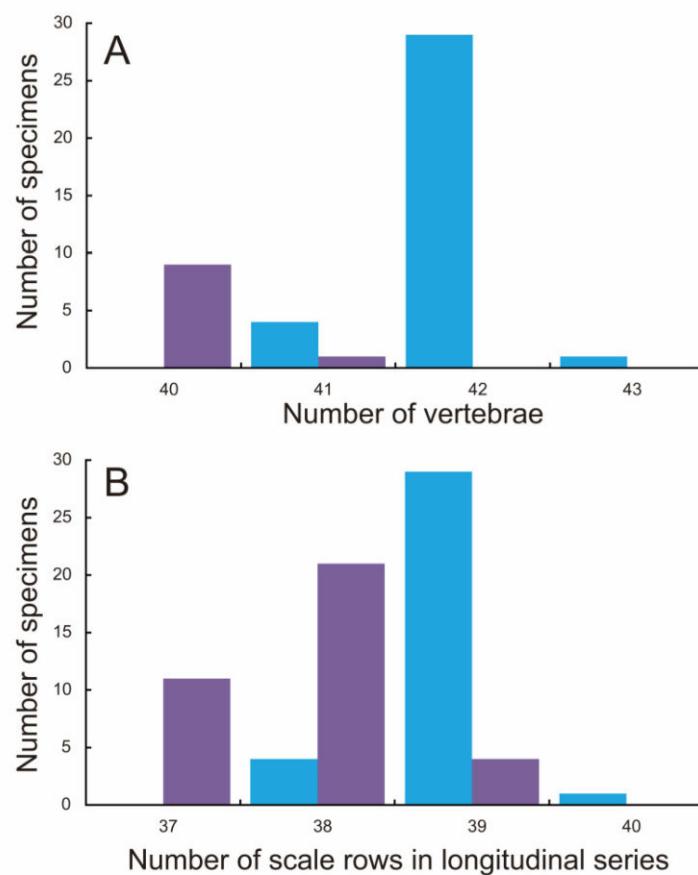


Figure 15. Frequency distributions of numbers of (A) vertebrae and (B) scale rows in longitudinal series in *Stolephorus horizon* (blue bars) and *S. indicus* (purple bars).

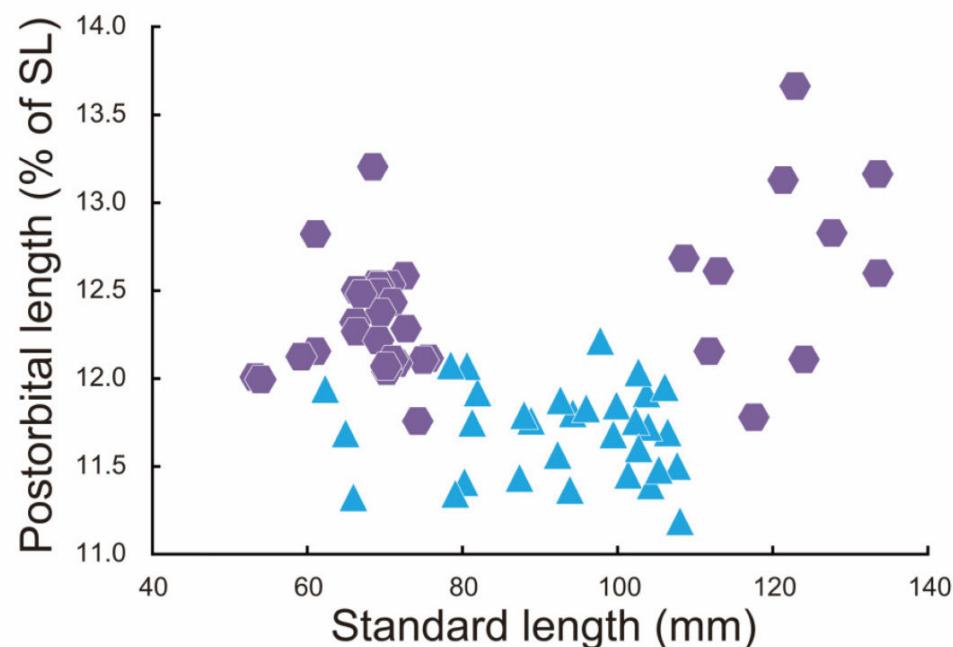


Figure 16. Postorbital length (as % of standard length; SL) relative to SL in *Stolephorus horizon* (blue triangles) and *S. indicus* (purple hexagons).

