

REDESCRIPTION AND DISTRIBUTIONAL RANGE EXTENSION OF A POORLY KNOWN ANCHOVY *STOLEPHORUS NELSONI* (ACTINOPTERYGII: CLUPEIFORMES: ENGRAULIDAE)

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Background. The poorly known anchovy *Stolephorus nelsoni* Wongratana, 1987 (Engraulidae), previously known only from the type specimens from Australia, is redescribed and its validity confirmed, on the basis of the holotype, paratype, and 15 additional specimens from Indonesia and Australia. Similar to *Stolephorus brachycephalus* Wongratana, 1983 in sharing the maxilla reaching more or less to the posterior border of opercle, a predorsal-fin scute absent and the preopercle rounded, the specific distinctiveness of *S. nelsoni* and differences between the two species have remained unclear. This study sought to confirm the validities of the two species and the distributional range of *S. nelsoni*.

Materials and methods. Seventeen and 9 specimens of *S. nelsoni* and *S. brachycephalus*, respectively, including the holotype of each, were examined morphologically, counts and proportional measurements following Hata and Motomura (2017).

Results. Comparisons of *S. nelsoni* with *S. brachycephalus* revealed the former to have 12–14 (mode 13) branchiostegal rays [vs. 10–11 (11)], 15–17 branched anal fin rays [vs. 20–22 (20)] and relatively fewer gill rakers [37–43 (39, 40) on the first gill arch vs. 35–37 (35)]. *Stolephorus nelsoni* also differed from *S. brachycephalus* in body depth [21.7%–23.7% (mean 22.6%) of standard length vs. 18.2%–20.3% (19.1%)], anal-fin base length [16.1%–19.3% (17.6%) vs. 21.6%–24.4% (23.2%)], caudal-peduncle length [15.7%–21.7% (18.8%) vs. 12.6%–15.2% (14.1%)] and snout length [4.5%–5.5% (5.1%) vs. 3.6%–4.3% (4.0%)].

Conclusion. The validities of both species were confirmed, Indonesian examples of *S. nelsoni* being the first known records of the species outside Australian waters.

Keywords: taxonomy, validity, morphology, distribution, *Stolephorus brachycephalus*

INTRODUCTION

The Nelson's anchovy, *Stolephorus nelsoni* Wongratana, 1987, based on four specimens from Western Australia and Queensland, Australia was originally described by Wongratana (1987), and confirmed as a valid species by Whitehead et al. (1988) and Wongratana et al. (1999). Paxton et al. (2006) listed the type specimens of *S. nelsoni* in their review of Australian engraulid fishes, there having been no additional specimens recorded. *Stolephorus nelsoni* is herein redescribed as a valid species, following examination of type and additional specimens from Australia and Indonesia, the latter representing the first records of the species outside Australian waters. Morphological differences between *S. nelsoni* and the closely related congener *Stolephorus brachycephalus* Wongratana, 1983 are also provided.

MATERIALS AND METHODS

Counts and proportional measurements followed Hata and Motomura (2017). All measurements were made with digital callipers to the nearest 0.1 mm. Standard and head lengths are abbreviated as SL and HL respectively. Institutional codes follow Sabaj (2016).

RESULTS

Family ENGRAULIDAE

***Stolephorus nelsoni* Wongratana, 1987**

(Fig. 1; Tables 1, 2)

Stolephorus nelsoni Wongratana 1987: 4, fig. 2 (type locality: Wallal, Eighty Mile Beach, Western Australia, Australia; paratype localities: Townsville, Queensland, Australia); Whitehead et al. 1988: 417, unnumbered figs.

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(Eighty Mile Beach, north Wallal, Western Australia and Townsville, Queensland, Australia); Wongratana et al. 1999: 1738, unnumbered figs. (Eighty Mile Beach, north Wallal, Western Australia and Townsville, Queensland, Australia); Paxton et al. 2006: 315 (Eighty Mile Beach, north Wallal, Western Australia and Townsville, Queensland, Australia).