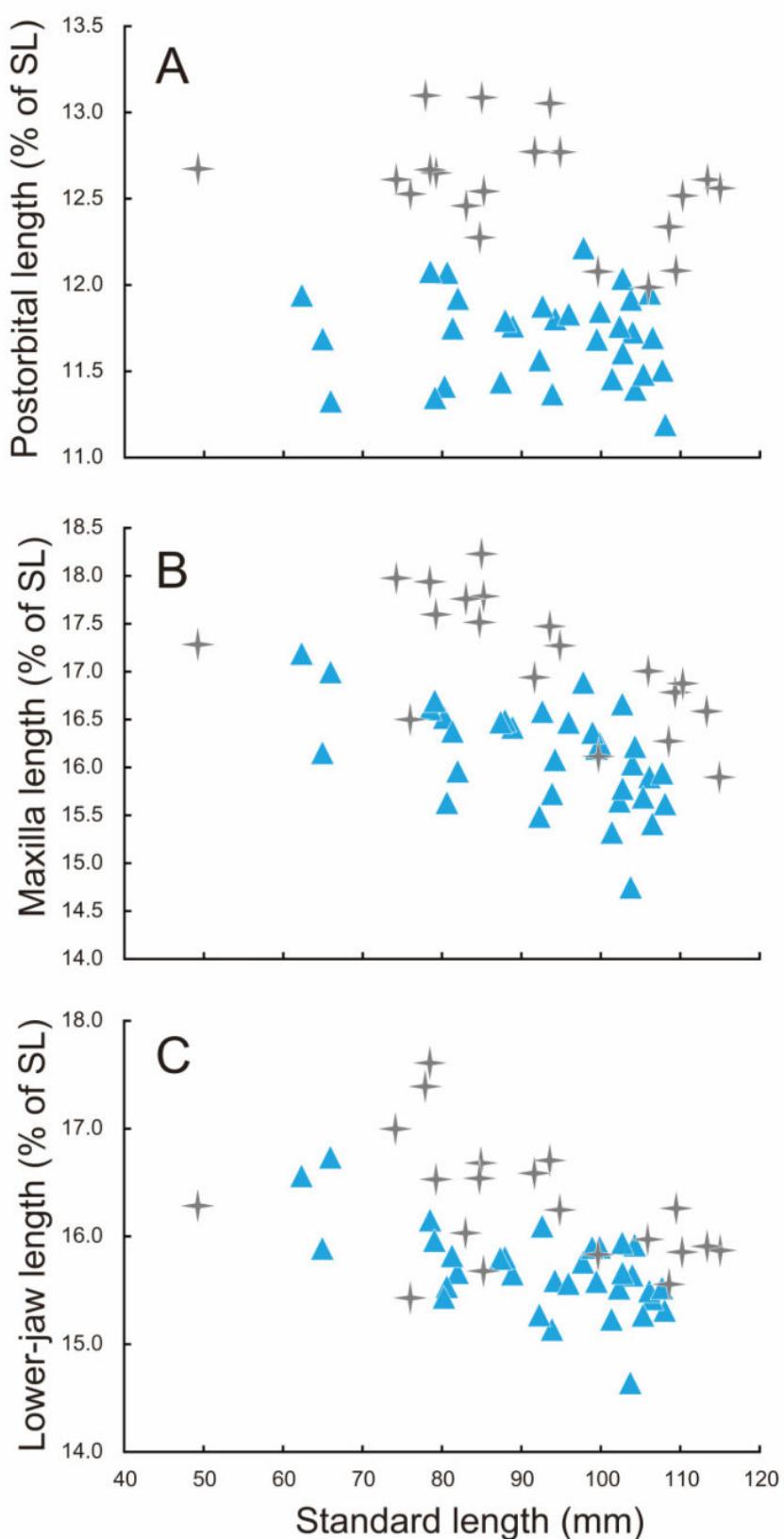


Figure 17. Postorbital length (A), maxilla length (B), and lower-jaw length (C) (all as % of standard length; SL) relative to SL in *Stolephorus horizon* (blue triangles) and *S. meteorum* (gray stars).

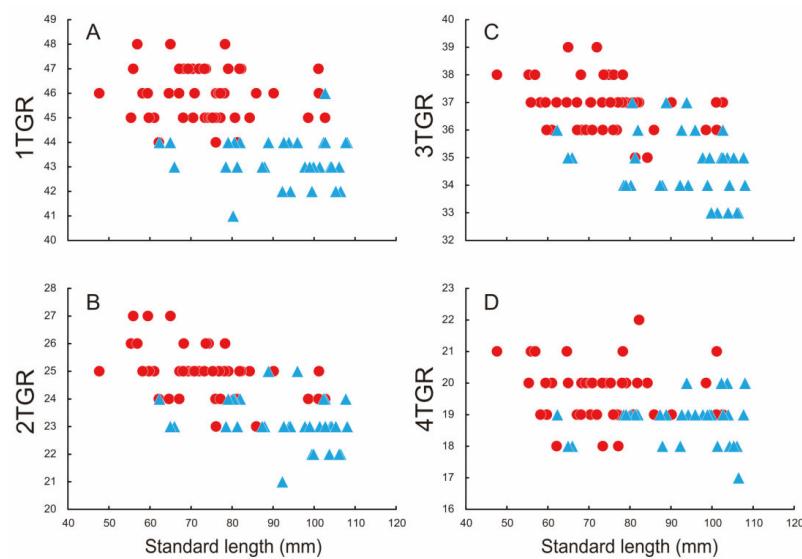


Figure 18. Total gill-raker numbers on (A) first gill arch (1TGR), (B) second gill arch (2TGR), (C) third gill arch (3TGR), and (D) fourth gill arch (4TGR), relative to standard length in *Stolephorus scitulus* (red circles) and *Stolephorus horizon* n. sp. (blue triangles).

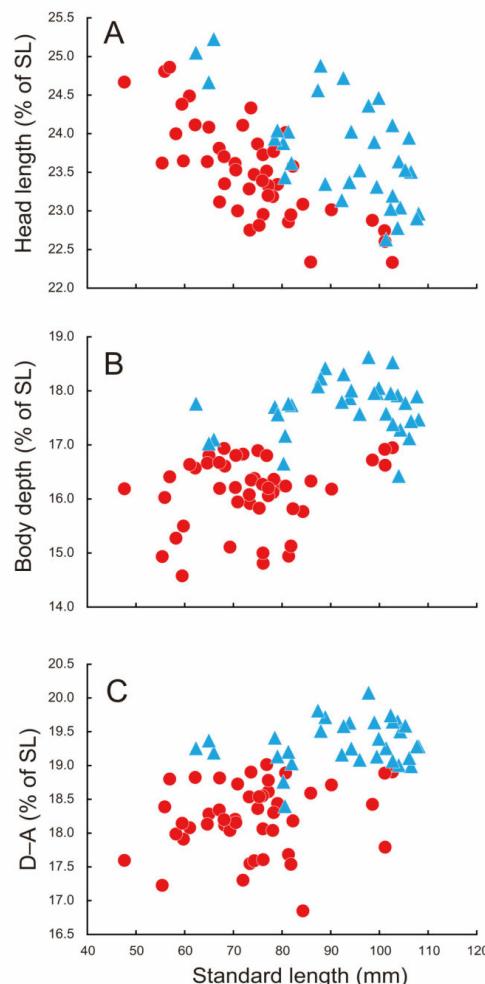


Figure 19. Head length (A), body depth (B), and distance between origins of dorsal and anal fins (D-A) (C) (all as % of standard length; SL) relative to SL in *Stolephorus horizon* (blue triangles) and *S. scitulus* (red circles).

Remarks. Because *S. horizon* has been utilized as bait fish for the commercial tuna fishery in Fiji (Ellway and Kearney 1981 [14]), the existence of the new species has been well-known since early times, although treated as *S. indicus* (e.g., Lee 1973 [13]; Blaber et al., 1993 [16]), and more recently as *S. scitulus* (Hata et al., 2021 [3]). As no bona fide examples of *S. scitulus* have been found in waters around Fiji and Tonga, that species is considered to occur allopatrically with *S. horizon* (Figure 4).

Key to species of *Stolephorus indicus* Group

Species of *Stolephorus indicus* Group are diagnosed by a short maxilla, posteriorly just reaching the anterior margin of preopercle, fewer than 7 prepelvic spine-like scutes, and fewer than 29 lower gill rakers on the first gill arch (Figure 1).