Material examined. 17 specimens, 41.2–81.5 mm SL. AMNH 57157, holotype of *Stolephorus nelsoni*, 71.6 mm SL, Wallal, Eighty Mile Beach, Western Australia, Australia, 15 May 1969, G. J. Nelson, W. H. Butler and D. E. Rosen; AMS IB. 3173, 59.2 mm SL, off Darwin, Northern Territory, Australia; AMS I. 26599-006, 61.7 mm SL, Cairns, Queensland, Australia; AMS I. 28535-001, 41.2 mm SL, Mackenzie Island, Queensland, Australia; NTM S. 12898-003, 2 specimens, 59.0 mm SL, north of Bowra Shoals, Fog Bay, Northern Territory, Australia, 12°42'S, 130°11'E, 20–21 m depth; NTM S. 13281-017, 7 specimens, 59.6–81.5 mm SL, northeast of Point Charles, Beagle Gulf, Northern Territory, Australia, 12°11'27"S, 130°24'27"E; NTM S. 14844-002, 2 specimens, 72.7–73.8 mm SL, estuary of Otokwa River, Irian Jaya, Indonesia, 04°56'2"S, 137°15'07"E, 25 May 1996; USNM 280176, paratype of *Stolephorus nelsoni*, 71.6 mm SL, Eighty Mile Beach, Western Australia, Australia.

Diagnosis. A species of *Stolephorus* with the following combination of characters: gill rakers 16–19 (modally 17) in upper series on first gill arch, 20–24 (22) in lower series, 37–43 (39, 40) in total; gill rakers 12–14 (13) in upper series on second gill arch, 18–22 (20, 21) in lower series, 30–36 (33) in total; gill rakers 9–12 (10) in upper series on third gill arch, 12–13 (12) in lower series, 21–25 (23) in total; gill rakers 8–9 (8, 9) in upper series on fourth gill arch, 9–11 (10) in lower series, 18–20 (18)

in total; prepelvic scutes 4–7 (5); branchiostegal rays 12–14 (13); pectoral fin with 13–15 rays; anal fin with three unbranched rays and 15–17 branched rays; long upper jaw, posterior tip more or less reaching posterior border of opercle; no predorsal scute; body deep, 21.1%–23.7%SL; anal-fin base short, 16.1%–19.3%SL; caudal peduncle long, 15.7%–21.7%SL, snout relatively long, 4.5%–5.5%SL; posterior border of preopercle convexly rounded; a pair of dark patches behind occiput without a following pair of dark lines; no black spots below eye or on lower-jaw tip.

Description. Data for holotype presented first, followed by paratype and non-type data in parentheses (if different). Counts and measurements, expressed as percentages of SL or HL, given in Tables 1 and 2.

Body compressed laterally, elongate, deepest at dorsal-fin origin. Dorsal profile of head and body slightly convex from snout tip to dorsal-fin origin, straight along dorsal-fin base. Ventral profile of head and body slightly convex from lower-jaw tip to pelvic-fin insertion, slightly convex or straight from pelvic-fin insertion to anal-fin origin, more or less straight along anal-fin base. Dorsal and ventral profiles of caudal peduncle slightly concave. Belly rounded. Anus situated just anterior to anal-fin origin. Caudal peduncle compressed; depth slightly greater than orbit diameter. Snout tip rounded; snout length less than eye diameter. Mouth large, inferior, ventral to body axis, extending backward beyond posterior margin of eye. Lower jaw slender, shorter than upper jaw. Maxilla long, its posterior tip pointed, just reaching to posterior border of opercle (beyond or just short of posterior border of opercle in some specimens). Single row of conical teeth on each jaw and palatines. Small conical teeth in patch on vomer. Small tooth



Fig. 1. Preserved specimens of *Stolephorus nelsoni*; upper, AMNH 57157, holotype of *Stolephorus nelsoni*, 71.6 mm SL, Western Australia, Australia; lower, NTM S. 14844-002, 72.7 mm SL, Irian Jaya, Indonesia

patch on dorsal surface of hyoid bone. Eye large, round, covered with adipose eyelid, positioned laterally on head dorsal to horizontal through pectoral-fin insertion, visible in dorsal view. Pupil round. Orbit elliptical. Nostrils close to each other, anterior to orbit. Posterior margins of preopercle and opercle smooth. Subopercle with rounded posterior margin. Opercular membrane without serrations. Interorbital space flat. Interorbital width less than eye diameter. Pseudobranchial filaments present, length of longest filament less than eye diameter. Gill rakers long, slender, rough, visible from side of head when mouth opened. 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, isthmus muscle mostly exposed (not covered by gill membrane). Scales cycloid, thin, deciduous, absent on head and fins, except for broad triangular sheath on caudal fin. Lateral line absent. Dorsal-fin origin posterior to vertical through base of last pelvic-fin ray, slightly posterior to middle

of body. Dorsal and anal fins each with minute first ray, three anteriormost rays closely spaced and unbranched. Anal-fin origin just below base of tenth (tenth to twelfth) dorsal-fin ray; posterior tip of depressed fin not reaching caudal-fin base. Uppermost pectoral-fin ray unbranched, inserted below lateral midline of body; posterior tip of fin not reaching vertical through pelvic-fin insertion. Pelvic fin shorter than pectoral fin, insertion anterior to vertical through dorsal-fin origin; posterior tip of depressed fin reaching to vertical through origin of fourth dorsal-fin ray (third to fifth).