1a Melanophores scattered on upper part of pectoral fin 2
 1b No melanophores on pectoral fin *S. horizon* (Fiji and Tonga)

2a Total gill rakers on first gill arch 44 or more 3
 2b Total gill rakers on first gill arch 43 or fewer 4

3a Pelvic fin short, 32.9–42.2% of HL (mean 38.3%), maxilla short, 64.5–70.7% of HL (68.6%) (Figure 10) *S. scitulus* (Society Islands)
 3b Pelvic fin long, 37.9–40.0% of HL (mean 39.0%), maxilla long, 70.2–73.4% HL (71.7%) *S. commersonii* (Mauritius)

4a Head short, 21.3–25.1% SL (mean 23.4%; fig. 4A in Hata et al., 2023 [2]), distance between dorsal-fin origin and pectoral-fin insertion (D–P1) 123.9–165.1% HL (148.5%; fig. 3a in Hata et al., 2019 [3]) 5
 4b Head long, 23.0–26.7% of SL (mean 25.0%; Figure 2), D–P1 118.6–150.4% of HL (134.6%) 6

5a Pelvic fin long, 7.9–10.3% of SL (mean 8.9%) and 34.8–43.0% of HL (38.3%) (fig. 4 in Hata et al., 2019 [3]) *S. belaeirus* (eastern coast of Africa and Madagascar)
 5b Pelvic fin short, 5.6–9.2% of SL (mean 7.6%) and 25.0–36.8% of HL (32.5%) *S. balinensis* (western Pacific)

6a Total gill rakers on first gill arch 40 or more; interorbital area narrow, 4.7–5.4% (mean 5.1%) of SL; D–P1 long, 33.1–36.0% (34.7%) of SL (fig. 4 in Hata et al., 2023 [2]) *S. meteorum* (Red Sea and Gulf of Aden)
 6b Total gill rakers on first gill arch 41 or fewer; interorbital area broad, 4.5–6.0% (5.3%) of SL; D–P1 short, 31.6–35.2% (33.2%) of SL *S. indicus* (Andaman Sea to Arabian Sea)

Comparative materials.

Stolephorus balinensis (104 specimens: 43.4–148.4 mm SL): listed in Hata et al. (2021) [3] and 18 additional specimens: BPBM 26576, 82.9 mm SL, Jakarta, Java, Indonesia; USNM 94806, 127.0 mm SL, Hainan Island, China; USNM 138399, 75.7 mm SL, Cavite, Luzon, Philippines; USNM 138403, 2 specimens, 87.6–90.3 mm SL, Guijulugan Beach, east coast of Negros, Philippines; USNM 138406, 5 specimens, 74.2–104.4 mm SL, Iloilo, Panay, Philippines; USNM 138407, 2 specimens, 74.9–78.6 mm SL, Manila, Luzon, Philippines; USNM 138409, 1 of 2 specimens, 64.2 mm SL, Pujada Bay, Davao Oriental, Mindanao, Philippines, 2.9 m depth; USNM 203242, 79.0 mm SL, Manila Bay, Luzon, Philippines; USNM 204238, 2 specimens, Limbones Cove, Nasugbu, Cavite, Luzon, Philippines; USNM 348278, 2 specimens, 69.5–73.7 mm SL, Bolinao, Pangasinan, Luzon, Philippines.

Stolephorus belaeirus (25 specimens: 63.4–127.1 mm SL): listed in Hata et al. (2021) [3].

Stolephorus commersonii (16 specimens: 62.1–112.3 mm SL): listed in Hata et al. (2021) [3].

Stolephorus indicus (41 specimens: 53.3–133.6 mm SL): listed in Hata et al. (2023) [2] and 20 additional specimens: USNM 204234, 20 specimens, 53.3–75.6 mm SL, Kochi, Kerala State, India.

Stolephorus meteorum (20 specimens: 49.2–115.0 mm SL): listed in Hata et al. (2023) [2] and one additional specimen: USNM 445706, 49.2 mm SL, Aden Harbor, Aden, Yemen.

Stolephorus mercurius, KAUM-I. 80755, holotype of *S. mercurius*, 84.7 mm SL, Panay Island, Philippines.

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