Coloration of preserved specimens. Body uniformly pale ivory with silver longitudinal band, its width slightly less than pupil diameter, from just posterior to upper opercular margin to caudal-fin base. A pair of dark patches behind occiput without a following pair of dark lines; no black spots below eye or on lower-jaw tip. Live and fresh coloration unknown.

Distribution. *Stolephorus nelsoni* is distributed along the northern coast of Australia (from Eighty Mile Beach,

Table 1

Meristics of the studied specimens of *Stolephorus nelsoni* and *S. brachycephalus*

Character	<i>Stolephorus nelsoni</i>			<i>Stolephorus brachycephalus</i>			
	Holotype	Paratype	Non-type	Holotype		Paratypes	
	Western Australia	IDN and AUS	Mode	Papua New Guinea		Mode	
	AMNH	USNM	<i>n</i> = 15	BMNH	<i>n</i> = 8		
Standard length (SL) [mm]	71.6	71.6	41.2–81.5		41.8	26.5–28.1	
Dorsal-fin rays (unbranched)	3	3	3	3	3	3	3
Dorsal-fin rays (branched)	13	13	12–13	12	13	12–13	
Anal-fin rays (unbranched)	3	3	3	3	3	3	3
Anal-fin rays (branched)	17	17	15–17	17	20	20–22	
Pectoral-fin rays (unbranched)	1	1	1	1	1	1	1
Pectoral-fin rays (branched)	12	12	12–14	12	11	10–12	
Pelvic-fin rays (unbranched)	1	1	1	1	1	1	1
Pelvic-fin rays (branched)	6	6	6	6	6	6	6
Caudal-fin rays (upper + lower)	10 + 9	10 + 9	10 + 9	10 + 9	10 + 9	10 + 9	10 + 9
Gill rakers on 1st gill arch (upper)	19	18	16–19	17	15	15–16	
Gill rakers on 1st gill arch (lower)	23	24	20–24	22	21	20–21	
Gill rakers on 1st gill arch (total)	42	42	37–43	39, 40	36	35–37	
Gill rakers on 2nd gill arch (upper)	14	14	12–13	13	11	11–13	
Gill rakers on 2nd gill arch (lower)	22	broken	18–22	20, 21	18	18–21	
Gill rakers on 2nd gill arch (total)	36	broken	30–35	33	29	30–33	
Gill rakers on 3rd gill arch (upper)	12	broken	9–11	10	9	9–10	
Gill rakers on 3rd gill arch (lower)	13	broken	12–13	12	11	10–12	
Gill rakers on 3rd gill arch (total)	25	broken	21–24	23	20	19–22	
Gill rakers on 4th gill arch (upper)	9	broken	8–9	8, 9	6	6–9	
Gill rakers on 4th gill arch (lower)	11	broken	9–11	10	9	8–10	
Gill rakers on 4th gill arch (total)	20	broken	18–20	18	15	14–19	
Gill rakers on posterior face of 3rd gill arch	7	broken	3–6	5	5	3–6	
Prepelvic scutes	4	5	4–7	5	4	2–5	
Scale rows in longitudinal series	35	35	34–36	35	33	33–34	
Transverse scales	8	8	8	8	8	8	8
Branchiostegal rays	13	broken	12–14	13	10	11	11
Pseudobranchial filaments	broken	broken	16–20	18	18	14–17	14, 16, 17

IDN and AUS = Indonesia and Australia, AMNH = AMNH 57157, USNM = USNM 280176, BMNH = BMNH 1979.3.21.447.

Western Australia to Mackenzie Island, Queensland; Wongratana 1987, Whitehead et al. 1988, Wongratana et al. 1999, Paxton et al. 2006, this study) and in Irian Jaya, Indonesia (this study) (Fig. 2).

DISCUSSION

Stolephorus nelsoni was described by Wongratana (1987) based on four specimens collected from Western Australia and Queensland, Australia, the species being known to date only from the type specimens. Examination of additional material from the northern coast of Australia and Indonesia confirmed the validity of *S. nelsoni*, with the unique combination of characters described in the Diagnosis (above). Although Wongratana (1987) recorded

S. nelsoni as having 20 or 21 anal-fin rays, modified by Whitehead et al. (1988) and Wongratana et al. (1999) as three unbranched rays and 20 branched rays, the anal-fin ray count observed in the presently reported study was iii, 15–17, the values indicated in Whitehead et al. (1988) and Wongratana et al. (1999) being clearly erroneous.

Although *S. nelsoni* is similar to *S. brachycephalus* (Fig. 3) in sharing the maxilla well beyond the posterior margin of preopercle, the latter rounded posteriorly, and the dorsal fin without scutes, the former has more gill rakers (24 in *S. nelsoni* vs. 20–22 in *S. brachycephalus*) and branchiostegal rays (12 or 13 vs. 10 or 11), and a tooth patch on the hyoid bone upper edge (vs. teeth absent), according to Wongratana et al. 1999. The present

Table 2

Morphometrics of specimens of *Stolephorus nelsoni* and *S. brachycephalus*

Character	<i>Stolephorus nelsoni</i>				<i>Stolephorus brachycephalus</i>		
	Holotype	Paratype	Non-type		Holotype	Paratypes	
	Western Australia		IDN and AUS		Papua New Guinea		
	AMNH	USNM	n = 15	Mean	BMNH	n = 8	Mean
Standard length (SL) [mm]	71.6	71.6	41.2–81.5		41.8	26.5–28.1	
As % SL							
Head length (HL)	28.4	27.2	26.4–28.1		27.3	26.4–26.9	
Body depth	23.7	23.6	21.1–22.6		22.1	20.2–20.3	
Pre-dorsal-fin length	55.2	52.6	49.8–54.9		53.2	52.3–57.3	
Snout tip to pectoral-fin insertion	30.1	30.9	27.9–30.6		29.4	27.1–28.8	
Snout tip to pelvic-fin insertion	49.1	47.6	43.9–48.6		46.9	44.4–46.4	
Snout to anal-fin origin	66.7	64.9	61.7–66.7		64.8	60.6–64.9	
Length of dorsal-fin base	16.7	16.8	13.9–17.4		15.6	15.1–16.4	
Length of anal-fin base	17.2	17.3	16.1–19.3		17.6	22.3–21.6–24.4	
Length of caudal peduncle	18.1	16.5	15.7–21.7		18.8	14.3–12.6–15.2	
Depth of caudal peduncle	10.0	9.9	9.0–11.0		9.9	8.9–6.9–9.7	
Pectoral-fin length	broken	17.1	15.2–17.8		16.5	17.4–13.5–16.9	
Pelvic-fin length	9.3	9.0	8.0–9.5		8.9	9.4–9.3–10.8	
Interorbital width	6.7	7.2	6.0–7.8		6.7	6.8–6.2–7.1	
Snout length	5.4	4.9	4.5–5.5		5.1	4.3–3.6–4.2	
Upper-jaw length	22.9	22.5	21.1–22.6		22.1	19.9–21.0–22.8	
Mandibular length	18.8	18.0	17.4–18.6		18.1	17.8–17.5–19.0	
1st dorsal-fin ray length	2.1	1.8	1.1–2.3		1.7	1.9–1.0–2.4	
2nd dorsal-fin ray length	broken	7.4	6.9–8.5		7.7	9.3–9.2	
3rd dorsal-fin ray length	broken	broken	15.4–17.9		16.3	broken	broken
1st anal-fin ray length	1.8	1.8	0.9–2.5		1.5	1.9–1.8–2.6	
2nd anal-fin ray length	5.1	4.7	4.4–6.7		5.1	5.5–4.4–6.3	
3rd anal-fin ray length	broken	broken	11.9–13.9		13.2	broken	15.1
1st pectoral-fin ray length	broken	broken	15.2–17.8		16.6	16.5–13.5	
1st pelvic-fin ray length	9.3	8.6	8.0–9.5		8.8	broken	9.3–10.6
As % HL							
Length of orbit	32.5	32.9	31.2–34.8		32.7	26.3–27.9–32.6	
Length of eye	23.5	23.3	23.3–29.4		25.1	22.2–20.8–25.8	
D-P1	122.6	128.8	117.6–130.6		122.8	127.2–122.2–133.8	
D-P2	90.3	93.7	80.0–94.4		87.2	86.3–79.2–86.9	
D-A	90.2	94.5	82.7–94.1		88.7	90.1–77.2–85.7	
P1-P2	68.5	68.3	61.0–74.3		68.5	67.1–54.6–65.7	
P2-A	62.2	68.8	55.5–72.8		65.3	67.0–62.4–68.4	
Postorbital length of the head	51.1	51.6	58.3–64.7		50.1	55.1–50.1–54.9	

IDN and AUS = Indonesia and Australia, AMNH = AMNH 57157, USNM = USNM 280176, BMNH = BMNH 1979.3.21.447.

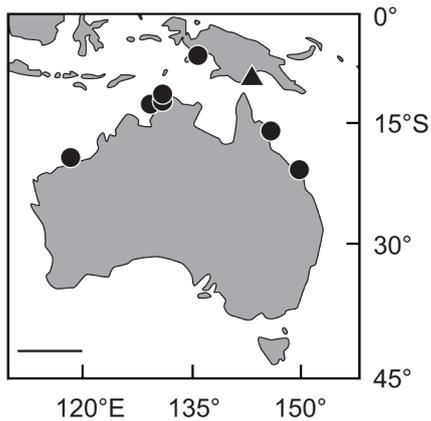


Fig. 2. Distributional records of *Stolephorus nelsoni* (circles) and *S. brachycephalus* (triangles), based on specimens examined in this study; scale bar represents 1000 km

comparisons of *S. nelsoni* with *S. brachycephalus*, based on 17 and 9 specimens, respectively, confirmed the branchiostegal ray and hyoid bone tooth conditions described by Wongratana et al. (1999). However, the lower gill raker number in *S. nelsoni* was 20–24 (modally 22), a greater range than that reported by Wongratana et al. (1999). The comparable range for *S. brachycephalus* was 20 or 21, not 20–22 as shown by Whitehead et al. (1988) and Wongratana et al. (1999). Therefore, lower gill raker numbers cannot clearly separate the two species. However, *S. nelsoni* differs from *S. brachycephalus* in having relatively more total gill rakers on the first gill arch (37–43 vs. 35–37), and fewer branched anal-fin rays (15–17 vs. 20–22) and branched pectoral-fin rays (12–14 vs. 10–12; Table 1). Morphometrically, *S. nelsoni* differs from *S. brachycephalus* in having a deeper body (21.1%–23.7% SL vs. 18.2%–20.3%), shorter anal-fin base (16.1%–19.3% vs. 21.6%–24.4%), longer caudal peduncle (15.7%–21.7% vs. 12.6%–15.2%) and longer snout (4.5%–5.5% vs. 3.6%–4.3%; Table 2; Fig. 4). Notwithstanding, *S. brachycephalus* has been reported only from specimens smaller than 41.8 mm SL (Wongratana 1983, Whitehead et al. 1988, Wongratana et al. 1999, this study), which may or may not have been adult. If larger and smaller specimens of *S. brachycephalus* and *S. nelsoni*, respectively, become

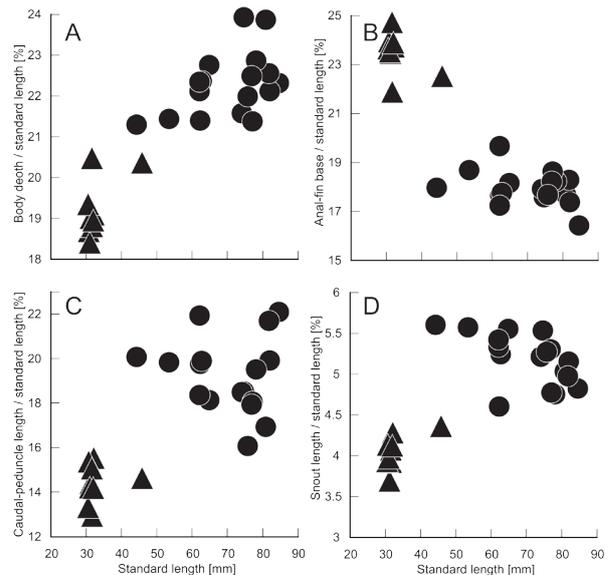


Fig. 4. Relations of (A) body depth, (B) anal-fin base, (C) caudal-peduncle length, and (D) snout length to standard length in *Stolephorus nelsoni* (circles) and *S. brachycephalus* (triangles)

available, the differences shown here between *S. nelsoni* and *S. brachycephalus* may not hold up.

The collection of *S. nelsoni* specimens from Indonesian and northern Australian waters suggests that the species is also likely distributed off the southern coast of Papua New Guinea.

Comparative material examined. *Stolephorus brachycephalus*, 9 specimens, 26.5–41.8 mm SL: BMNH 1979.3.21.447, holotype of *Stolephorus brachycephalus*, 41.8 mm SL, east side of Daru Wharf, Gulf of Papua, Papua New Guinea; USNM 270294, 8 paratypes of *Stolephorus brachycephalus*, 25.6–28.1 mm SL, east side of Daru Wharf, Gulf of Papua, Papua New Guinea.

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Fig. 3. Holotype of *Stolephorus brachycephalus*; BMNH 1979.3.21.447, 41.8 mm SL, Papua New Guinea

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